LEARNING AND COMPUTERS:

A STUDY OF PROFICIENT COMPUTER-USING TEACHERS

A thesis submitted as partial fulfilment of

the requirements for the degree of Master Education Massey University

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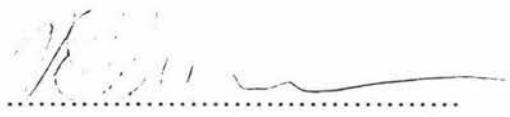
DECLARATION

I declare that this thesis represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualification.



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ABSTRACT

This thesis examines how primary school teachers use computers to create conditions for better learning in the classroom. The claims about computers and learning are reviewed and teachers are shown to have a crucial role in realising the potential benefits of educational software. In the past there has been a tendency to ignore the voice of teachers in their efforts to integrate the computer into the curriculum. The study addresses the problem that without documenting the experiences of teachers in the regular classroom, many assumptions about the computer may become uncritically enshrined in both theory and practice. A number of methodological issues related to the area of educational computing are considered and a strong argument made for a multi-dimensional research paradigm.

The research is designed over three phases to identify and systematically investigate a purposive sample of proficient computer-using teachers. The first phase of the study involves a survey method in which a questionnaire is used to document the background characteristics, experiences and practices of teachers 'nominated' as proficient at using computers in the classroom. In the second phase, the survey method is extended through an informant interview. A sample of 'perceived' proficient computer-using teachers are interviewed on their beliefs about teaching and learning and the ways the computer supports these processes. The final phase culminates with microethnographic case studies on two teachers 'judged' to be proficient at using computers within the classroom programme.

An analysis of data shows that the computer is perceived to be a social experience. It is predominantly used for word processing, but there are a diverse range of teaching practices and the computer is not a uni-dimensional machine. The participating teachers have considerable teaching experience and many are frustrated in their attempts to successfully integrate the computer into the classroom. Lack of resources, time and teacher education are key inhibitors of computer use. There appears a second wave of proficient computer-using teachers who are enthusiastic beginners, and largely women, confident in their ability to use educational software for learning. Although the common orientation of teachers is towards a learner-centred philosophy, a considerable gap remains between theory and practice. The thesis concludes that theory needs to be more responsive to the demands of using the computer in the classroom, but also that teachers have much to gain from a better understanding of contemporary educational theory.

ACKNOWLEDGEMENTS

This research was inspired by the commitment that many teachers have made in the last decade towards integrating a new educational innovation in the classroom. The integration of computers in such a short time has demanded a lot from teachers, and without their expertise the use of educational software would not be so prevalent in New Zealand schools.

I owe a particular debt to the teachers who participated in this study for their time and willingness to converse with me. The research was dependant upon their participation and I sincerely thank the teachers for sharing so much rich information about their teaching practice. In particular, I would like to thank Anne and Barry from whom I learnt so much!

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CHAPTER ONE

Introduction

"There is no good educational software, only good teachers using software well" (Ham, 1989, p.14).

1.0 INTRODUCTION

The use of computers to support learning has become a common feature in most New Zealand primary schools. In the majority of schools we now expect to see students engaged in computer-related activities on a regular basis. Clearly, computers and associated information technology (IT) are now an integral part of New Zealand schools and have become synonymous with education as we move into the 21st century. Evidence that computers will have a central role in the future can be found in the document *Education for the 21st Century* (Ministry of Education, 1994). A key target in this document is to increase, by 2001, the extent of computer technology in schools. The aim is to raise the current level of approximately one computer per 17 students, to a level of one computer per five students. The cost of achieving such a target is considerable and some commentators estimate that it comes with a $700 million price tag (Rivers, 1994). The obvious question is: *Why are computers so important for schools?* The high priority currently being given to computers requires careful scrutiny and a sound analysis in relation to their potential contribution to education.

1.1 BACKGROUND TO THE TOPIC

There are a number of possible explanations for the current emphasis on computers in schools. It is common to assume that the main rationale relates to the betterment of teaching and learning. The use of educational technology in school is, after all, nothing new and students use a range of teaching aids on a daily basis to support their learning in the classroom. This is an important explanation, but it must be understood in the context of other rationales for the increasing presence of computers in schools. The computer was not originally designed for the purpose of learning and there are many interested parties who potentially benefit from their use in education. The different rationales for using computers in education can be summarised as: (a) social; (b) vocational; (c) economic; (d) commercial; (e) marketing; (f) cost effectiveness; (g) transformation; and, (h) pedagogical (Pelgrum & Plomp, 1993).

1.1.1 Social Rationale

The social rationale is based on the view that we must prepare children for a new world that they will have to live in. There are people with an eye on the future who believe that there is an increasing gap between school and the world outside of school. The size of this gap necessitates an urgency to produce students who are ready for, and have the skills to survive in, the information and communication age.

1.1.2 Vocational Rationale

The vocational rationale is motivated by the belief that computers enhance the prospects of students gaining employment in an increasingly competitive labour market. The belief is based on the assumption that schools have an important role in meeting the demands from industry, for workers who are competent and skilled at using a range of computer technologies.

1.1.3 Economic Rationale

The economic rationale is founded on the tenet that high levels of technological literacy are vital if New Zealand is to respond successfully to the challenges of the modern international competitive environment. The economic commodity of the future is 'information' and the country needs to create 'smart' citizens capable of adapting to the requirements of a new global market.

1.1.4 Commercial Rationale

The commercial rationale has its origins in the self-interest and financial viability of commercial groups who will benefit from the on-going supply of computers to schools, and the development of a large number of technologically literate students. The students of today are thought to be the potential consumers of the new information and communication technologies of the future!

1.1.5 Marketing Rationale

The marketing rationale is in response to the new environment where schools must attract students in order to get adequate funds. The computer becomes a powerful marketing icon for schools to entice parents who are concerned that their children do not have access to computers and are somehow missing out. Many adults want schools to match the learning experiences available at home on their own personal computers (PC).

1.1.6 Cost Effectiveness Rationale

The cost effectiveness rationale is grounded on the premise that computers can substantially reduce the cost of education and make teaching more efficient by decreasing the need for teachers. Many new information and communication technologies can overcome problems of distance and isolation and even allow for the closure of rural schools that are no longer considered to be economically viable.

1.1.7 Transformation Rationale

The transformation rationale is derived from a desire and visionary enthusiasm to transform the nature of school and steer the curriculum in bold new directions. The use of computers in schools will act as a catalyst that accelerates change and thereby closes the door on the traditional three Rs. Computers may even render obsolete the concept of school as we know of it today.

1.1.8 Pedagogical Rationale

The pedagogical rationale is built on the assumption that the use of computers in schools offers an unprecedented potential to enhance learning. There are distinct learning advantages from students having frequent access to computers and a range of educational software. The computer is a unique learning tool that affords new opportunities for social and cognitive development within the classroom.

1.2 THE COMPETING RATIONALES

The different rationales are not all compatible, as they represent the interests of many groups. The dominance, however, of one rationale over another gives some indication of whose interests are being served by the increasing use of computers in schools. Although the pedagogical rationale is the most visible, it is important to note that one rationale may be supported because it furthers another. There may not be a strong commitment to that particular rationale. It is unlikely that there is one single rationale that is responsible for the use of computers in schools, but rather that there are a combination of factors that simultaneously make the presence of computers desirable. Any discussion about computers in schools must be mindful of the competing rationales and critique their underpinning assumptions. This thesis supports the pedagogical rationale, but is motivated by some of the erroneous assumptions on which this pretext is based. It is driven by a concern for the lack of critical debate about the learning benefits of using computers in New Zealand schools.

1.3 DO COMPUTERS ENHANCE LEARNING?

The key question that dominates discussion about the pedagogical rationale is: *Do computers enhance learning?* We can justify the use of computers in schools by establishing, beyond doubt, their educational value. Unfortunately, this question is rather naive. The question is a bit like asking: *Do students learn better on sunny days?* It raises more questions than answers. There can never be one definitive answer because there are many changing contextual variables in the processes of teaching and learning. No two teachers use the hardware and software in the same way. Furthermore, during computer-related activities students are ultimately responsible for setting their own learning goals. The endless range of contextual variables in the computer learning environment does not stop some analysts from making impressive claims. For example, an Adviser for the Ministry of Commerce recently concluded from a selective analysis of the literature that 'I.T. really can enhance learning' (Templeton, 1995, p.5). Such comments are not that helpful as they only stifle further critical debate. The answer to the question of whether computers enhance learning, is that it depends!

It depends on how computers are used in the context of the classroom. The real issue is not whether computers enhance learning, but what are the circumstances where computers create conditions for better learning? This question recognises that the key to using computers for learning purposes is the environment in which the hardware and software are used, and the way the teacher integrates the technology into the classroom, not just the features of the machine itself. The important point is that there is still a need to understand the conditions under which computers support teaching and learning processes. Much of the rhetoric about computers and learning comes from anecdotal evidence and lighthouse projects that bear little resemblance to the conditions of the regular classroom. These projects may well deceive us. The voice of regular teachers is largely neglected and there are surprisingly few studies of how New Zealand teachers are grappling with computers to create conditions for better classroom learning.

1.4 THE ROLE OF THE TEACHER

If computers are to enhance the learning process then teachers have a key role. The history of educational technology is characterised by many failed innovations. For example, early teaching machines and educational television did not have a major impact on practice because insufficient attention was given to the teacher's role (Olson, 1988). The prior experiences, practices and perceptions of teachers are more important in determining how a computer is used in the classroom than the educational software itself (Miller & Olson, 1994). One of the problems is that the nature of educational software is in rapid and continuous process of

development. There is not a corresponding rate of development in our understanding of the teacher's role in the computer learning environment. As new kinds of software, offering new educational possibilities, emerge, we increasingly need to understand how 'good' teachers are using software well? This question is important because it gives the opportunity to evaluate the claims about computers in terms of what constitutes 'proficient' practice in the regular classroom. The study of proficient computer-using teachers has the potential to offer valuable insights into classroom practice that may further our understanding of the conditions where computers enhance the processes of teaching and learning.

1.5 STATEMENT OF PURPOSE

This thesis investigates the context of computer use in proficient computer-using teachers classrooms. It describes a systematic sample selection process that documents the practice of proficient computer-using teachers and their perceptions of how computers support teaching and learning. A multi-dimensional research paradigm is adopted, utilising a range of both quantitative and qualitative techniques. The research involves three phases over a period of 18 months and culminates in two microethnographic case studies. The purpose of the research is not to judge the existing practice of proficient computer-using teachers, nor to provide any definitive answers, but simply to learn from these teachers, valuable experience and collective wisdom about the potentialities and problems of using educational software in the classroom. The intention is to follow a direction of inquiry that might be fruitful in understanding how computers can be used to support learning in the classroom under regular conditions.

1.6 ORGANISATION OF THE THESIS

The thesis is organised and generally presented in terms of the American Psychological Association (1994) guidelines. Chapter One introduces the significance of the topic and backgrounds factors related to the use of computers in schools. Chapter Two outlines the parameters of the study and reviews both the theoretical and research literature on educational computing and the nature of proficient teaching in the computer learning environment. Chapter Three introduces the research problem and states the specific aims of the study; it also considers a number of methodological issues related to conducting research in the area of computers in education. Chapter Four provides a detailed account of the method and procedures used throughout data collection. Chapters Five, Six and Seven present the results for each phase of the study. Chapter Eight discusses the main findings and a number of emerging themes in relation to: (a) the computer; (b) the teacher; (c) the students; and, (d) other factors that inhibit and enhance classroom computer use. Chapter Nine concludes with a summary of cogent points including the implications of the study for teachers, theorists and researchers interested in making more effective use of computers in the classroom.

CHAPTER TWO

Literature Review

"The computer is no substitute for the individual, experienced teacher" (Rowe, 1993, p.22).

2.0 INTRODUCTION

This chapter outlines the parameters of the thesis with a discussion on the meaning of the term information technology (IT). It shows that this term encompasses a broad range of technologies and is an imprecise substitute for the word computer. The different frameworks for studying educational computing and the various theoretical perspectives on learning and computers are described. An inclusive perspective is advocated where alternative theoretical traditions of the learning process are not seen to be mutually exclusive. The research literature is reviewed on learning and computers and the role of the teacher in the computer environment. Consideration is given as to what constitutes proficient teaching practice with computers, and it is argued that prior research has not sufficiently acknowledged the problems of defining and identifying such teachers. The study of computer-using teachers is shown to be a fruitful area of inquiry, especially when future investigations are informed by the extensive literature on the nature of proficient teaching *per se.*

2.1 THE FRAME OF REFERENCE

There is much confusion about the meaning of IT. Many people seem to automatically associate IT with computers. Although computers pervade our daily lives, IT is not confined to electronic gadgets or machines. After all, chalkboards, papyrus scrolls, stone tablets and even cave drawings are all types of IT. Moreover, IT does not have to be a visible product or artefact. The technology can be an environment or system of acquiring, storing, retrieving and manipulating information, that is usually designed to solve a perceived human problem. This section builds on this conceptualisation and proposes a definition of IT that extends beyond just computers.

2.1.1 Towards a Definition

There is no one generally accepted definition of IT. The words, used together, have only acquired special significance in recent years, arguably, since people in positions of control have started to understand that information is a source of power. The important point is that

IT is nothing new, as people have been using a range of these technologies since the dawn of human existence (see Fig 2.1).

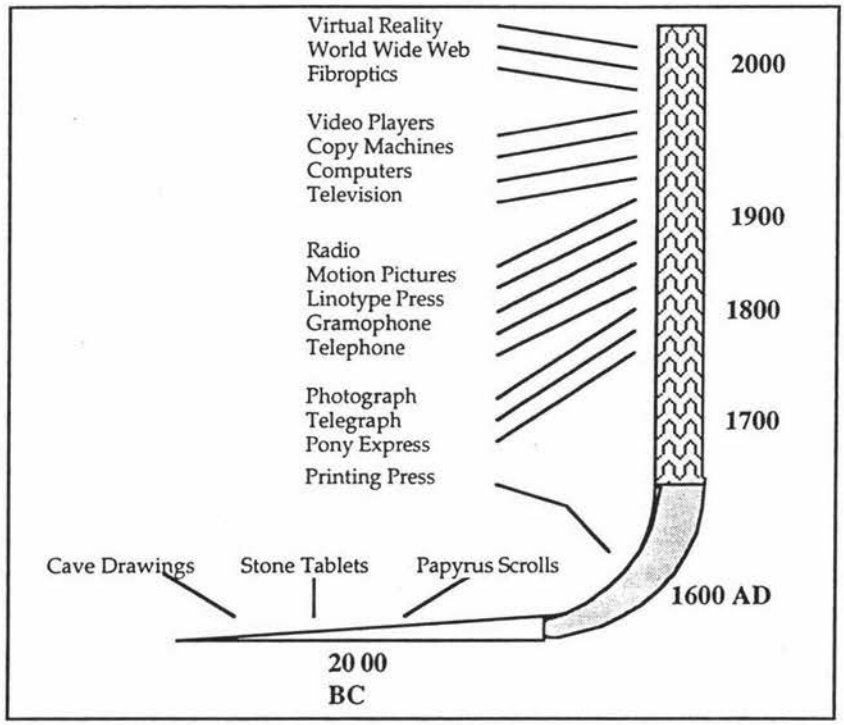

Figure 2.1
Proliferation Of Information Technology (adapted from Morgan, 1994).

It is naive and potentially dangerous to use the term IT as if it were a recent phenomenon and one that relates simply to electronic machines that process information. There is a long history of IT being used for educational purposes and the role of the computer in education needs to be understood within this context. The important point is that misconceptions of IT that over emphasise recent electronic machines, notably the computer, ignore a precise definition of 'information' and a contemporary understanding of 'technology'.

2.1.2 What is Information?

Information can be defined in two ways: structurally and functionally (Paisley & Chen, 1982). Structurally, information is a system of encoding symbols into a message that can be stored, retrieved and communicated usually through various media. Needless to say, structurally, information can take many forms, for example, a collection of measurements, a string of symbols and a table of numbers. Functionally, information is any structure of information that alters a person's existing cognitive organisation. In other words, information is what people internally process and use to develop new understandings and knowledge. A distinction between knowledge, information and data helps to clarify this definition. Data provide the basic building bricks for information. The word data is the plural form of *datum,* the Latin for 'fact' (Wellington, 1985). *Datum* is generally understood to mean something that is assumed to be trustworthy and made the basis for reasoning. Data

become information as some meaning or interpretation is given, but information only becomes knowledge once a person uses it to construct new understandings. Too often we are drowned in information but starved for knowledge!

2.1.3 What is Technology?

Technology may be understood to be a process by which society identifies human problems and seeks solutions to solve them, such as, an artefact, environment or system (Pacey, 1983). The process of technology is not neutral and it generally involves a number of overlapping phases (Medway, 1989). The first phase is the identification of a problem that impedes the realisation of a perceived human need. The second phase is the investigation and conceptualisation of a solution to that problem. The third phase is the design and construction of an artefact, environment or system to overcome the perceived problem. The implementation of the solution is the fourth phase, and the final phase is evaluating the success of the solution to the original problem. At this point the solution can be either refined or the problem can be redefined such that the process begins again. It is important to note that these phases are not separate, but on-going and intertwined within technological processes (Kimbell, 1991).

2.1.4 What is IT?

When the words 'information' and 'technology' are put together the definition of the term IT should read something like:

> *The design (and evaluation) of an artefact, environment or system as a solution to a human problem with either the structure or function of information.*

The proposed definition conceptualises IT as something that is designed for a specific purpose to meet a perceived human 'information' problem. The solution to the 'information' problem may take many forms and is not always a computer. We should not confuse the 'computer' with the broader and more generic term IT.

2.1.5 What is the Difference Between Old and New IT?

In recent years misconceptions about the nature of IT have been addressed by describing the computer as a 'new' IT (see for example, Hawkridge, 1983; Bigum & Green, 1992). This distinction defines 'old' IT as solutions to problems that depend upon mechanical means of carrying out their functions, whereas 'new' IT are electronic where the moving parts are replaced by the flow of electrons. Although this is a potentially useful dichotomy, it fails to

address that IT is not just an artefact and that many solutions to the problems of today are identical to those of 100 years ago. For example, the problem of recording information is still being solved using pencil and paper. A better distinction is to define 'old' IT as that designed to meet problems of the past and 'new' IT as a means of providing solutions to the problems arising today. The computer is a type of 'new' IT, but it does not have an exclusive patent on this term and the phrase IT is an imprecise substitute.

2.1.6 Parameters of the Thesis

The discussion thus far about the nature of IT is more than a pedantic concern with regard to the misuse of the term. It is important that the thesis establish from the outset the concepts and phenomena that are the subject of investigation. This study is about the computer and not the whole gamut of IT. For this reason, the study refrains from using the term IT in favour of simply the 'computer'. The 'computer' is considered the most accurate description of the phenomena in question. In other words, the focus of inquiry is the range of computer hardware and educational software employed by teachers for learning purposes in the classroom. The remainder of the chapter reviews the literature on the use of computers in education with specific attention to the role of the teacher in the computer learning environment.

2.2 FRAMEWORKS FOR STUDYING COMPUTERS IN EDUCATION

There are a number of possible frameworks for studying computers in education. Each framework offers a different way for analysing how teachers and students use a range of educational software in the classroom. In the past many of the frameworks have been criticised for ignoring the context of computer use. The majority of the proposed frameworks have been 'technocentric' with the computer, as opposed to the learner, at the centre of the teaching and learning process. To help overcome some of these criticisms a combination of frameworks are described, that together, serve to conceptualise the area of educational computing in a manner more sensitive to the contextual variables within, and beyond, the computer learning environment.

2.2.1 Paradigms of Computer Use

The first systematic framework for categorising the different uses of computers in education was suggested by Rushby (1979). In this framework there are four main styles or paradigms of computer use: (a) the instructional; (b) the revelatory; (c) the conjectural; and, (d) the emancipatory.

The 'instructional' paradigm involves the use of drill and practice and tutorial software where the emphasis is on the subject material and students gaining mastery of specific

concepts and facts. It focuses on individualised instruction following small steps, in a coherent sequence, with clearly defined prerequisites and learning objectives (Sewell, 1990). The aim is to use the unlimited patience of the computer to individually tutor students and thereby optimise their chance of learning.

The 'revelatory' paradigm encompasses the use of simulation and interactive fiction-type software where the computer guides the learner through a process of discovery and in which subject material is progressively revealed as one proceeds through the package. It concentrates on the student and their understandings of the subject material being portrayed on the computer (Rushby, 1984). The intention is to exploit the unique features of the computer in situations where it would otherwise not be possible through more conventional means.

The 'conjectural' paradigm includes the use of model building and artificial intelligence software that allows the student to create their own knowledge. It attempts to give the student control over the computer in order to construct and manipulate information in ways that help them to test their ideas on specific topics (Sewell, 1990). The goal is for the student to use the software as a vehicle by which to explore their own cognitive models and build on their existing experiences and understandings.

The 'emancipatory' paradigm covers the use of tool-like computer applications where the software is viewed as a means of reducing the workload of students. It encourages students to utilise the calculation and information handling capacities of the computer to achieve new and higher levels of cognition. The mission is for the student to use the computer in a manner that decreases non-essential tasks and encourages them to think about problems in more creative and empowering ways (Rushby, 1984).

2.2.2 Modes of Computer Use

The most common and enduring framework for the study of educational computing was proposed by Taylor (1980). In this framework there are three main modes of using computers in education: (a) tutor, (b) tutee, and (c) tool.

As 'tutor', the computer is used to instruct the learner. In other words, students learn from the computer. The common term for this type of learning is computer assisted instruction (CAI). Traditionally, CAI has been classified into categories of drill and practice, tutorials, simulations, instructional games and, more recently, interactive fiction and problem solving software (Lockard, Abrams & Many, 1994). The software has in common, the purpose of teaching some specific content or subject matter, either directly or indirectly, as a substitute

for the teacher. The computer as a surrogate teacher is located at the centre of the learning process.

As 'tutee', the computer is used by the student to develop and programme software. Here students learn how to teach the computer. The common applications of this type of software are programming in Logo™, constructing microworlds, building expert systems and designing multimedia projects (Merrill et al., 1992). With these applications the roles are reversed, with the student becoming the teacher, such that the learner is considered to acquire a more thorough understanding of the material than might otherwise be achieved. In the process of teaching the computer, students are considered to gain new insights into the way they themselves think.

As 'tool', the computer is used to complete tasks faster and solve problems more efficiently with less intellectual energy than would otherwise be possible. In other words, students learn with the computer. The common tool applications are word processing, desktop publishing, databases, spreadsheets, graphing and statistical software, music composition programs, art packages and electronic communications (McInerney & McInerney, 1994). These tool applications are not content specific and can be used across the curriculum for a variety of purposes. In this mode the student, rather than the computer, is placed at the centre of the learning process.

An extension to Taylor's three Ts is the computer as 'topic' and as 'toy'. As 'topic', students learn about the computer and its relationship to society. As 'toy', students play with the computer for the purpose of 'edutainment'. Although these five Ts have been accessible in the literature for some years, the various modes remain one of the most versatile frameworks for understanding the different ways that computers are used in education.

2.2.3 A Learning Dichotomy

A more straightforward, but equally useful framework is the dichotomy often conceptualised between learning 'from' the computer as opposed to learning 'with' the computer (Ryba & Anderson, 1990). In learning 'from' the computer, students are taught directly by the machine and expected to acquire a range of concepts and facts from the content of the software. This dimension of educational computing is equivalent to the 'tutor' mode and the 'instructional' and 'revelatory' paradigms. Learning from computers emphasises what the software can do for learners as opposed to 'what the learners can do with the computer' (Lai, 1992, p.13). In learning 'with' the computer, students use the machine to manipulate information in ways that support the construction of new understandings. This dimension of computer use corresponds to the 'tool' and 'tutee' modes, and the 'conjectural' and

'emancipatory' paradigms. Learning with computers takes place within a wider physical, social and educational context, where students are active participants in their own learning.

2.2.4 Dimensions of Collaborative Interaction

The most contemporary framework for understanding the role of computers within teaching and learning processes is offered by Crook (1994). In this framework the emphasis is placed not on the computer itself, but on the dimensions of collaboration and social interaction between the computer, students and the teacher. There are four configurations of collaboration described within this framework: (a) interactions with computers; (b) interactions in relation to computers; (c) interactions at the computer; and, (d) interactions around and through computers (Crook, 1994).

Collaborative interactions 'with' computers simulate traditional guided instruction where the software acts as the expert and engages the novice student in a type of instructional conversation. The dialogue between the computer as the master teacher, and the student as the apprentice learner, can mediate changes to the cognitive organisation of existing understandings and thus facilitate the construction of new knowledge.

Collaborative interactions 'in relation to' computers refers to the way students and the teacher interact in the presence of the technology. This is not just intermittent contact while students are engaged in computer activities, but interactions that occur within the broader social context of the classroom. These include deferred or indirect encounters that take place after the computer experience that contribute to learning.

Collaborative interactions 'at' computers involve situations where groups of students work together using the hardware and software. This type of interaction is usually where pairs or small groups of students are organised to work on the same hardware at the same time. The interest here is not necessarily in the software being used, but rather the type of collaboration that is occurring between the learners as they discuss their ideas and negotiate shared understandings.

Collaborative interactions 'around and through' computers entail circumstances where contact may be dislocated in time and space, that is students are not using the technology together at the same moment or in the same location. The emphasis is on the level of collaboration that can arise when computer activities are extended beyond the classroom. These are arrangements that afford possibilities for community-based collaboration through a shared common space.

2.2.5 Ecological Model

The most comprehensive framework was proposed by Pelgrum and Plomp (1988) in a model of the inter-related systems that impact on a computer learning environment. In this model, the learning environment is depicted as an ecological system consisting of a number of elements and sub-systems interacting with each other. The strength of studying the computer in an ecological way is that different elements and systems must always be considered in relation to each other. No one element or system is seen in isolation. There are multi-systemic components to the learning environment that interact to create what has been called a computer learning culture (Papert, 1980). The following adaptation of the original model suggests the ecological composition of the computer learning environment. It indicates the nature of the relationships and interactions between the various systems that combine to form a computer learning culture (see Fig. 2.2).

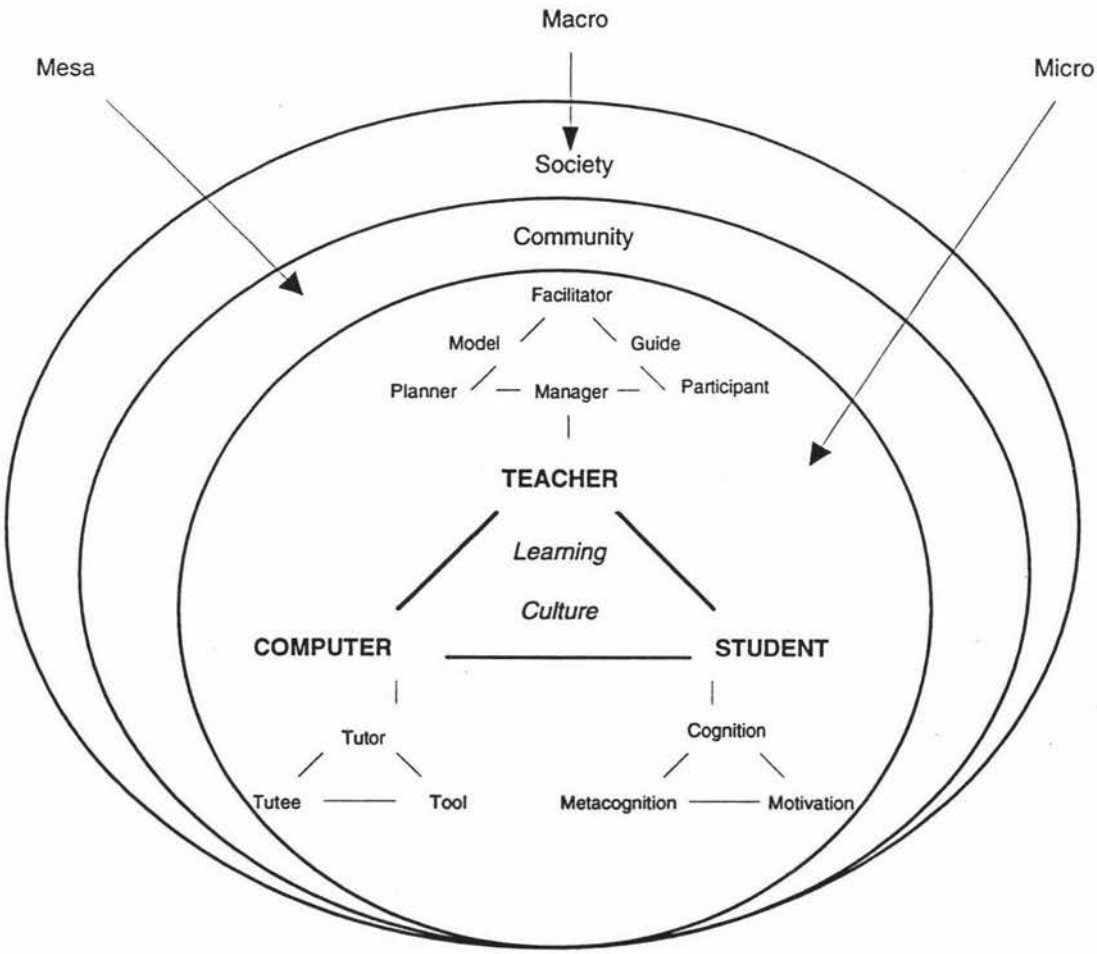

Figure. 2.2
Ecology Of The Computer Learning Environment

This schematic representation of the learning environment shows how different systems simultaneously and conjointly define each other. Teachers, students, and computers are in constant and mutual interaction. Teachers are shown to have a crucial role. There are various

dimensions of the teacher's role: manager, planner, model, facilitator, participant, and guide, which influence the type of interactions that impact upon the development of a learning culture (Ryba & Anderson, 1990). Students are obviously a central component. The importance of the student is expressed in the alliance between cognitive, metacognitive, and motivational/social processes. These processes form the cornerstone of learning (Short & Weissberg-Benchell, 1989). In this model the computer is not the exclusive focus of attention, but is nonetheless an important component that impacts upon the type of interactions that take place. Taylor's (1980) three Ts are used to show that different applications of the computer are conducive to different sorts of interaction.

The model shows that these interactions occur within a definite hierarchical structure. There are distinct micro, mesa and macro systems that influence the relationships between the various actors at and across the society, community and school level. Pelgrum and Plomp (1993) provide a detailed account of how government, teacher education services, educational and software publishers, school boards and parents all make decisions that impact on, and regulate, the conditions under which a computer learning culture can develop. A computer learning culture is the sum of the activities between the different levels and inter-connected systems. It consists of the shared meanings, beliefs, symbols, materials and experiences through which students learn. The arrangements and inter-related elements that create a particular learning culture are obviously difficult to define. They are by nature dynamic and unique to each learning environment.

2.2.6 Contribution of the Frameworks

The alternative frameworks with their different categories and dimensions of computer use are complementary to each other. When used together the frameworks offer a robust construct for understanding the practice of computer-using teachers. No one framework can accommodate the range of possible computer experiences and the full context in which these occur in the classroom. The frameworks in combination, support a deeper analysis of the computer learning environment; for example, the word processor can be understood as a tool that empowers students as they learn with the software, depending on the type of collaborative configurations in the classroom and the extent of support within and beyond the school. An amalgam of frameworks that either classify different features of the computer, or the manner in which the hardware and software are employed in a wider context, provides a powerful explanatory construct when linked with learning theory. The common ground of the frameworks is their implicit link to different theoretical perspectives that describe how computers support teaching and learning processes.

2.3 THEORETICAL PERSPECTIVES

There are a number of theoretical perspectives that explain the different ways software applications and computer experiences contribute to learning. The alternative perspectives have differing claims about the potential of computers to support learning and have been the subject of much analysis and debate. Two main traditions of learning theory, that is the 'behavioural' and 'cognitive', offer contrasting perspectives on how computers create conditions for better learning. The behavioural and cognitive traditions are often seen to have conflicting assumptions on what constitutes better learning and can be depicted at opposing ends of a learning continuum (see Fig 2.3). This continuum offers an interesting, if somewhat simplistic, synopsis of the variables related to learning and computers.

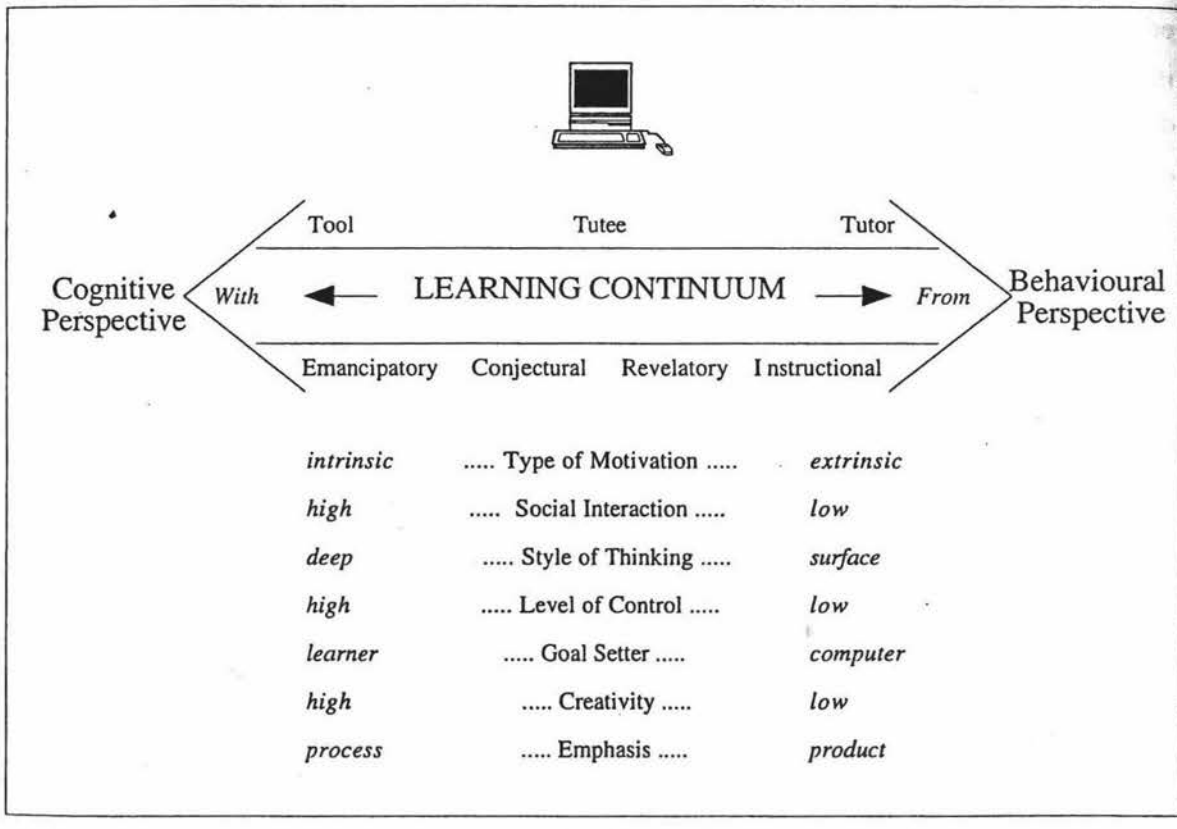

Figure 2.3
Learning Continuum Of Using Computers In Education

It is important to note that despite the differences between the main traditions of learning, the respective theoretical perspectives are not considered to be separate and mutually exclusive categories. These perspectives reflect an evolution of thought rather than a discontinuous series of steps (Ryba, 1990). The purpose of describing each perspective as a separate theory is to provide an indication of how the perspectives and the claims about the potential of computers to enhance learning have evolved over time.

2.3.1 Behavioural Tradition

The behavioural tradition denotes those perspectives that are concerned with behaviour and its modifications rather than hidden mental processes (Ryba & Anderson, 1990). It is a tradition founded on the principle that learning can be observed and quantified through stimulus response associations. In other words, there are particular stimuli that elicit particular responses. Desirable responses can be reinforced through appropriate instruction. The tradition places a strong emphasis on the manipulation and control of stimuli and the appropriate sequencing of teaching material. It emphasises the value of individualised instruction, following small learning steps, with reinforcing rewards when students get the right answer (Jones & Mercer, 1993). Inherent within behaviourist theory is that teaching steps have to be small in order to be successful, and that these have to be linked in chains to yield mastery of more complex material.

2.3.1 Instructional Technology Perspective

The origin of the behavioural tradition can be traced back to the beginning of the century and the instructional technology perspective. This perspective recognised the benefits, long before the invention of the computer, of controlling the sequence of subject material to maximise the probability of learning. It emphasised the connections between learning experiences and the need to make teaching more efficient. The following quote indicates the type of thinking behind this perspective:

> *"If by a miracle of mechanical ingenuity, a book could be so arranged that only to him [her] who had done what was directed on page one would page two become visible (...) much that now requires personal instruction could be managed by print (....) Books to be given out in loose sheets, a page at a time, and books so arranged that the student only suffers if he [she] misuses them, should be worked in many subjects" (Thorndike, 1911, p.221).*

The extract from Thorndike, a key proponent of the instructional technology perspective, demonstrates that behaviourist theory has a long tradition and is an approach to learning that is still influential in education. The concept of the mechanical book has evolved such that it is now a common feature of many classrooms through the use of CAI in schools.

2.3.2 Skinnerian Perspective

The most influential behaviourist was B.F. Skinner, who was responsible for the development of a number of early mechanical teaching machines. Skinner was a vocal advocate of behaviourist theory and the use of machines to teach subject material based on

the principles of Operant Conditioning (see for example, Skinner, 1986). According to the law of Operant Conditioning, if the occurrence of an operant was followed by the presentation of a reinforcing stimulus, the strength of the behaviour was reinforced (Skinner, 1954). The Skinnerian perspective proposed that teaching machines offered a way to reinforce behaviour such that it was more likely to happen again (Simonson & Thompson, 1994). In other words, mechanical devices provided the means to control stimuli and reinforce the probability of students gaining correct responses. The advent of CAI was simply an extension of this perspective through an electronic device that allowed new possibilities for managing teaching and presenting subject material for students to learn (see for example, O'Green, 1984).

2.3.3 Cognitive Tradition

The cognitive learning tradition is concerned with the underlying mental processes of thinking and learning (Ryba & Anderson, 1990). It grew out of the concern that behavioural perspectives took no account of the internal processes that occur in students during teaching and learning. Proponents of the cognitive tradition maintain that teaching should emphasise the existing cognitive structure and knowledge of the learner. How knowledge is internally structured or organised by the student has considerable impact on what is learnt (Simonson & Thompson, 1994). It is assumed that students bring to each task an individual and unique set of prior experiences, knowledge, self and task perceptions and motivations that mediate whether new learning will occur. All these factors combine to affect the way a particular learner responds and completes a learning task. There are various perspectives that make up the cognitive tradition and although these are each distinctive, they share many similar assumptions about the processes of learning.

2.3.4 Information Processing Perspective

The information processing perspective recognises that the key to successful learning lies in the quality of the processing. It uses the computer as a metaphor to explain cognitive processes such as information acquisition, retention and retrieval (McInerney & McInerney, 1994). The perspective has its origins in experimental cognitive psychology and from definitions of intelligence, that concentrate on the mechanisms involved in the flow of information from sensory systems (Crook, 1994). Considerable attention has been directed towards identifying and explaining the cognitive processes engaged in the acquisition of knowledge. The belief is that internal actions are amenable and can be enhanced by applying appropriate teaching strategies. The perspective has provided the impetus for the direct teaching of cognitive strategies and is based on the premise that we can systematically analyse cognitive processes into specific components (Sternberg, 1985). Students can be trained to employ these components in a way that will facilitate their learning. The value of

the computer is that it provides a model of thinking and a range of software that creates a social context for strategy instruction in the classroom.

2.3.5 Constructivist Perspective

The constructivist perspective views learning as an active process of making sense of experiences in terms of prior knowledge. According to this perspective, students learn by relating new experiences to their existing understandings (Duffy & Jonassen, 1991; Jones & Mercer, 1993). The basic tenet is that people learn by processing information they encounter on the basis of what they already know, and thus construct their own knowledge. Constructivism originates from Piagetian schema theory and is closely associated with Seymour Papert (1980) who developed the Logo™ programming language. Papert designed Logo™ to help students build their own intellectual structures in an environment designed for discovery. The computer is seen as a way of providing students with more autonomy through a range of discovery-based experiences, that enrich the overall learning culture (see for example, Forman & Pufall, 1988). The teacher's role is to facilitate these experiences as opposed to directly teaching specific knowledge and skills (Perkins, 1991). Although originally a personal theory of cognition, recent developments in social constructivism now recognise that learning occurs in a definite social and cultural context. There is a wider appreciation that learning does not take place in a vacuum and that it is a social experience made even more so with the computer.

2.3.6 Cognitive Apprenticeship Perspective

The cognitive apprenticeship perspective places greater attention on the role of the teacher in helping students acquire domain specific knowledge. It is based on the view that an expert learner has more knowledge than a novice (Pieters & de Bruijn, 1991). The teacher's role, as a master or coach, is to provide scaffolded instruction where control is gradually faded to the student. The aim is to provide the learner with just enough support to achieve a goal that would be impossible without assistance. Cognitive apprenticeship emanates from an interest in the area of artificial intelligence and anthropological work on the learning process outside of school (see for example, Resnick, 1987; Salomon, 1988). A basic tenet is that the acquisition of knowledge and skills should occur in the social and functional contexts of their use (Brown, Collins & Duguid, 1988). De Corte (1990) argues that learning processes should be embedded in contexts that are representative of the kinds of problems to which students will have to apply their knowledge and skills in the future, that is, to situate cognition in authentic problems that are relevant to the real world of students (Chiou, 1992). Computers can imitate situations in the real world which are difficult to create in traditional classrooms, and thus support greater transfer of learning to actual life situations (The Cognition and Technology Group at Vanderbilt, 1993). Furthermore, computers afford

opportunities for 'intellectual partnerships' where students can learn from vast knowledge databases and with software that scaffolds expert learning and instruction.

2.3.7 Metacognitive Perspective

The metacognitive perspective is concerned with the development of higher order thinking skills. These metacognitive skills are cognitive processes that students use to regulate their own learning. The main feature of students who display metacognitive skills is that they are 'aware' of their own thinking processes and make conscious attempts to 'control' their cognitive strategies (Brown, 1978). The significance of metacognitive skills is that they are attributed towards the ability to learn how to learn (Lieberman & Linn, 1991). It is assumed that students with knowledge of how they learn, and how to regulate their cognitive strategies, are more effective learners. Thus, a metacognitive student is a person who adopts a mindful and systematic approach to learning. The main aim of the metacognitive perspective is to encourage students to become reflective thinkers and self-directed learners (Ryba & Anderson, 1990). A basic premise is that 'metacognitive awareness and self-regulatory activity has its root in social interactions with others' (Reeve & Brown, 1985, p.347). The computer is seen as an excellent way to encourage social interaction and get students to think about their own thinking. It is a highly social experience that supports the sharing of ideas and exchanging of learning strategies.

2.3.8 Socio-Cultural Perspective

The socio-cultural perspective presents human learning as socially grounded within culture. Learning is profoundly defined as a social phenomenon, that is, conceptualised as something 'distributed' within culture, rather than just a set of cognitive processes thought to exist in the head (Crook, 1994). It argues that the social organisation of an environment cannot be separated from the analysis of thinking and learning. The socio-cultural perspective refers to a school of thought inspired by the Soviet socio-historical movement of the 1930s and in particular the work of Vygotsky, Luria and Leont'ev. There are three main themes that unify a social-cultural view of learning: (a) the importance of culture; (b) the central role of language; and, (c) the zone of proximal development (ZPD).

The basic tenet is that cognitive attributes of the individual are the outcome of engagement with culture. Vygotsky (1978) claimed that a learner's experiences are initially encountered on an inter-psychological plane and only understood at the intra-psychological, or cognitive, plane once they had been socially mediated through culture. This mediation occurs through the shared perceptual space between cognitive processes and their cultural, historical and institutional settings (Wertsch, 1985). The point is that individual accounts of cognition must incorporate a dimension of culture with a strong contextual flavour (Crook, 1994).

A key feature of the perspective is that language is central to the richness of human culture (Moll, 1990). In contrast to other perspectives, language is an organiser of cognitive processors and a cognitive tool that helps individuals to think in new ways (Jones & Mercer, 1993). The theory proposes that speech and action are directly related (Wertsch, 1985). Students use speech and action together in the development of higher mental functions and in the processes of problem solving. The implications of the socio-cultural perspective are that human communication provides the medium for teaching and learning, and instruction should develop in students an increasing mastery of language (Jones & Mercer, 1993).

The importance of language and social interaction is expressed through a concept known as the ZPD. The ZPD refers to the distance between actual development, as determined by independent problem solving and the level of potential development, as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky, 1978). Awareness and control of one's own thought processes are believed to be based in social interactions with other learners (Ryba & Anderson, 1990). Through communication and cooperation with more capable peers students learn how to progressively understand their own cognitive processes and control their own learning (Moll, 1990). In this type of environment teacher intervention provides the scaffolding for better learning (Rowe, 1993).

The computer can also provide a supportive context for learning by acting as a partner in dialogue and as a more capable peer that amplifies cognitive processes (McInerney & McInerney, 1994). Furthermore, it is a cultural medium for student-student and student-teacher interaction. The computer is considered a mediating tool that helps to reorganise the interactions between people (Jones & Mercer, 1993). In this regard the computer is not seen as a replacement for the teacher, but a medium for creating new learning environments with a strong emphasis on collaborative interaction in the classroom. The computer is a tool through which and around a teacher and learner can communicate and jointly create the context for social and cognitive growth (Crook, 1994).

2.3.9 A Unifying Position

In the past there has been a tendency to view the alternative perspectives as competing theories. A unifying position focuses on the commonalities between the learning traditions and does not view the different learning perspectives in direct competition (see Table 2.1). Rather, it seeks to merge the complementary elements of each perspective within an overarching framework. The position is taken that we need an inclusive perspective for the range of learning opportunities afforded by computers.

Table 2.1

Learning Traditions And Perspectives In Educational Computing Literature

Learning Tradition	Learning Perspective	Main Tenets
Behavioural	Instructional Technology	• instruction is individualised • the teacher provides all the knowledge • emphasis on the connection between tasks • the aim is to make teaching as efficient as possible
	Skinnerian	• emphasis is on reinforcing appropriate behaviour • learning is in small steps -- a chain of learning • the computer is used to individualise instruction • the computer acts as a substitute for the teacher • the teacher is at the centre of the learning process
Cognitive	Information Processing	• the brain is like a computer • people have short and long term memories • the key to learning is the quality of the processing • learning problems are problems in information loss • the computer provides a context for the teaching of cognitive and information processing strategies
	Constructivist	• emphasis placed on learner's prior experience • learners build their own cognitive structures • attention on student's concepts and understandings • knowledge is individually constructed but within a social context with the teacher as facilitator • the computer helps to create a rich learning culture or environment for discovery
	Cognitive Apprenticeship	• the teacher is seen as a master or coach • expert learners have more domain knowledge • emphasis on situating cognition in real contexts • focus on the dialogue between experts and novices • the computer can imitate authentic contexts not possible in conventional classrooms
	Metacognitive	• emphasis on thinking about thinking • focus is on helping students learn how to learn • students take responsibility for their own learning • teaching of learning strategies and thinking skills • students regulate their own thinking processes
	Socio-Cultural	• learning is a social and cultural experience • attention is given to interactions in the ZPD • relationship between speech, language and learning • speech and action together help process information • self-regulatory activities based in social interactions with others
Unifying Position	Inclusive	• trans disciplinary incorporation of theories • the computer is a new way of doing new things • perspectives simply explanatory constructs • an emphasis on praxis and the evolution of theory • learning culture of many inter-dependent variables • teacher adopts a dual role as facilitator and manager

This theoretical construct offers a synthesis of the learning traditions through a trans-disciplinary incorporation of the various perspectives on learning. It is based on the view

that a theory is not a fully elaborated position that is impermeable to historical shifts or reformulations, but a partially developed explanatory construct that can always evolve in response to new experiences and understandings. In this light, the inclusive perspective recognises the reciprocity between theory and practice and emphasises the mutual importance of both culture and the environment on behavioural and cognitive aspects of learning. It does not regard 'formal' and 'informal' theories of behaviour and cognition as mutually exclusive.

The opportunities that computers provide for 'better learning' from the inclusive perspective, are based on their potential to create conditions where students have to organise and construct their own knowledge and engage in higher-order intellectual activities. These activities encourage individual and collaborative learning experiences where students are empowered to take control of their learning and reflect on the consequences of their actions. In these computer learning environments students acquire higher order thinking skills, such as planning abilities, problem-solving heuristic's and reflexiveness on the revisionary nature of the problem-solving process itself (Nastasi & Clements, 1992). In other words, they have learnt many of the skills of how to learn. In addition, the computer provides access to domain specific knowledge that would not otherwise be available, and facilitates a change to the social organisation of the classroom where novice students and master teachers become partners in the learning enterprise. The teacher has a crucial role in this environment as both a 'facilitator of learning' and as a 'manager of instruction'. As facilitator, the teacher acts as a co-learner and works alongside the students in jointly constructing knowledge. As manager, the teacher acts as a broker of knowledge, where responsibility is taken for orchestrating a range of computer experiences in relevant contexts within and beyond the classroom.

2.4 OVERVIEW OF RESEARCH

There have been numerous research projects to substantiate the claims about the use of computers in education. Despite efforts to demonstrate empirically that computers enhance learning, the research findings are somewhat equivocal (see for example, Hativa, 1994; Khalili & Shashaani, 1994; Krendl & Lieberman, 1988; Niemiec & Walberg, 1987, 1991; Thompson, Simonson & Hargrave, 1992) There are few consistent results and the theoretical claims about the potential of computers to create conditions for better learning have yet to be shown on a large scale and in the regular classroom. As Bracey (1992) aptly states, the reseach jury is still out!

2.4.1 Learning and Computers

A comprehensive review of the research literature on learning and computers is beyond the scope of this thesis as there is nothing uniform in what the software does (Crook, 1994).

The computer is not a monolithic system where findings can be transferred from one setting and one learning environment to another. Generalisations of the research literature are highly suspect as the contribution of computers to learning is dependant on the context in which the software are used in the classroom (Salomon, 1990). The various meta-analyses of research are problematic as these are usually insensitive to the context of computer use. Positive results may be attributed to many factors, such as differences in instructional method or instructional content rather than the delivery medium -- the computer. Moreover, the methodological assumptions and weaknesses of prior research are seldom exposed within such literature reviews. The validity of quantifying causal effects of the computer on learning is open to much debate (Papert, 1987). According to Salomon (1990) there are many mutually dependant variables that effect learning. Furthermore, effects may be attributable to the novelty of the computer and decline as the software becomes more familiar (Krendl & Broihier, 1992). Hence, the research is rarely persuasive and worthy of direct comparison. The judicious answer to the question of whether computers enhance learning, is that it depends!

2.4.2 Teaching and Computers

It is not surprising that among other things the impact computers have on learning are dependant on the role of the teacher. The teacher's role was acknowledged as a promising area of study by Krendl and Lieberman (1988) in their early synopsis of the research literature. In a more recent meta-analysis Thompson, Simonson and Hargrave (1992) respond to the equivocal results by concluding that early research has shown that teacher intervention can improve learning outcomes. Hativa (1994) summarises six years of qualitative and quantitative research and comes to a salient conclusion that the 'teacher has a crucial role' (p.108). This statement is supported in a recent analysis of 133 research articles and reviews commissioned for the Software Publishers Association (Sivin-Kachala & Bialo, 1995). Sivin-Kachala and Bialo (1995) state that:

> *"These studies underscore the importance of the teacher's role in creating an effective, technology-based learning environment" (p.25).*

This conclusion is consistent with seminal reviews of the research on the use of the word processor for learning purposes. Cochran-Smith (1991) provides one of the most detailed and thoughtful considerations of both the qualitative and quantitative research in this area. In a synthesis of the research Cochran-Smith stresses that it is the teacher who creates the instructional context for writing.

> *"We cannot determine how word processing is most effectively used in classrooms apart from the ways particular teachers work in particular*

> *instructional contexts and that we cannot understand how word processing affects the quality, quantity, or processors of children's writing apart from the ways these are embedded within, and mediated by, the social systems of classrooms" (p.107).*

A meta-analysis of 32 quasi-experimental studies on the effects of word processing as an instructional tool adds further weight to the importance of the teacher's role (Bangert-Drowns, 1993). Bangert-Drowns (1993) asks why the results are often so ambiguous and not as convincing as one might expect, and concludes:

> *"The accompanying instruction must explicitly identify and practice the skills that one expect to gain from the tool in order for those gains to occur" (p.88).*

The role of instruction is highlighted in another recent comprehensive analysis of the research on word processing and the writing process (Snyder, 1993). In this critical review of the literature Snyder (1993) points out that the effects of the computer are influenced by the entire writing context:

> *"The effect of word processing on writing development and achievement is related to a complex interplay of a number of variables: the computer hardware and software; access to computers; proficiency with keyboarding and word processing; the idiosyncratic style and skills of individual writers; and the effectiveness of the writing instruction" (p.63).*

It is abundantly clear that instruction from the teacher has an important bearing on how the computer influences learning. Teachers make a difference! There are many other contextual variables that must also be examined, but the teacher has a key role in the computer learning environment.

2.4.3 The Importance of Teachers' Beliefs

Although the benefits of studying the teacher are self-evident, there is still a need for more research in this area. The teacher continues to be a neglected variable in the processes of educational change (LaFrenz & Friedman, 1989). The development of theory on how computers create conditions for better learning must take into account the views of teachers. In particular, there is a shortage of systematic research on what teachers think. As Cochran-Smith (1991) states:

> *"Most important, perhaps, is research that investigates how teachers in various settings and with various goals in mind interpret computer technology*

over relatively long periods of time and what influences their interpretations have on students' opportunities to learn" (p.123.).

Katterns and Haigh (1986) suggest that attention should be directed towards teachers' beliefs as these determine how teaching occurs. Lai (1993) adopts a similar stance in claiming that the success of educational innovations are influenced by teacher's belief systems. How teachers teach, and what they teach usually reflects their conception of the 'world' and how they view the purposes of education. This view is based on the assumption that beliefs are the best indicators of the decisions teachers make and influence their perceptions, which, in turn, affect their actions in the classroom (Pajares, 1992). A key distinction is made here between beliefs and perceptions. Beliefs are basic understandings that underpin the practice of teachers, whereas perceptions are more fluid interpretations of everyday experiences. A clear link is seen between teachers pedagogical beliefs and their classroom practice (Kagan, 1990, 1992). Yet there have been few studies of teachers beliefs in the computer learning environment (see for example, MacArthur & Malouf, 1991; Veen, 1993). The value of such research is that it can yield an insight into how computers are filtered through teachers as they modify learning experiences to fit their beliefs.

2.4.4 Why Study Proficient Computer-Using Teachers?

The importance of studying proficient computer-using teachers and their beliefs is that they are likely to influence how other teachers use computers in the classroom. Studying proficient teaching practice has the potential to provide valuable information for pre and inservice teacher education, and for the development of future policy. Furthermore, such research can help justify the pedagogue rationale for using computers in schools and highlight the critical role of the teacher and their beliefs in the effective use of computers for learning purposes. D'Ignazio (1990) raises the significance of researching proficient practice in the following quotation:

"Classrooms experimenting with advanced teaching strategies are often devoid of technology [whereas] classrooms using advanced technologies often employ older teaching strategies" (p.17).

The point here is that a proficient computer-using teacher not only knows how to use a computer, but also has the pedagogical knowledge of how to 'best' use the software in the classroom. We can learn much from teachers with this type of knowledge. When a teacher uses a computer in the social context of the classroom there are innumerable questions (Weinstein, 1991): What are computers and software good for? How do computers fit into the social organisation of the classroom? How does the computer relate to existing curricula and styles of learning? Is the computer congruous with the current approach to teaching?

Teachers' answers to these questions determine the role of the computer in the classroom and the impact that the hardware and software have on learning. The benefits of studying teachers who are deemed proficient at using computers is to understand their responses to these questions and how they are derived. Such an approach may allow an illuminative analysis of what makes a proficient computer-using teacher, and encourage further debate on the characteristics and features of proficient teaching practice.

2.5 RESEARCH ON PROFICIENT COMPUTER-USING TEACHERS

In recent years the study of proficient computer-using teachers has been increasingly recognised as a fruitful area of research. Research has sought to identity and describe the distinctive practices of such teachers. The emphasis has been on how proficient teachers differ from other teachers in an attempt to better realise the claimed potential of computers. In pursuing this objective there have been studies on: (a) successful computer-using teachers; (b) accomplished computer-using teachers; (c) effective computer-using teachers; (d) competent computer-using teachers; and, (e) exemplary computer-using teachers.

2.5.1 Successful Computer-Using Teachers

The first attempt to study the practices and perceptions of teachers deemed 'successful' at using computers was undertaken by Shavelson, *et al.* (1984). In this research 60 primary and secondary teachers were identified as exponents of 'good' practice and observed in the classroom. The teachers were also interviewed on their teaching methods and perceptions about the computer. It was found that successful teachers:

> *"stressed both cognitive and basic-skill goals, as well as microcomputer use as a goal in and of itself, used a variety of instructional modes to meet these goals; (...) they integrated the content of microcomputer-based instruction with the on-going curriculum, and coordinated microcomputer activities with other instructional activities" (Shavelson, et al., 1984, p.vii).*

The teachers were considered 'adaptive experts' in that they changed their use of computers in the classroom according to feedback from the students. Although the research provided a seed for further work, the study itself was limited to mathematics and science instruction and restricted by conceptions of success at that time. The identification of successful teachers was based on criteria more akin to the 'tutor' mode and 'instructional' and 'revelatory' paradigms of computer use.

The concept of studying teachers and schools 'successful' at using computers for learning purposes was developed further in a research project under the auspices of the International

Association for the Evaluation of Educational Achievement (IEA). As a follow-up to a survey on the use of computers in 21 education systems throughout the world (see for example, Nightingale & Chamberlain, 1991; Pelgrum & Plomp, 1993), a case study approach was used to collect more detailed data from two secondary schools in each country. The follow-up case study was optional for each country, but a project in which New Zealand chose to participate (see for example, Chamberlain & Kennedy, 1991). It involved the selection of two schools deemed to be successful at using computers. Success was determined on information gathered during the survey phase of the study. The selection criteria emphasised: (a) the year that computers were introduced for teaching and learning; (b) the student-computer ratio; (c) the extent to which computers were being used across the curriculum; and, (d) the extent and nature of available software. In many ways these criteria were just as interesting as the reported findings. The results were not surprising in that computers were characterised by an 'ad hoc' approach in New Zealand schools, but the theoretical basis from which the criteria were derived was not made explicit and the notion of success was clearly problematic.

2.5.2 Accomplished Computer-Using Teachers

A nationwide survey of grade 4-12 teachers in the United States (US) investigated the experiences and patterns of practice among 'accomplished' computer-using teachers (Sheingold & Hadley, 1990). The research was notable for its use of a nomination technique in the sample selection process. A range of strategies were employed to obtain the sample, including letters and telephone contacts to local and state directors of educational technology, hardware and software industry personnel, professional organisations, and leading educators and researchers in the field. In addition, an advertisement was placed in a magazine which invited teacher self-nominations. This search process resulted in a data base of over 1,200 names including teachers from every state and major city.

The process did not define in advance specific criteria for the nomination of teachers, but rather accepted recommendations on face value. It was the intention for people to define what constituted an accomplished teacher for themselves. Accomplishment was regarded, nonetheless, by Hadley and Sheingold (1993) as teachers who integrated the computer as a tool into their everyday classroom practice and used the software for more self-directed learning on the part of the students. The lack of explicit selection criteria and a justification for the assumed definition of accomplishment presented a number of problems. At best the sample could be only considered a selection of nominated or perceived accomplished computer-using teachers.

The computer-using teachers were sent a letter inviting them to participate in the research. About half (N=608) only of the original sample agreed to complete a questionnaire on

different dimensions of their practice. The questionnaire gathered data on: (a) the demographics of the teachers; (b) the teachers training and experience with computers; (c) the teachers current practice; (d) ratings on barriers to computer integration; and, (e) ratings of incentives to integration (Sheingold & Hadley, 1990). Data were interrogated using factor analysis and multi-variate segmentation techniques.

It was found that there were few differences between teachers in conventional demographic variables. The teachers were, however, employed in schools with an unusually high level of access to computers compared to those in a recent random survey (see for example, Becker, 1991). The sample consisted of 58% of women and 42% men, and in most instances teachers had been using computers for instruction for four years or more. Hadley and Sheingold (1993) offered the following profile:

> *"The teachers in the sample were on average, a mature and experienced group, more than half between 40 and 49 years old, and three-quarters having been teachers for 13 years or more" (p.268).*

As many as 80% of the teachers had access to a home computer and most indicated that they were to some degree self-taught. The teachers were considered eager consumers of information about computers. Up to 90% of the participants reported they used software catalogues, computer magazines, conference proceedings and educational workshops for gathering information. Teachers pursued a range of inservice and learning opportunities about computers, with many of them completing courses in their own time. Together, these characteristics were attributed to the very high level of comfort that teachers reported about using the computer as a tool for their own work.

According to Hadley and Sheingold, one of the most striking features was that the computer was not a 'single-use' machine, but rather a multi-purpose tool used in many different ways. A range of both content specific and tool software were utilised by teachers, however, by far the most popular and versatile application was the word processor. It was used by 90% of the participants at all grade levels and reported to be the 'most productive and interesting use of the computer in the curriculum' (Hadley & Sheingold, 1993, p.271). Instructional software, including drill and practice, tutorial and problem solving programs, were a close second with respect to the number of teachers who used them. This software was most common in mathematics and remedial work, but was not used to the same extent as the word processor. When teachers were asked to report the three most frequently used applications the responses were clear cut, with 75% of the participants ranking the word processor first, followed by 37% with drill and practice and 24% tutorial programs.

A high percentage (88%) of the teachers indicated that the computer made a difference to their teaching. There were three main types of reported changes. Firstly, there were changes to the teacher's expectations about the amount and complexity of student work. The students were thought to grasp more difficult concepts and cope with higher levels of thinking. Secondly, there were perceived changes in the ability to individualise student work. The computer was reported to permit greater individualisation. The third and most significant change to teaching was the perceived tendency to turn a teacher-centred classroom into a student-centred classroom. Hadley and Sheingold (1993) quote one teacher as stating:

> *"It has enabled me to change from a teacher centred classroom to a student centred classroom. It has also led to a more open approach to problem solving, rather than the pursuit of one correct answer" (p.277).*

These comments gave Hadley and Sheingold the confidence to conclude that teachers were using computers in ways that deeply affect their teaching and their students' learning. It was deduced that teachers were now teaching differently and more effectively than they did in the past. Whether a survey technique can elicit teacher beliefs is a matter of debate. This conclusion would have more validity if Sheingold and Hadley (1990) had conversed with the teachers. An even less convincing conclusion, considering the methodological approach and the supporting evidence, was that teachers were creating 'conditions for deep, engaged and meaningful learning' (Hadley & Sheingold, 1993, p.278). This is a rather difficult statement to defend without direct observations of classroom practice.

The amount of experience that teachers have with computers was identified as a key determinant of accomplished practice. As teachers gain more experience they become more comfortable and expert at integrating the computer into the classroom (Sheingold & Hadley, 1990). Hadley and Sheingold propose that with experience teachers gradually manage more expansive uses of the computer and this in turn engenders new approaches to the curriculum itself. Again, a highly speculative claim based on the results of a single questionnaire! Nonetheless, Hadley and Sheingold present three interesting conclusions about the features of accomplished computer-using teachers. Their distinguishing characteristics were summarised as: (a) teachers' with a high level of motivation and commitment to their students and their own development; (b) teachers with strong support and collegiality for the integration of computers into the classroom; and, (c) teachers with access to the computer itself in sufficient quantity (Hadley & Sheingold, 1993).

These characteristics were not generalised into one overall profile of the accomplished computer-using teacher. Instead, Hadley and Sheingold outline a number of different 'genres' among the participating sample of teachers. The sample was divided using a kind of segmentation analysis into five distinctive sub-groups: (a) enthusiastic beginners; (b)

supported integrators; (c) high school naturals; (d) unsupported achievers; and (e) struggling aspires (see Table 2.2). Although these groups provide a useful construct to better understand the diversity of accomplishment, they are based on a potentially flawed assumption. The participants were assumed to be accomplished computer-using teachers. This assumption was rather crude given that there was no attempt to interpret data and select a refined sample of teachers based on a theoretical understanding of what constitutes accomplishment in the computer environment.

Table 2.2

Different Characteristics Of Accomplished Computer-Using Teachers

Genre	Profile	The Computers Impact
Enthusiastic Beginners	• Less experience • More likely female • Teach primary age and/or special needs students • Optimistic outlook • Use few computer applications	The revolution is here and supported in its initiation, but we have yet to know fully what it will mean.
Supported Integrators	• Often men • Extensive computer experience • Usually computer coordinator • Have an interest in computers • Use a range of software applications in the classroom	The revolution is a schoolwide evolution that is well under way and becoming part of the larger school culture.
High School Naturals	• Most often men • Less experience teaching • Specialist teachers • Computers are an extension of existing expertise • Usually high school teachers	There is no revolution or deep change; rather, it is a matter of fact, technology is simply what is taught and used in certain subjects.
Unsupported Achievers	• Younger teachers • Experienced with computers • Regard computers as important for education • Have less access to support and hardware and software • Teach in less affluent schools	Neither the revolution nor widespread change has happened yet. The work to make it happen is being done in the face of great odds, but it is worth it.
Struggling Aspires	• Less experience with computers • Older age group • More likely women • Less secure about computer use • Acknowledge their frustration • Less likely to own a computer	The revolution is far off. No change has happened, and it is not clear whether change is really worthwhile or possible.

2.5.3 Effective Computer-Using Teachers

The same methodology as used by Sheingold and Hadley was replicated by Sherwood (1993) in an Australian study on the practices and perceptions of 'effective' computer-using teachers. In this research a national survey was undertaken using a sample of Australian teachers who were either self-nominated or selected by their school or education authority as effective computer users. There were 731 teachers nominated for the research of which 362 only responded to the same questionnaire instrument as used in Sheingold and Hadley's study. Despite the low response rate and inherited weaknesses of the research there were some interesting findings in a context not totally dissimilar to the New Zealand situation.

The nominated or perceived effective computer-using teachers were a mature group with almost half (49%) between 35-44 years of age. Those who participated in the research had considerable teaching experience with 61% of teachers having spent 13 or more years in the classroom. A majority of the teachers were men (55%) with just under half (49.5%) of the participants having used a computer in their teaching for seven years or more. It was found that 65% of the teachers own a home computer. The teachers reported that to some degree they were self-taught, but at the same time many had taken advantage of a range of training opportunites, with the most common being courses offered during teaching hours and instruction from other teachers.

It was claimed that most teachers devoted a considerable amount of their own time to integrating educational software into their classrooms (Sherwood, 1993). A variety of software was used in the classroom with the most common application being word processing (96%). The use of drill and practice software (89%) and interactive fiction-type programs (79%) were also popular. Whilst adequate support was perceived at the school level for using educational software, there were insufficient resources and trained personnel available at the school district and central level of the education authority. Interestingly, the incentives for teachers persevering with using computers in the classroom were related to the betterment of teaching and learning and the personal challenge of integrating the hardware and software into the curriculum. A high percentage (76%) of the participating teachers reported that the computer made a significant difference to the way they teach. The main difference was in the shift from a teacher-centred towards a student-centred classroom. As one teacher is quoted:

> *"I'm no longer a sage on the stage, but a guide on the side (Sherwood, 1993, p.172).*

It was unwise, however, of Sherwood to use such data to claim that the computer was a major force in reshaping the curriculm and teacher's own beliefs about teaching and

learning. Although this may be the case, a survey instrument is not an appropriate technique to elicit teachers beliefs, and clearly self-report data on changes over time are highly problematic. In this regard, the research did not address any of the conceptual and methodological concerns in the original study. Hence, the conclusion that effective computer-using teachers are 'motivated learners with an enthusiam for their profession and a dedication to their students' was not as sound as it might seem (Sherwood, 1993, p.173). What is required is research that goes beyond a superficial level of analysis where more detailed information is gathered from conversations with teachers.

2.5.4 Competent Computer-Using Teachers

In a quite different study Vockell and Sweeney (1993) compared the responses of teachers who reported themselves to be 'competent' at using computers, with those who perceived themselves less competent users. The research examined two school systems in Indiana, US; one with substantially greater commitment than the other to using computers within the classroom. The less committed school was not considered 'bad', but rather 'typical' in its use of computers for instruction (Vockell & Sweeney, 1993, p.24). It was presumed that differences in commitment between the schools would provide a measure of varying competence among the teachers at each school. The teachers at the respective schools were asked to rate their competence at using the computer in the classroom through a questionnaire. On the basis of their responses teachers were classified as either less competent or more competent computer users. Teachers at the more committed school reported a higher rate of competence than those at the other school, but the differences were not that significant, especially given an approximately 60% response rate only. Despite claims otherwise, the assumption that more competent teachers were in schools with greater commitment to using computers in the classroom was not apparent in data. Furthermore, data was self-report only and there was no attempt within the research design to define and verify competence in the actual classroom.

The results indicated that differences between the levels of competence were in the strength of the responses and the frequency that more competent teachers employed specific strategies and applications in the classroom. More competent teachers used the computer more often for both individual and small group work. Moreover, a higher percentage of these teachers used the computer for word processing than their less competent colleagues. The most frequently used applications for both groups of teachers were word processing, drill and practice and tutorial programs in that order. The high percentage of teachers within the more competent category at each school explains in part why their were similar perceptions of what was required to become competent. Notably, the factors that were perceived to have contributed least to competence were information in professional journals and university undergraduate and graduate courses. The most effective factors were 'workshops at their

schools specifically geared to personal goals and interests' (Vockell & Sweeney, 1993, p.28).

In keeping with the methodological weaknesses of the study Vockell and Sweeney concluded that there were no clear models of how to develop competence. The authors consider the merits of different professional development models and use Bitter and Yohe's (1989) criteria that computer-using teachers must meet. Firstly, competent teachers will be critical users of computers and be able to recognise their limitations and future possibilities. Secondly, teachers must have a broad education in order to conceptualise the use of computers from more than one perspective. Finally, teachers must be able to integrate computers into the curriculum in ways that will stimulate thinking. Whilst research on computer-using teachers at different ends of a competence contiuum offers much potential, there were few memorable points to emerge from this particular study.

2.5.5 Exemplary Computer-Using Teachers

Becker (1994) undertook a secondary analysis of data from the 1989 IEA survey on computer use in US schools (see for example, Becker, 1991) to distinguish 'exemplary' computer-using teachers from more typical ones. In the original national probability survey 516 upper elementary and secondary teachers completed a subject-specific questionnaire or telephone interview on dimensions of their practice. Because the questions differed for each level and subject group a series of common and group specific standards were developed to identify teachers who were perceived to be exemplary. The common standards were based on questions relating to: (a) the teacher's goals for computer use; (b) the frequency with which students use computers; (c) the saliency of the computer approaches used in the classroom; (d) the amount of experience using different types of software; and, (e) the general functions of the computer in the classroom (Becker, 1994). There were a series of 12-15 group specific standards that sought to identify characteristics that exemplary computer-using teachers might be expected to possess. These standards were guided by the principle that computers were being used by the teacher to help students 'think better, writer better and solve problems better' (Becker, 1994, p.317).

The teachers were given an index score based on these standards and placed on a continuum of exemplary practice. In the absence of any prior research of this type, an arbitrary cut-off score was used to judge between typical and exemplary computer-using teachers. The problem of determing where to draw the line was demonstrated by Becker in his admission that a less rigorous cut-off point was required to get enough teachers in the sample. As Becker (1994) states a 'more rigorous definition would have produced only two math teachers' whereas a 'less rigorous cut-off score produced a total of 11 mathematics teachers' (p.321). The results may have provided quite a different profile of exemplary practice had

this decision not been made for the purpose of statistical analysis. In total there were 45 teachers identified as exemplary, with 12 of these in the elementary school. It was estimated that because the elementary teachers were over-represented compared to an equal probability sample, between only 3-5% of all US teachers would meet the defined standards. Of course, another explanation for the larger sample of elementary teachers is that these practitioners are simply more expert than other teachers!

The distinctive characteristics of exemplary computer-using teachers were described as: (a) differences in teachers' school and classroom environments; (b) differences in teachers' own backgrounds and experiences; and, (c) differences in teachers' practices and perceptions concerning computer use.

The school and classroom environments of exemplary teachers were found to be representative of the larger sample. There was little difference between exemplary and typical teachers with regard to the socioeconomic status of the school and the number of years that computers had been used in the classroom. The largest predictors of exemplary practice were the collegiality among the teachers using computers in the school and the amount of available software within each institution. Furthermore, the levels of support from the school and the available professional development opportunities were important factors. According to Becker smaller class sizes and better ratio of computers to students were also key indicators of exemplary practice.

There were a number of differences in exemplary computer-using teachers' backgrounds and experiences. The largest difference was that exemplary teachers spent twice as many hours personally working on computers at school than did other teachers. Surprisingly, there was little difference between the two types of teachers in their use of computers at home. The exemplary computer-using teachers were, however, disproportionately men and the male teachers used computers twice as often in the home as the female exemplary teachers. A strong connection was seen between exemplary practice and time and experience in the classroom. In other words, an exemplary computer-using teacher had spent time using computers in the classroom as well as time learning to teach well. It was deduced that exemplary teachers taught on average three years longer than other computer-using teachers, and used computers in the classroom for about one year longer. Experience by itself was not the most significant difference, but it was considered a contributing variable in exemplary teaching practice.

A key difference was the amount of formal training in teaching with computers. Almost all exemplary computer-using teachers received some training and had extra credits beyond a bachelor's degree. Becker makes the point that these additional qualifications may be a proxy

of experience. Another explanation is that exemplary teachers may have a stronger commitment to teaching which contributes to their desire for further education. This additional education may lead to a better understanding of teaching and learning processes and, thus, more effective use of computers in the classroom. The inter-play between experience, qualifications and practice obviously requires further investigation.

There were some interesting differences in the practices and perceptions of exemplary computer-using teachers. The sample of exemplary teachers reported that they introduced new topics as a result of computers and appeared to emphasise small-group work more than other teachers. A key point to note is that differences in the social organisation of computer use may reflect the teachers' long-standing classroom practices as opposed to being the consequence of their learning to maximise the benefits of using computers (Becker, 1994). There were just as many barriers perceived to computer use by both exemplary and typical teachers, but the problems tended to be different ones. The exemplary teachers did not regard insufficient hardware and software as a major problem, like the typical teachers. Instead, inservice training opportunities and access to a home computer were perceived as impediments to exemplary practice. Finally, Becker points out that whether students are benefiting from such exemplary practice can only be assumed and there is still a need to study the competencies of students in these computer learning environments.

2.5.6 Characteristics of Proficient Computer-Using Teachers

There has been a basic failure in the research to-date to recognise that what you define as a 'successful', 'accomplished', 'effective', 'competent', 'exemplary' or 'proficient' computer-using teacher is exactly what you get. In other words, the criteria, or lack of criteria, adopted and the methods employed have an obvious bearing on which teachers are identified and subsequently profiled as exponents of proficient practice. The use of the term 'proficient' here is quite deliberate. It is selected in light of the burgeoning literature on effective practice that suggests there is no one profile of the expert teacher, nor any single recipe to teaching success (see for example, Boylan, Battersby, Wallace, Retallick & Edwards, 1991; Brown & McIntyre, 1993; Katterns & Haigh, 1986; Knight & Smith, 1989; Olson, 1992). Proficiency indicates that there are a range of teaching practices with computers that help to create conditions for better learning. The research in this area has tended to ignore that teaching involves intricate, intuitive and idiosyncratic processes that are exceedingly difficult to describe, especially through survey techniques. What is required is educational computing research that is informed by the literature on proficient teaching *per se*. There is an extensive body of theory and research on the attributes of proficient teachers, and it would be to the detriment of the field if this literature did not underpin future studies in this area.

2.6 WHAT MAKES A PROFICIENT TEACHER?

The question of what constitutes effective teaching practice and thereby proficient teaching has obvious importance. It has taken on increasing importance in a time when there is a movement to individually reward teachers for the quality of their instruction. There are a number of theoretical models of proficiency, each of which have implications for the study of proficient computer-using teachers. This section does not attempt a comprehensive review of these models, but rather describes the distinguishing features of proficient teachers from the different perspectives. The position is taken that proficiency does not fit one particular model and that the identification of proficient teachers is problematic, in that it is inherently a subjective and value laden process (Olson, 1992).

2.6.1 Technical Rationality Model

Early accounts of teaching were based on what has been described as a technical rationality model (Schon, 1983). This model viewed proficient teaching as the consequence of external and exogenous factors. What goes on in the classroom was considered the product of the educational system itself. This was a mechanical model of teaching where proficient teachers were seen to be like machines that made efficient use of the materials and resources that the education system deemed appropriate. It was strongly influenced by the behavioural tradition of learning and the belief that student achievement was caused by, and the result of, a prescribed set of teaching skills (Olson, 1992).

2.6.2 Cognitive Model

The cognitive model rejects the mechanistic view of teaching and is based on the assumption that thought and action go on at the same time. If you analyse the thought processes of the expert that will tell you what expertise is and thus reveal how proficiency is achieved (Olson, 1992). It is grounded in the study of experts and novices in action and the belief that proficient teachers have different cognitive structures than those with less expertise. Berliner (1986) has been influential in the development of this model and in proposing that experts follow a set of rules that are built up in their cognitive structures from experience over time. It is argued that expertise is an outcome of experience and that the main difference is that novices have less subject-specific and pedagogical knowledge than more expert teachers.

2.6.3 Dreyfus Model

The Dreyfus model of expertise has gained recent attention in education. It was proposed by the Dreyfus brothers that expert practice arises without conscious reflection, but through semi-automatic processes. The model makes the case for tacit knowledge and intuition rather

than reasoning as critical features of professional expertise (Eraut, 1994). In other words, proficient teaching is arational (Olson, 1992). There are five stages of skill acquisition with novice behaviour characterised by dependence on rules, whereas expert practice just happens much like skilfully driving a car. It is considered impossible to decontsruct expertise into specific rules that guide practice. Teaching is too complex for this and involves a type of 'know how' that has to be understood in a holistic way.

2.6.4 Reflective Practitioner Model

An influential model in recent years has been that of the reflective practitioner (Schon, 1983, 1987). This model emphasises the importance of 'reflection in action' and 'reflection on action' and suggests that some conscious cognitive processing is going on as expert teaching is occurring. Proficient teachers think critically about their teaching and try out new actions to change things for the better (Eraut, 1994). Schon's model straddles other accounts of proficiency, but with more of a cognitive emphasis and concern about the artistry of teaching (Olson, 1992). It is a comprehensive model and there are many variations on the concept of the reflective practitioner (see for example, Elbaz, 1990; Sparks-Langer & Colton, 1991). The concept attracts criticism as there is no universal position on what is entailed in the reflective process (Eraut, 1994). Despite these criticisms, it remains one of the most receptive models on what constitutes and distinguishes proficient teaching practice.

2.6.5 Synthesis of Theory and Research on Proficient Teaching

There is some consensus that proficient teaching requires a degree of experience. It is related to a combination of pedagogical, subject and tacit knowledge which is grounded not only in practice, but also refined over time through formalised theory. The inter-play between this knowledge remains problematic as it is likely to be contextually bound (Eraut, 1994). Reflection and metacognitive-type processes are clearly important, as are practices that have become automatised and the wider systems that limit the content and structure of the curriculum. In addition, Olson (1992) makes the point that proficient teaching requires certain personal attributes that are grounded within a moral framework. There have been numerous definitions of these attributes from different studies on proficient teachers in action and the findings are not dissimilar. The most relevant study of teaching proficiency for this thesis comes from research by Ramsay and Oliver (1993) on 'quality' teachers in New Zealand schools. According to this study there are 15 capacities and behaviours of such teachers:

i) *Are highly intelligent people with outstanding powers of observation and the ability to carry out many ideas in their heads at the same time;*

ii) Have developed strong philosophies of education, containing theories which are well grounded and tested regularly against their personal practice;

iii) Have capacities of patience and are also prepared to preserve for long periods of time;

iv) Are extremely rational people who reflect carefully on their practice and who give reasons for making particular decisions relating to children's learning outcomes;

v) Have a very strong sense of humour and demonstrate a caring capacity for the children in their classrooms;

vi) Work long and arduous hours;

vii) Besides their excellent relationship with children, also have the ability to interact meaningfully with other adults;

viii) Complete tasks themselves and also demand that children be completers of their work;

ix) Reveal themselves to their children as persons rather than just teachers;

x) Adopt bicultural approaches wherever possible;

xi) Modify the environment in their classrooms;

xii) Place an emphasis on security, comfort, well-being and happiness of their students;

xiii) Have a very high passionate commitment to their career as teachers;

xiv) Are confident in their own ability as teachers;

xv) Have a wide knowledge of socio-political issues and a strong social conscience;

(Ramsay & Oliver, 1993, p.70).

These attributes can help guide the identification and selection of proficient teachers, but we should not lose sight of the fact that how we define 'proficiency' is determined by the importance given to the different rationales for the use of computers in schools. Definitions of proficiency are essentially a reflection of what we value about education itself. Our values about the meaning and function of education determine the priority we give to specific criterion. The study of proficient computer-using teachers must always be placed within this wider socio-political context.

2.7 SUMMARY

The parameters of the thesis have been outlined and a range of frameworks introduced for studying the use of computers in education. An outline of the different traditions and theoretical perspectives on learning and computers was offered, and the inclusive perspective advocated as the most appropriate for understanding the range of conditions that computers create for better classroom learning. The research literature on both learning and teaching with computers was reviewed, with an emphasis placed on studying proficient computer-using teachers and the beliefs that underpin their practice. Prior research in this area was described and shown to have a number of conceptual and methodological weaknesses. The concept of proficiency was discussed from within the literature on effective teaching practice and demonstrated to be highly problematic. It was argued that future research on computer-using teachers needs to be better informed by the literature on proficient teaching *per se.*

In the following chapter the specific research problem is stated and the aims of the study outlined, with a number of methodological issues discussed on conducting research in the computer learning environment.

CHAPTER THREE

Background to the Study

"The people effects and the teaching effects are more important than the machine effects" (Ryba, 1992, p.95).

3.0 INTRODUCTION

This chapter backgrounds the research topic in relation to teachers and their use of computers in New Zealand schools. It states the general problem that the study was designed to examine and provides the main objective and research aims. A number of methodological issues are discussed on conducting research in the area of educational computing. The different paradigms of educational research are described and consideration is given to appropriate methods of research from an historical account of past studies on the use of computers in education. A detailed analysis of different methodological approaches is undertaken, and it is argued that educational computing research needs to be conducted within a multi-dimensional paradigm where methods are not pre-determined by particular philosophical orientations, but selected according to the definition of the problem and the specific research questions.

3.1 BACKGROUND TO THE PROBLEM

The use of computers is common practice in most New Zealand primary schools. In a recent survey it was estimated that there were a ratio of one computer per 15-17 students in New Zealand schools (Henderson, 1995; McMahon; cited in Wallis, 1994). Although there is considerable support for the increasing use of educational software for teaching and learning purposes, there remains a potentially dangerous assumption. That is, there has been a tendency on the part of many New Zealand educators to assume that the mere use of sophisticated computer technologies will automatically equate to conditions for better learning (Brown, 1992). The acceptance of such a view, however, is contrary to much of the current research evidence. It is not just the computer, but the overall learning context in which the software is embedded that creates the potential conditions for better learning.

Whilst significant resources continue to be invested in equipping New Zealand schools with up-to-date computer hardware and software, rather less attention has been given to the teaching and learning context. The point has been made that students in computer environments may be learning rather less than anticipated (Brown, 1994). While students

may appear on the surface to be highly attentive and engaged as they work with sophisticated computer technology, it may be that many of them are still learning through fairly traditional methods and processing information in relatively passive ways (Selby, Ryba & Williams, 1993). Furthermore, some students may be spending a large portion of their time dealing with technical and presentation requirements of computer tasks, such that there is limited opportunity for processing specific domain knowledge. There is, therefore, a need to pay close attention to the different ways computers are used in the classroom and to the professional development opportunities teachers have to learn how to use the software to meet existing curriculum goals.

3.1.1 Early Professional Development

In the early years of educational computing professional development was not given high priority (Hodson, 1992). Most schools were still struggling with expenditure and budgetry requirements and it was a case of running cakestalls, raffles and bottle drives simply to obtain sufficient hardware. The period of the 1980s was a time of experimentation and learning for teachers. In 1984 the former Department of Education established a small professional development team known as the Computer Courseware Development Unit (CCDU, later changed to Computer Education Development Unit -- CEDU). This unit had an important role in helping disseminate information to teachers on selecting and using a range of educational software in the classroom.

In 1986 there was a major professional development and research initiative in which 24 'Exploratory Studies' were undertaken, over two years, on various computer applications in 66 kindergarten, primary, intermediate and secondary schools (McMahon, 1986). There was a perceived lack of information and experience on the use of computers in schools and $900.000 was allocated to these studies after a government election promise to develop greater computer awareness among teachers (Nightingale & Chamberlain, 1991). A few 'Action Research Projects' were supported in 1988 by CEDU pertaining to the use of electronic mail (e-mail) . The disestablishment of CEDU in late 1989 meant that the reports of the Exploratory Studies and Action Research Projects were never widely circulated, but undoubtedly these opportunities gave many teachers the chance to explore computer practice in their own classrooms.

The majority of the professional development opportunities throughout the 1980s were not conducted in the actual classroom. Although there was no stated policy on teacher training there was a widespread belief that teachers should be trained, and consequency there were a number of courses offered by different educational institutions and district support staff on the use of computers in education (see for example, Watts, 1990). The dominant philosophy

that underpinned these predominately 'hands on' courses was that teachers were most likely to use the computer as a 'tool' in the classroom if they found it useful in their own personal and professional work. Many teachers were taught the 'mechanics' of how to use the computer as a word processor, database and spreadsheet, that is as a powerful information processing tool.

In 1989 a National survey was undertaken, supported by the International Association for the Evaluation of Educational Achievement (IEA), on the use of computers in New Zealand Schools. It was acknowledged for the first time that:

> *"educational computing in New Zealand was characterised by an apparent lack of government commitment to providing formal policy and resources. A number of problems had arisen regarding the introduction of computers, which resulted from the lack of any formal direction. Problems such as (...) the ad hoc range of computing activities in schools, and the difficulties with providing appropriate training for teachers were just some" (Nightingale & Chamberlain, 1991, p.21).*

The formal and informal teacher training opportunties were, up until this time, quite successful in helping a small group of teachers to learn how to personally use a range of different computer applications. The *Report of the Consultative Committee on Information Technology in the School Curriculum* pointed out, however, that prior professional development had failed to help teachers turn this knowledge into learning gains in the classroom (Ministry of Education, 1990). The challenge was to provide professional development opportunitites for teachers to match the type of access that most students in New Zealand schools now had to computers. It was crucial that teachers not only know how to use the machine, but also have sufficient pedagogical knowledge to make effective use of the computer in the classroom.

3.1.2 Recent Teacher Development

The *Consultative Committee on Information Technology in the School Curriculum* recommended that the government make 'a commitment to a major upgrading of the levels of teacher development' (Ministry of Education, 1990, p.4). In recent years, based on this recommendation, extensive teacher development has taken place on the use of information technology, that is computers, in schools (see for example, Gilmore, 1992a; 1992b; Tuck, 1992). A new model of teacher development has emerged that moves beyond a narrow skill approach. It was recognised that:

> *"When the objective is to make children composers, performers and appreciators of music, it is not enough merely to place a piano in every classroom and provide each teacher with a one day course on how a piano works" (cited in Gilmore, 1992a, p.75).*

The current model of teacher development is based on a type of 'reflection in action' approach. This model is influenced by the ideas underpinning the concept of reflective teaching (Schon, 1987) and the strategy of action research (see for example, Elliott, 1991). It seeks to promote continuous learning through experience. The teacher development is notable for its attempt to develop information, skills and resources in the context of classroom practice (see Fig 3.1). The model relies upon trained facilitators (and researchers) to work with clusters of teachers to plan, implement and reflect on a range of practical computer-related activities in the classroom. A related point is that a number of these trained facilitators are now employed by the private sector. Teacher development is increasingly being offered by private organisations working under contract to the Ministry of Education. One of these contracts even includes a toll free helpline for teachers who have computer-related problems. The common aim of current teacher development is to link learning experiences directly to teachers' classrooms to ensure that both teachers and students benefit from the experience.

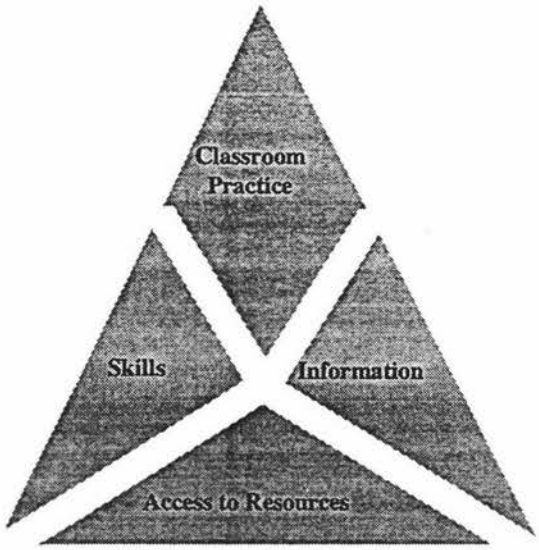

Figure 3.1
IT Teacher Development Model (Gilmore, 1992a, p75).

It is fair to say that this model of teacher development has been more successful than earlier initiatives at getting teachers to use computers in the classroom (see for example, Gilmore, 1993a; 1993b; 1994; Tuck, 1992). At the same time, arguably, it has fallen short of providing teachers with sufficient 'formalised' theoretical knowledge to make critical reflections that result in new understandings about the teaching and learning process. The

role of formalised theory is that it provides teachers with the 'conceptual language' to make more expert and critical observations of classroom practice. Without a sound knowledge of educational theory, and a framework for applying this in the classroom, such critical reflection is problematic (Eraut, 1994). By analogy, a master musician is not created by enticing a novice player to give many unrehearsed live performances. A master musician is usually someone who has a sound understanding of both theory and practice and who uses this expertise in creative and insightful ways. The purpose of this analogy is to demonstrate that formalised theoretical knowledge has a crucial role in the ultimate success of an educational innovation and in its potentially lasting transformation of classroom practice (Perkins, 1992).

3.1.3 Bridging The Gap Between Theory and Practice

In the past few years more than 6000 New Zealand teachers have participated in teacher development programmes (McMillan, 1994). There remains, however, a considerable gap between theory and practice. Although there are some well-developed theories about using computers in education, there is still a real need to understand how proficient teachers use computers to create conditions for better classroom learning. In particular, we need to study teachers' own theories and the way that their perceptions and beliefs mediate computer use in the classroom. This includes both 'personal' theories as well as 'ways of knowing' that proficient computer-using teachers employ to guide their classroom practice. We need to understand why some teachers see specific learning opportunities and use computers according to a particular philosophy, and others do not. Despite the claims about computers there are few studies that document proficient practice in the classroom. There remains a need to study the reciprocity between theory, research and 'proficient' teaching practice.

3.2 STATEMENT OF THE PROBLEM

There is a lack of critical debate over the widespread use of computers in New Zealand primary schools. The seductive appeal of using many new computer technologies in schools, for example, Internet and Multimedia, has diverted much attention from the overall learning context. There has been a tendency for people to over-emphasise the technical aspects of the machinery at the expense of the teacher's role in using the hardware and software to enhance the teaching and learning process. It is abundantly clear that teachers have a major influence on the way that computers are used in the classroom. The perceptions and beliefs of teachers, arguably, lie at the heart of computer use in education. There is a need to study these beliefs and the way in which they inform teaching practice. In particular, we need to document the experiences and practices of proficient computer-using teachers to ensure that the claimed benefits of computers do not become uncritically enshrined in both educational theory and practice. In this regard, relatively little information is available on the

different ways that proficient teachers are using computers to create conditions for better learning in the classroom.

3.3 RESEARCH OBJECTIVE

The main objective of this study was to:

> *Investigate how primary school teachers use computers to create conditions for better learning in the classroom.*

3.4 RESEARCH AIMS

The specific aims of the research were to:

i) Document the background and educational experience of primary school teachers who were proficient at using computers in their classroom;

ii) Determine how proficient computer-using teachers use specific computer applications to support learning in their classrooms;

iii) Describe the changes proficient computer-using teachers perceive have occurred to their practice as a result of computer use in their classrooms;

iv) Document the beliefs proficient computer-using teachers have about the processes of teaching and learning and about how computers support these processes;

v) Identify factors that proficient computer-using teachers perceive inhibit and/or enhance the use of computers in the classroom;

vi) Describe the role that proficient computer-using teachers adopt during computer-related activities in the classroom;

vii) Document the confidence and competence of students at using computers within the classrooms of proficient computer-using teachers;

viii) Gather information on the perceptions of students on how computers support their learning within the classrooms of proficient computer-using teachers.

3.5 METHODOLOGICAL ISSUES

In designing a research method to address the aims of the study, it was considered important to take into account a number of methodological issues. The methods of educational research have been open to much debate in recent decades. This debate has its origins from arguments within the philosophy of social science and social research theory. These arguments have deep ontological and epistemological roots and stem from three main philosophical traditions: positivism; interpretivism; and a combination (and convergence) of critical, feminist and post-modern theory (Carr & Kemmis, 1986; Reid, Robinson & Bunsen, 1995). It has become common to describe these different traditions in terms of three distinct paradigms. A paradigm is a basic belief system which is based on specific ontological, epistemological and methodological assumptions (Guba & Lincoln, 1994). The importance of the paradigms is that they are claimed to reflect quite different assumptions that manifest themselves in their own distinct methods of social science.

The following discussion outlines the nature of each paradigm and contrasts their respective philosophical assumptions. It describes how the tension between the different paradigms has fuelled debate about appropriate methods of research in the area of educational computing. The methodological strengths and weakness of different research designs are discussed, and the limitations of prior research are used to argue that the paradigms of social science are not incommensurable. It is proposed that the different philosophical traditions complement each other and no one research methodology has any claim to supremacy. The chapter concludes that educational computing research needs to adopt a non universal methodology, one that utilises both quantitative and qualitative methods within a multi-dimensional paradigm.

3.51 The Competing Paradigms

The main philosophical paradigms of social science represent competing ontological, epistemological and methodological worldviews (see Table 3.1). A 'worldview' is simply a person's orientation toward a particular philosophical perspective on the human world. Guba and Lincoln (1994) claim that alternative worldviews are based on how people respond to three key questions:

- *What is the nature of reality and what, therefore, can be known about it?*
- *What is the nature of the relationship between a human person and what can be known?*
- *How can a human person go about finding out what they believe can be known?*

The answers to these questions are what define and distinguish the different philosophical paradigms. The response to the first question determines to a large extent the answers that follow. For example, if a 'real' reality is assumed then the relationship of the social scientist is considered to be one of objective and value free in order to determine the nature of the real world. Conversely, if reality is assumed to be socially constructed then the posture of the social scientist is deemed to be subjective with multiple, and often conflicting, realities of the social world. Guba and Lincoln (1994) maintain that even pragmatic responses still assume a particular philosophical position. All responses are claimed to reflect one, and only one, of the three main paradigms of social science.

Table 3.1

An Overview Of The Main Research Paradigms

Assumptions	Positivism	Interpretivism	Critical
Ontological	Real Reality Real But There Are Imperfect Conclusions	Constructed With Multiple Realities Of The Social World	Reality Shaped By Values: Social, Political, Cultural, Economic.
Epistemological	Objective/Dualist In Search Of Truth	Subjective Value Laden	Subjective Value Mediated
Methodological	Experimental Control/Manipulation	Contextual/ Holistic Analysis of Variables	Active/Dialectical Designed for Action

There are many variations and nuances within each paradigm and it is important to bear in mind that these are only explanatory constructs which help to understand the nature of human inquiry. The paradigms, like any theory, should not be seen as fixed positions, but rather fluid texts always open to debate. There is no way to establish, beyond question, their ultimate truthfulness (Guba & Lincoln, 1994). If there were, the paradigm debate would have been resolved centuries ago. Nonetheless, Guba and Lincoln stress that no researcher should go about their work without being clear about what paradigm informs and guides their approach. With this in mind the following section describes each paradigm and their main philosophical assumptions.

3.5.2 Positivist Paradigm

The positivist paradigm, also known as the empirical or post-positivist, emanates from the natural sciences (Bredo, 1989). It is based on the premise that the methodological procedures of natural science can be directly applied to the social sciences (Soltis, 1984).

The assumption that natural scientific methods are applicable to social research reflects a realist view of the world that has dominated the discourse of science for some 400 years (Guba & Lincoln, 1994). In its crudest form realism presumes the world exists externally, that is independent of the social scientist (Hughes, 1990). The scientist is seen as a 'rational spectator' -- someone able to make neutral, value free and objective observations (Toulmin, 1981). It is objective observations of the 'real' world that are the cornerstone of positivist social science.

3.5.3 Interpretive Paradigm

An alternative to the positivist paradigm is the interpretivist. The interpretivist paradigm attracts a number of different theoretical perspectives which lean toward a relativist or constructivist view of the world (Schwandt, 1994). In its extreme form relativism denies the existence of a real world (Hughes, 1990). The relativist claims that individuals' construct their own versions of reality. There are multiple realities of the world and observations are continually mediated through the social scientists' particular view of reality (Mishler, 1979). The social scientist is acknowledged to wear a 'theoretical lens' that results in inherently biased, value laden and subjective observations (Lincoln & Guba, 1985). The foundation of interpretivist social science is based on subjective observations of an 'indeterminate' world.

3.5.4 Critical Paradigm

The critical paradigm adopts a form of historical realism that supports the subjectivity of interpretivism, but within a more emancipatory ideology. This ideology is based on a combination of critical, feminist and post-modern theory (Anderson, 1989; Longino, 1989; Reid, Robinson & Bunsen, 1995). These theoretical orientations are used to argue that social science should engage in a critique of ideology. The assumption is that perceptions of social reality are distorted and a critique of ideology has the potential to raise false consciousness. Anderson (1989) refers to false consciousness as unknown and imprecise reconstructions of reality that perpetuate, as much as explain, social phenomena. A critical examination of social phenomena is claimed to liberate people from sources of domination, repression and subjugation and thus result in more enlightened observations (Carr & Kemmis, 1983). It is these enlightened observations that are at the 'heart' of critical social science.

3.5.5 Summary of Paradigms

There are many interpretations of the paradigms and the above descriptions are somewhat simplistic. Nonetheless, in its purest form positivism construes a view of humans as passive and determined by exogenous causes (Hughes, 1990). Humans are not seen as significantly different from other things explained by the methods of the natural sciences. In contrast,

interpretivism, with its constructivist view of knowledge, encourages a view of humans as active and self-creating (Guba & Lincoln, 1994). Humans are radically different from other things in the natural world and totally inexplicable in terms of such methods. The critical paradigm supports a similar position, but presents a view of humans as oppressed and in need of liberation (Anderson, 1989). Human liberation is thought to reside in critical self-reflection and highly practical research methodologies.

3.6 THE METHODOLOGICAL DEBATE

The paradigms manifest themselves as quite different research methodologies, hence the methods of social science have been open to intense debate in recent years (Guba & Lincoln, 1994). It is a mistake, however, to see this debate as a crude distinction between quantitative and qualitative methods (Salomon, 1991). Such a dichotomy is overly simplistic. The methods of social science are more sophisticated than this and such a focus does not do the methodological debate justice. The battle for methodological supremacy is complicated by the fact that it is not only fought between the paradigms, but also within each paradigm. There are different interpretations and intra-paradigm altercations on what constitute appropriate research methods. The question of appropriate methods is crucial as it strikes at the core of what counts as 'good' research. The research literature on educational computing has not been oblivious to this point and there has been much controversy about research designs in the study of computers in education.

3.6.1 Designing Research on Computers in Education

A great deal of research has been completed on the use of computers in education. In the early years much of this research was exploratory and undertaken in relatively contrived conditions. The literature was dominated by experimental studies that attempted to measure the machine effects on learning. The aim was to isolate the beneficial effects of the computer on learning by attempting to control all the intervening variables (Ryba, 1991). This type of research was characterised by its attempt to establish whether the computer was more effective than traditional methods of instruction. In recent years there has been a shift away from this style of research towards a greater interest in the contextual variables related to computer use. The computer is seem to be part of a much larger social system. More recently there has been trend towards adopting collaborative and emanicipatory methodologies that aim to help teachers make more effective use of computers in the actual classroom. This approach involves teachers and researchers working together with a common goal. The following discussion traces the development of research methods within the computers in education field and analyses the different methodological approaches in terms of the main paradigms of social science.

3.6.2 Early Positivist Approaches

When computers were first studied in education the basic research design was that adapted from the scientific method used in the natural sciences. It usually involved two groups of students in a treatment and non-treatment experiment. An hypothesis was stated and quasi-experiment designed to test for cause and effect relationships. The intention was to control, manipulate and observe a range of variables in order to measure the effect of the computer on learning. The effects were normally measured by some type of pre and post-test research instrument. Data were analysed using various statistical procedures and the research was synonymous with quantitative techniques. The predominant emphasis was on measuring learning outcomes, rather than studying the learning process (Ryba, 1992).

The key point is that early research emanated from the positivist paradigm. The research was based on the assumption that experimental designs were the only 'true' way to test whether the computer was more effective than other, more traditional, forms of instruction (see for example, Becker, 1987). It was considered that the methodology provided a simple and straight forward means to determine, under a variety of conditions, the benefits of the computer on learning. The method provided a rigorous and acceptable way to establish the value of using computers for instructional purposes, across different levels and contexts. It demanded a high level of precision and offered the ability to replicate studies, if necessary, using multi-variant techniques with large groups for comparative purposes (Pea, 1987).

The research during the 1970s and early 1980s on the benefits of computer assisted instruction (CAI) was based on such assumptions. The design of research during this period usually involved one group of students receiving traditional instruction and another group receiving instruction in the same material, but with the computer. The group that recorded the greatest learning gains was deemed to have had the most effective type of instruction. One of the difficulties in forming such a conclusion was that the groups were normally studied in isolation from the regular curriculum. Furthermore, the groups were observed only for a limited period and there was rarely any attempt to control for Hawthorn effects. The results may have been due to the novelty of the computer experience and not the actual treatment. This type of research tended to emphasise what computers could do to, or for students, rather than what students could do with computers (Harel & Papert, 1990).

In a classic paper by Johnson and Johnson (1986) this early research was used as evidence for the potential of computers to facilitate improved social and cognitive growth. Johnson and Johnson (1986) put forward the hypothesis that students working in cooperative groups with CAI, would out perform those who worked alone. The hypothesis was important

because it highlighted a previously neglected aspect of computer use, that is student--student interaction. A number of quasi-experimental studies were subsequently designed to quantify this claim (see for example, Niemiec & Walberg, 1991). A common mistake, however, was the failure in these studies to include a traditional non computer control group for both individual and cooperative types of instruction. The inconclusive results were, nonetheless, not directly a consequence of this design flaw, but arguably because the research was still based on a number of relatively naive assumptions.

3.6.3 Early Critiques of Positivism

These assumptions were first exposed by Clark (1983). In swimming upstream from conventional wisdom he argued that media did not effect learning, but rather it was the different methods of instruction that impacted upon what was learnt. He used an analogy to show that media was mere vehicles that delivered instruction, but that did not influence learning any more than a truck delivering our groceries cause changes to our nutrition. Clark made the point that it was problematic to assume that the effects of media were always related to causes, and that differences after an experimental treatment were directly related to the treatment. Clark (1983; 1991) argued that effects on learning from media could not be captured in isolated, contrived situations which relied almost exclusively upon quantitative techniques.

This view was supported by Salomon and Gardner (1986) who examined the lessons from television research and maintained that when computers were introduced into classrooms a number of other factors altered as well, the teacher reacted in different ways, the nature of student interaction was different and the physical environment changed. Salomon and Gardner showed that it was problematic to design an experiment to control all variables, as you can never identify the full range that might relate to a particular effect. The main thesis of their argument was that experimental methods were inappropriate on there own as they were insensitive to the multiple ways that computers could be used for instructional purposes. What was required was a holistic paradigm that studied the computer as a cultural phenomenon.

Despite this argument the issue of appropriate methodologies was not properly debated until exhaustive research on the effects of Logo™. In the 1980's research on the Logo™ programming language and the ideas of Seymour Papert (1980) dominated the computers in education field. The interest in Logo™ was centred particularly in North America where there was a lot optimism for its potential to enhance general problem solving skills. The claimed potential of Logo™ to develop such skills resulted in a flurry of experimental research. The key question was: *Did Logo™ work?* The results were somewhat equivocal.

Some research reported positive effects on the development of cognitive and metacognitive skills (see for example, Clements & Gullo, 1984), whereas other studies were notably more cautious about the acquisition and potential transfer of higher order thinking skills (see for example, Pea & Kurland, 1984). The controversy was such that there was even a movement to place a moratorium on the use of Logo™ in schools.

In a seminal article Papert (1987) took exception to some of the criticisms about Logo™. His reaction was not over the equivocal results of research on Logo™, but more on the methods being used to establish its beneficial and deleterious effects. Papert maintained that Logo™ had been judged unfairly; the criticisms were rooted in a misunderstanding of what Logo™ was about and how it should be studied. In particular, he argued that experimental methods largely missed the point. It was not the machine *per se* that directly influenced learning, but the overall social and cultural context within which the computer was embedded. Papert (1987) pointed out that:

> *"The context for human development is always a culture, never an isolated technology (...) you have to center your attention on the culture -- not on the computer" (p.23).*

The key point that Papert (1987) made was that research had to focus on the educational culture surrounding the computer, as opposed to the technical and cognitive requirements of simply doing Logo™. What he rejected here was a school of thought known as technological determinism. Technological determinism assumes that the effect a technology has on society depends on the structural properties of the technology itself, regardless of social and cultural factors (Mehan, 1989). Papert (1987) described prior educational computing research as trapped at a 'technocentric' stage where centrality was being given to the computer. To move beyond this stage he proposed that research needed to adopt a paradigm that concentrated on the learning environment as a whole and the researcher as an educational activist.

3.6.4 Experimenting With Naturalistic Methods

The methodological weaknesses of prior research on Logo™ were first addressed in a quasi-experimental study by Clements and Nastasi (1988). In this study systematic observations were undertaken of the social and cognitive interactions within a naturalistic Logo™ learning environment. The study was unique in that unlike prior research it clearly stated the theoretical assumptions on which observations were dependant. Clements and Nastasi (1988) provided an excellent synthesis of socio-cognitive learning theory and how it related to the potential of Logo™. The research was designed around an observation scheme

that operationally defined, for the first time, the type of metacognitive activities that students engaged in as they learnt with Logo™. Although the operational definition of metacognition was problematic in that it ignored how individual students mediated such experiences, the study provided some important evidence that Logo™ learning environments offered a context for socially strategic problem solving behaviours.

Whilst these results were encouraging, the design of this study did not fully address Papert's methodological concerns. Clements and Nastasi's (1988) research did not promote activism and disregarded many contextual variables, such as: (a) the prior experience of students; (b) their different levels of motivation; (c) the diversity of learning styles; (d) the varying perceptions of the Logo™ learning experience; and, (e) the role of the teacher. Indeed, the teacher's views of the learning process, their pedagogical approach and expectations for learning were never considered or controlled (Brown, 1992). Although the research was conducted in a naturalistic environment, the experimental method left out much of what was human. There was still a need to study the range of contextual variables within a naturalistic computer learning environment.

3.6.5 Alternative Models of Research

Another important contribution to the on-going methodological debate came in the work of Emihovich and Miller (1988). In an original paper on the social context of Logo™ a multi-disciplinary, multi-method approach to research was proposed utilising a modified reference model. This 'reference model' drew upon concepts from anthropology, psychology and sociolinguistics to form a frame of reference (Emihovich & Miller, 1988). It made no strong claims to external reality, but was designed to allow an inter-disciplinary qualitative and quantitative contextual analysis using a specific theoretical frame. The supposition was that research needed to be guided by, and analysed in relation to, an explicit educational theory. Although Emihovich and Miller acknowledged that this model was at its embryonic stage, they argued that research stripped of context was no longer a fruitful avenue of inquiry. What was required was a research model that combined both experimental and naturalistic forms of inquiry within a contextual approach.

Ryba (1989) built upon this work by proposing an ecological perspective which drew attention to the social interaction and environmental aspects of learning with computers. As part of this perspective he designed a model for analysing the social and cognitive interactions within the computer environment (Ryba, 1990). The important feature of this model was its emphasis on the learning process as opposed to the technical aspects of the machinery, and its attempt to integrate both naturalistic and experimental methods of research within an overall ecological framework. The precise nature of this framework was

defined by Brown (1992) as the study of inter-related systems and connections between elements within a particular computer learning environment.

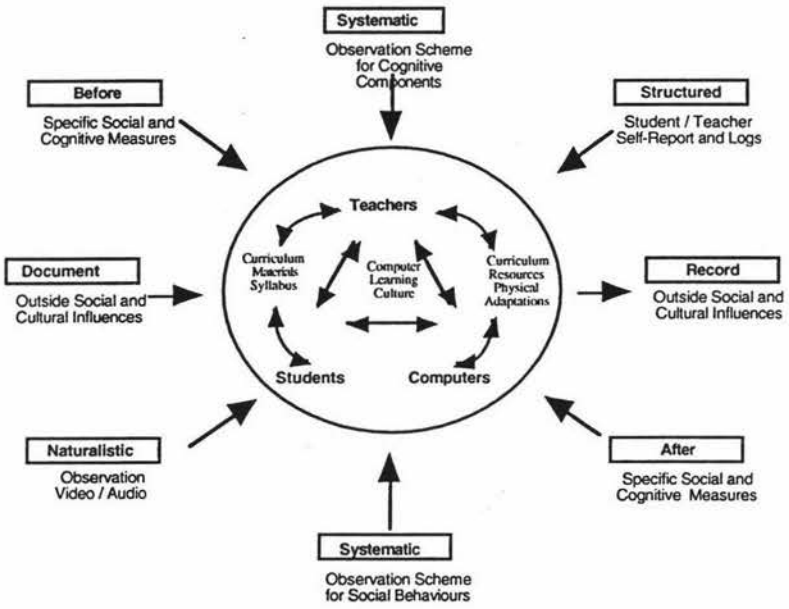

Figure 3.2
An Ecological Research Model (Brown, 1992, p.69).

There were four main components to the research model (see Fig 3.2). The first component referred to traditional experimental procedures used to examine before and after change. The second component consisted of systematic observations of cognitive and social behaviour utilising a variety of quantitative techniques. The third component focused upon a qualitative analysis of the teacher and student interactions within the naturalistic computer environment. The final component documented the influence of other social systems on the development of the computer learning culture. The benefit of studying the learning culture in this ecological way was that no one component or system was seen in isolation (Brown, 1992). A combination of different quantitative and qualitative techniques was required to document the dynamic interactions that created a computer learning culture.

3.6.6 The Computer as Social Practice

The interest in culture and naturalistic methods in the computer learning environment was encouraged by Mehan's (1989) research. Mehan (1989) was one of the first to apply traditional ethnographic techniques to research in the computers in education field. His year long ethnographic case study of changes to classroom arrangements, teacher and student relations and curriculum organisation showed that in the natural context of the classroom, teachers could either use the innovative features of computer technology to meet previously

established educational goals or to strive toward previously unattainable educational goals. Mehan (1989) used these findings to argue that it was social practice not the features of the technology, nor the structure of a social organisation, that determined the ultimate use of an educational innovation. As social practice the computer was always part of a larger social system. This social system included:

> *"the students, the teacher, their history of past relationships, the history of ways of teaching, the history of ways of organising classrooms, the relationships that the classroom curriculum has to the surroundings, and the relationship between the classroom and the school, community, and agencies beyond" (Mehan, 1989, p.19).*

Mehan's (1989) insight into the relationship between the computer and society at large had significant implications for research. The mutually influential nature of this relationship meant that it was important to study the modifications and changes to social practice that accompanied computer use in schools. The thrust of Mehan's thesis was that the effects of the computer were unlikely to be unidirectional, but rather multifarious. A study of this type demanded methods sensitive to the computer learning environment and the range of ethical, historical, moral and political issues endemic to human inquiry. The argument was that all research of social phenomena takes place within a social system, and that this system has a bearing on both the process and outcome of the research. The crucial ingredient according to Mehan (1989), was people and their experiences with the computer, not the inherent features of the technology itself.

3.6.7 The Rise of Interpretivism

The focus on 'people effects' led to a much wider appreciation that it was the dynamic interactions between computers, students, teachers, curricula and wider social systems that was central to what was learnt (Ryba, 1991). It was not the computer that determined learning, but a range of nested mutually influential relationships within an inter-related web of social practice. According to Salomon (1990, 1991) there were a conglomerate of interdependent variables, events, perceptions, attitudes, expectations and behaviours that effected the computer learning environment. This claim was first illustrated through an analogy of a symphony orchestra. Salomon (1990) pointed out that:

> *"the music we enjoy is produced by symphonic orchestras, not just single flutes" (p.530).*

This was, arguably, the first time that someone fully articulated an interpretivist worldview on research methods in the computers in education field. Salomon (1990) was reacting to a growing disenchantment with the reductionist, one-variable-at-a-time experimental, analytic paradigm which often lost the forest for the trees -- the orchestra for the flute. He criticised the positivist tradition by stating that:

> *"the analytic-experimental approach we are so familiar with cannot fully satisfy the need to study individual changes in a changing context. One of the reasons is that such an approach requires the manipulation of single a variable (...) Rather than having a single or a few independent variables to which differences in a well specified dependent variable can be attributed, with everything else held constant, we now have a complex package of interdependent and mutually defining variables each of which is "independent," "mediating," and "dependent" at the same time" (Salomon, 1992, p.65).*

The key point to emerge from this interpretivist view was that educational computing research needed to shift towards a systemic paradigm, recognising that people and culture coexist and jointly define one another in contributing to the nature and meaning of an event (Salomon, 1991, 1992). In other words, each has the potential to effect the other as well as the learning environment as a whole. The main difference between a systemic paradigm and a more traditional analytic method was that one focused on the whole ecology of inter-related variables within a learning environment and the other treated social, emotional, physical or cultural contexts as either nonexistent or, at best, as background variables (see Fig 3.3).

To more precisely define the systemic paradigm Salomon (1991, 1992) distinguished between the need to study the effects 'with' the computer and the effects 'of' the computer. Effects 'with' the computer related to changes as students used computers to support their learning. These were effects pertaining to a particular context. Salomon described these as situated cognitions. Effects 'of' the computer related to the consequence of computer use. These effects were generalisable and transferable outcomes related to decontextualised cognitions. Although Salomon contended that both types of effects needed to be understood within a systemic paradigm, the effects 'of' the computer were ultimately more significant as these effects related to changes to culture rather than just to isolated experiences. Polin (1992) emphasised this point by suggesting that prior research had been looking for love in all the wrong places!

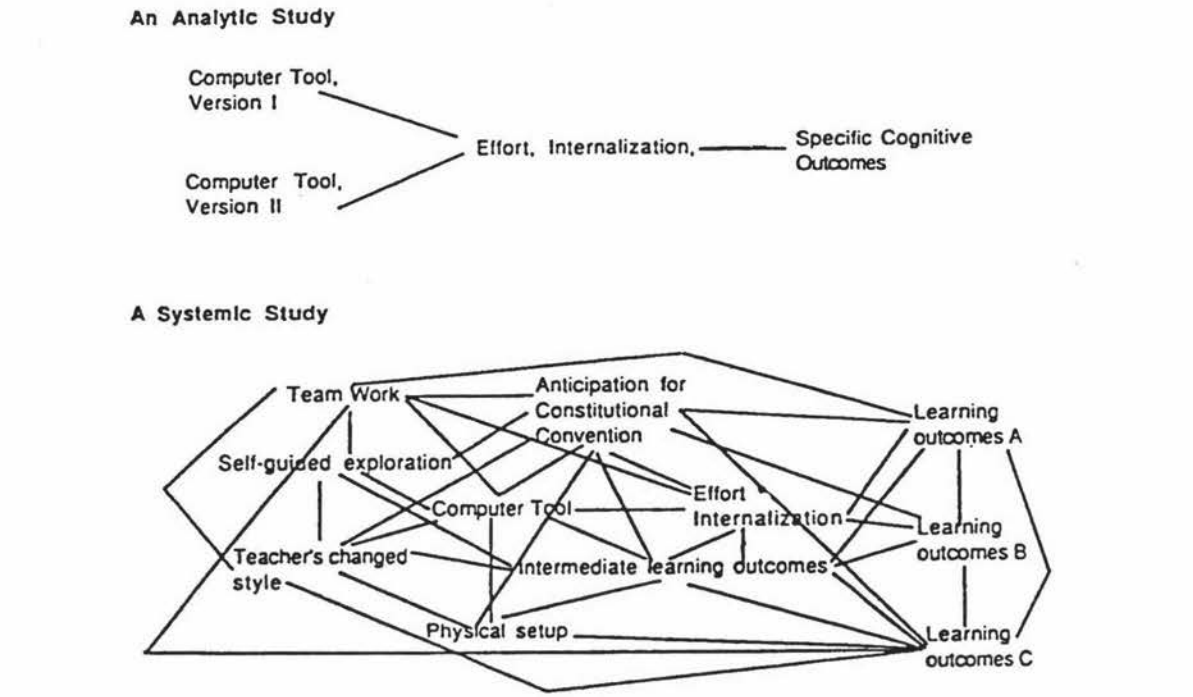

Figure 3.3
Analytic vs. Systemic Research Paradigms (Salomon, 1990, p.527).

The discussion about different types of effects within a computer learning environment was evidence that an increasing number of people were questioning the philosophical assumptions of experimental research. There remained staunch support for the traditional experimental design (see for example, Becker, 1987), but it was no longer regarded by many educators as a trustworthy way to conduct research in the area of educational computing. Khalil and Kern (1989) summarised the typical problems confronting research on the impact of computers, and Levine (1990) outlined a range of alternative qualitative methodologies that were increasingly being used in the assessment of classroom-based microcomputer educational programmes. These methods included a variety of case study and ethnographic approaches that in the late 1980s and early 1990s were gaining attention as valid forms of inquiry (see for example, Blomeyer & Martin, 1991; Olson, 1988; Pozzi, Hoyles & Healey, 1992). The emergence of case study and ethnographic approaches as legitimate methodologies epitomised the shift from the dominant positivist to flourishing interpretivist paradigm.

3.6.8 The Growth of Case Study

Case study was not so much a discrete methodology, but more a style of research with an aim to observe, probe and understand the subjective meanings of complex social phenomena (Stenhouse, 1982). The concern was not to control the computer, but to make sense of the

multiple experiences that both teachers and students were having with the technology within the context of the classroom (Levine, 1990). The computer learning environment, or part of it, was studied as an 'instance in action' or as a 'bounded system' and the method was open to a range of research techniques (Yin, 1989). Although Levine (1990) claims it attracted many closet positivists, case study distinguished itself in that the fieldwork was predominantly qualitative. The researcher would often participate with those under study to gain an understanding of the complex relationships between the variables that created a computer learning culture (Olson, 1988).

The method tried to maintain a close link between theory and practice such that experiences gained from case studies were 'illuminative' and thus mutually comprehensible, that is directly relevant to classroom practice (Beynon, 1993; Levine, 1990). The aim was not to test theory about the role of computers in education, but to collect a database of information that might yield insights, give meanings and provide converging evidence for the construction of tentative theories. There were many variations of case study, but whatever the particular style the purpose was to gather a rich archive of descriptive information that could over-time become a cumulative resource with the potential for generalisation (Olson, 1988). The belief was that a collective of case studies, each with a high level of internal validity, would ultimately provide a secure basis for generalisation (Levine, 1990). The major strength of the method was not, however, its generalisability, but rather flexibility and adaptability to the rapidly changing nature of the computer learning culture.

3.6.9 Positivism Fights Back

The case study method was not without its critics. There were on-going criticisms within and beyond the educational computing literature concerning the effects of the researcher, the time required for observation, the amount of data that had to be processed and the difficulty of accurately reporting complex interactions within a case. Many traditional positivist researchers attacked the foundations of case study and a number of modified experimental designs were proposed for determining the effectiveness of technology in education (see for example, Becker, 1987; Poirot & Knezek, 1992). It was argued that the methodology lacked a clear definition with non random naturalistic studies providing large volumes of information, but very little knowledge or explanation. Moreover, case studies had little reliability as other researchers could well come to different conclusions using 'soft' qualitative data. There was no basis for replication and rigorous testing and falsification of educational theory (Becker, 1987). As a consequence, it was concluded that case studies of computer environments had little external validity and generalisability to other contexts.

3.6.10 The Rise of Critical Research

The major criticism of case study and related contextual approaches to research in the computer environment had its origins in a quite different philosophical tradition. A small but increasing number of researchers were not convinced that interpretivist methods presented a consistent and unified alternative to the shortcomings of positivist research. The preoccupation with context and learning cultures were seen as a form of cultural determinism. Cultural determinism is the belief that it is culture as a whole that influences a social system and not a specific technology (Mehan, 1989). The problem with this view is that culture can be very conforming and that it is usually resistant to innovation and change. A culture reflects the dominant ideology and is inextricably linked to issues of power and social control.

This outlook considered that interpretivist methodologies, such as case study, were pragmatic as much as epistemological (Carr & Kemmis, 1986). They were pragmatic in that they supported conflicting epistemological positions and there was very little recognition that humans have misconceptions of the social world that are not in themselves a secure basis for validation. More importantly, case study was not committed to critique (Kelly, 1985). Whilst the methodology could accommodate a critical perspective, it did not always prescribe for action. The approach could shed light on the nature of the interactions within a computer learning culture, but it usually left it for others to decide how to act. The key point here is that these criticisms can be traced to the philosophical assumptions of the critical paradigm (Carr & Kemmis, 1986).

3.6.11 The Teacher as Researcher

An alternative methodology emerged known as action research in which the classroom teacher adopted a dual role as teacher-researcher (Carr & Kemmis, 1986). This method embraced the ontological and epistemological foundations of the critical paradigm and did not cast the researcher into a separate and distinctive role, but one of collaborating with the participants with the common purpose to improve classroom practice (Beynon, 1993). The design required the researcher to work with the participants to directly help them with their practical problems of trying to integrate the computer into the classroom. The method tried to engage in a demoncratic and non-exploitative form of self-reflective inquiry (Beynon, 1993). It was concerned with the experimentation of practice and the collaborative monitoring of effects through a process of critical reflection (Somekh, 1991). The aim was to challenge the rhetoric about computers, and teachers distorted perceptions about the role of computers in education, in an attempt to demystify the technology.

There were several strands of action research with the most common model containing four basic steps: (a) planning; (b) acting; (c) observing; and, (d) reflecting (Kemmis & McTaggart, 1988). The first step tried to define the problem and look beyond present constraints. The aim was to devise a critical plan of action. The second step adopted the plan and attempted to put it into practice. The third step was one of observing and carefully documenting the effects of a specific action. The fourth step was to critically reflect on this action and consider the problems that needed to be addressed in a revised plan.

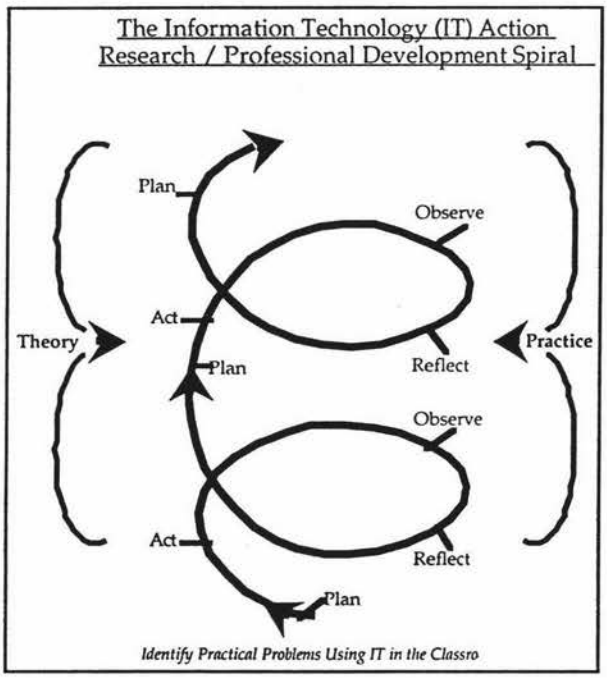

Figure 3.4
IT Action Research Model (Ryba & Brown, 1994, p.4).

These steps were not discrete but rather dynamic. Each step or phase was but one element within an action research spiral (see Fig 3.4). This spiral was a continual process that sought to mutually understand and overcome the problems of using computers in the classroom in order to improve existing practice. In this regard, action research was concerned not only with the empowerment and enlightenment of teachers, but also with activities that would support lasting social change.

The origins of action research in the computer environment are difficult to establish, but the method has strong connections to the Centre for Applied Research in Education (CARE) at the University of East Anglia, Norwich and the Educational Computing Research Group (ECRG) at Deakin University, Australia. It is no coincidence that a leading proponent of action research, Stephen Kemmis, was associated with both institutions (Beynon & Mackay, 1993). Whilst Olson (1988) first contemplated the benefits of an action research agenda for educational computing in the late 1980s, many early initiatives were poorly conceptualised and not designed in keeping with the philosophical assumptions of the approach. The first

genuine attempt at action research on a large scale came in the PALM project where a team from the University of East Anglia worked in partnership with over 100 teacher-researchers in 24 schools (Somekh, 1991). This project relied predominantly on qualitative techniques to capture the voices of teachers as they attempted to find out whether the rhetoric about computers could be put into practice.

A related aim of this project was to investigate the effectiveness of action research as a means of teacher professional development (Somekh, 1991). In recent years action research, and its many deviations, have attracted a strong following as an effective form of professional development (see for example, Poirot, 1992; Ryba, Anderson & Brown, 1992; Ryba & Brown, 1994). The method is claimed to help break down the mistrust and legacy of suspicion that many teachers have of research. The relationship that develops between the researcher and those involved in action research is thought to facilitate a supportive environment that bridges the gap between theory and practice (Palm/NCET, 1990). A major strength of action research is the validation of theory directly through practice.

3.6.12 Criticisms of Action Research

Despite the acceptance of action research as a valid model for professional development, it has no claim to any sort of methodological supremacy. Action research has a number of weaknesses as a research methodology. These weaknesses have yet to be fully exposed, but they relate, among other things, to the unequal power relationships between the participants, the skills required of both the researcher and the teachers concerned and the difficulties of collecting and accurately reporting the research findings. The positivist researcher argues that the methodology is impractical to the requirements of the computer environment and that the outcomes have no status. The method cannot be replicated and it lacks external validity. Moreover, the success of an educational technology is determined by factors that are often beyond the control of the individual. The commitment to action is at odds with falsification and leaves the potential for practice to be hijacked by a particular ideology.

The interpretivist is just as concerned with the ideological foundations of action research. It is alleged that action research has the potential to impose an ideology that could be both liberating and oppressive. The liberation of some groups may be at the expense of others. For example, the focus on the problem of using computers successfully in the classroom could be detrimental to a group of students who have a learning style incompatible with the technology. Action research presupposes that the researchers' perceptions of reality are not distorted and that there is a common ground on what constitutes better practice. Furthermore, the goal of empowerment is problematic. Some teachers may be quite happy

with their existing practice. There is no guarantee that enlightenment will lead to freedom of action in that certain types of change may be impossible within the existing social system.

3.7 HOW DO WE STUDY COMPUTERS IN EDUCATION?

The development of an appropriate research paradigm remains a major challenge within the educational computing literature. The limitations of prior research methods suggest that no one methodology is sufficiently inclusive toward the study of computers in education (Mercer & Scrimshaw, 1993). No doubt the methods of research will continue to be refined, but the debate over their legitimacy tends to deflect from their compatibility. Despite tensions between the different methods and their respective competing paradigms, each methodology contributes to our understanding and explanation of the role of computers within teaching and learning processes. This complementary position refutes Lincoln and Guba's (1985) incommensurability argument that there can be no accommodation between the paradigms. It maintains that in the future the paradigms of social research need to shift toward not just a pluralistic tolerance of different methodologies, but mutual support for each other. This view is based on the premise that no one approach to the study of computers in education is an end in itself. Each approach enriches the other.

This position does not mean that the paradigms of social science should combine, rather that research needs to be conducted within a multi-dimensional paradigm. A multi-dimensional paradigm suggests a type of epistemological pluralism where each perspective is valuable in understanding the complexity of the interactions that occur within a computer learning culture. In this perspective different forms of knowledge are needed to address different kinds of interests. The key point is that the paradigm debate is less problematic than it is often considered because what is important is what we want to find out, not necessarily the method we adopt to try and find it out (Howe, 1992). It is our questions that are crucial as these are what should determine our methodology. Hence the problems we define and questions we ask ought to be the main focus of debate. We will engage in more fruitful intellectual activity if the philosophical paradigms are used to critique our questions, rather than debase the available research methods.

In this regard we are better served to think of the research paradigms and their underpinning ontological, epistemological and methodological assumptions as open texts. In other words, explanatory frameworks that are partially developed and that can, and should, be re-written in light of new experiences. We need to understand that the research paradigms, and indeed all theory and scholarly work, are not a fixed set of beliefs to which one must adhere, but rather evidence of the intellectual struggle with questions which can never be fully resolved. It is, therefore, not surprising that different theoretical perspectives contain contradictions as

this will always be case for all the theories and research agendas we encounter. For this reason, a multi-dimensional paradigm is guided by general principles and questions, rather than any type of fixed orthodoxy.

3.8 GUIDING PRINCIPLES FOR RESEARCH

There will never be one all-inclusive research methodology, but there are a number of general principles that should guide social science and the study of computers in education in particular. The main principle should be to make research visibly relevant to the improvement of practice. This principle will in turn correspondingly lead to a practice that is informed by, and critically response to theory (Mercer & Scrimshaw, 1993). The aim is to explore the reciprocity between theory and practice and improve both at the same time through a reflective and self-consciously applied research programme. Besides this specific aim the following general principles can be derived from the research methods and paradigm debate:

(i) *Focus on an educational problem rather than select an educational technology or specific software application and go looking for a problem;*

(ii) *Include contextual factors in research designs such as teacher intervention, curriculum materials and interaction between learners. These factors may contribute in a significant way to learning outcomes;*

(iii) *Ensure that prior theoretical assumptions are made explicit and that every opportunity is given to build new as well as critique existing theories;*

(iv) *Explain and clearly justify the decisions throughout the research process such that these are always open to scrutiny and/or potential replication;*

(v) *Recognise the limitations of experimental methods and ensure that research conditions are feasible in, and applicable and transferable to, regular classroom settings;*

(vi) *Utilise both quantitative and qualitative research techniques such that a range of data can be obtained from as many different sources as possible;*

(vii) *Allow sufficient time for the study of significant effects so that observations and measurements do not pertain to simply novel experiences, but more durable and lasting changes over-time;*

(viii) *Involve the participants as much as possible in the research process as their concerns and perspectives will ultimately judge the value of the research and its applicability to the regular classroom;*

(ix) *Exercise caution in generalising findings from one study to the next. There are many approaches to using the computer and situational factors may prohibit the transfer of results from one setting to another.*

It follows that the design of this research was founded on, and guided by, these principles. In addition, the study was influenced by Lincoln and Guba's (1985) concept of what constitutes trustworthy research.

3.9 SUMMARY

There are many claims about the benefits of using computers in education. Despite the fact that computers have been in New Zealand schools for more than a decade, there are relatively few naturalistic studies that show how teachers are using educational software to create conditions for better learning in the regular setting of the classroom. The study of proficient computer-using teachers has the potential to address this gap in the literature. The research attempts to study the experiences, practices and perceptions of teachers who are considered to be proficient at using computers in the classroom. In undertaking this study the research was informed by deep philosophical divisions between the different traditions of social science: the positivist, interpretivist, and critical paradigms. The chapter contrasted these paradigms and described the strengths and weaknesses of different methodologies for conducting research in the computer environment. Each method was shown to have important limitations and these were used to argue that no one method has claim to supremacy. It was concluded that the different methodologies can complement each other and that research on the use of computers in education needs to be guided by questions that are framed within a multi-dimensional paradigm.

In the following chapter the method, procedures and techniques compatible with a multi-dimensional paradigm are described.

CHAPTER FOUR

The Method

"For the beginner there are many solutions. For the expert there are few" (Knight & Smith, 1989, p438).

4.0 INTRODUCTION

This chapter outlines the overall methodological approach and describes the three main phases of the research. It presents the research questions, a description of the sample participants and the sample selection process for each phase of the study. The development of the study in several phases involved a progressive analysis of a purposive sample of 'proficient' computer-using teachers. This required the use of specific criteria and a systematic process for the selection of the sample. A detailed account of the procedures and techniques used for piloting, gathering and analysing data within each phase are provided, along with justifications for the decisions made throughout the study. Attention is also given to ethical considerations, issues of trustworthiness and methodological limitations of the research.

4.1 RESEARCH DESIGN

The research was designed to realise the specific aims of the study within a multi-dimensional paradigm, involving both qualitative and quantitative methods of data collection. The first phase of the study was based on a survey method using a questionnaire to gather information on teachers' background experiences and the ways in which they were using computers in the classroom. Phase two extended the survey through an informant interview technique in which selected teachers were invited to converse about their own computer-using experiences. The final phase involved a microethnographic case study approach to document the perceptions and teaching and learning processes within the classrooms of two proficient computer-using teachers.

4.1.1 Justification for Research Design

A multi-dimensional paradigm adopts a design that is most suitable in terms of the objective and aims of the study. It is based on the selection of a method, or a combination of methods and research techniques, that can best answer the specific research questions. The questions in this study required a multi-method approach in order to examine the full complexity of social practice within which computers are embedded in schools. It was necessary to use

both quantitative and qualitative research techniques, within a multi-dimensional framework, to gather information on computer use in the naturalistic context of the classroom. This approach is supported by Salomon's (1990) analysis and Levine's (1990) review of research methods in the computers in education field, in which it is claimed there is a need for more holistic and systematic case study and ethnographic type research.

4.1.2 Research Population

The target population for the research were all computer-using teachers in primary and intermediate schools (N=34) within a 10 km radius of the centre of Palmerston North city.

4.1.3 Research Definitions

The following definitions applied to the target population:

i) A 'computer-using teacher' was defined as any teacher who used a computer for teaching and learning purposes within their regular classroom;

ii) A 'primary school' was defined as that offering either six or eight year school programmes;

iii) An 'intermediate school' was defined as that offering a traditional year seven and eight programme.

The inclusion of traditional intermediate school teachers within the target population was necessary as some primary teachers were employed at schools that offered an eight year school programme.

4.1.4 Justification for Population

There has historically been strong support for the use of computers in Palmerston North schools. Teachers in the area have had ready access to a number of educational computing courses offered by the College of Education, Ministry of Education, and Massey University. Massey University has sponsored a number of computers in education school-based research projects (see for example, Nolan & McKinnon, 1991; Ryba, Anderson, & Brown, 1992). There are several key people within the region who have established reputations in the field, and combined with the active involvement of local commercial educational computing agents, the use of computers in schools has a high profile. In sum, there were indications that: (a) computers are used extensively in Palmerston North primary and intermediate schools; (b) there is considerable availability of educational support for teachers

who wish to use computers; and, (c) there are a sizeable number of well-informed and experienced computer-using teachers.

4.1.5 Research Sample

The research involved an extreme case, purposive sample of proficient computer-using teachers from within the target population. The selection of the sample participants served a dual purpose: (a) to collect general information about teachers 'nominated' and 'perceived' to be proficient at using computers in the classroom; and, (b) to identify two proficient computer-using teachers for more in-depth study.

4.1.6 Justification for Sample

The study of proficient teachers has the greatest potential to meet the research objective. Such a study may offer valuable information and powerful insights on classroom practice (see for example, Berliner, 1986; Knight & Smith, 1989; Ramsey & Oliver, 1993). It is likely that proficient computer-using teachers have a major impact on how other teachers use computers in the regular classroom. There have been only a few previous studies of successful (Shavelson *et al.,* 1984), accomplished (Sheingold & Hadley, 1990), competent (Vockell & Sweeney, 1993), effective (Sherwood, 1993) and exemplary (Becker, 1994) computer-using teachers, and these have had important methodological weaknesses. Prior research has failed to address that the defintion of proficient teaching is problematic and that there are many contextual variables related to using computers in schools.

The sample of proficient computer-using teachers in this study has the potential to provide more detailed contextual information on how computers are being used to support teaching and learning processes. The purposive sample was considered necessary in order to critique existing theory and provide an illuminative analysis of the ways in which computers are being used to create conditions for better classroom learning. Moreover, the study of proficient computer-using teachers may encourage a dimension of critical self-reflection where participants question their existing practice and become active in the social interpretation of the role of computers within education. It was also anticipated that such a study might provide some indication of the crucial role of teachers' perceptions and beliefs in shaping patterns of computer use and, thus, highlight factors that should be addressed in future teacher education initiatives within the region.

4.1.7 Sample Selection

The identification of proficient teachers was considered to be problematic in that it depended upon how 'proficiency' was defined and what criteria was applied (see for example, Brown & McIntyre, 1993; Boylan, Battersby, Wallace, & Retallick, 1991; Knight & Smith, 1989).

In recognition of this concern, a proficient computer-using teacher was defined at each phase of the research as:

Phase 1 *Any teacher who was 'nominated' by other educators and/or professionals to be proficient in the use of computers in the classroom.*

Phase 2 *Any teacher who was 'perceived' by a selected group of professionals (Research Advisory Committee) to be proficient in the use of computers in the classroom.*

Phase 3 *Any teacher who was 'judged' by a selected group of professionals (Research Advisory Committee) to be proficient in the use of computers in the classroom.*

4.1.8 Research Advisory Committee

The researcher invited four well known professionals, who had different background experiences in the computers in education field, to assist with the selection of the sample participants (see Appendix A). This included: (a) a teacher representative with formal qualifications in educational computing; (b) a pre-service teacher educator with extensive experience in schools using computers across the curriculum; (c) a university information systems senior lecturer with educational computing experience and formal qualifications in the area; and, (d) a university senior lecturer with previous experience at conducting educational computing research (see Appendix A for details). These professionals, in addition to the researcher, constituted the Research Advisory Committee.

4.1.9 Justification for Advisory Committee

The above committee members were chosen on the basis that they had different practical and theoretical knowledge about using computers in education, and different perspectives on what constitutes proficiency in the field of educational computing. The inclusion of a range of professionals, with contrasting experiences, was consistent with the concept of 'cross-perceptual analysis' in which people with different perspectives had to work together to reach consensus, and helped to address the shortcomings of previous research which had depended upon undefined and/or restricted selection processes (see for example, Becker, 1994; Hadley & Sheingold, 1993; Shavelson *et al.*, 1984; Sheingold & Hadley, 1990; Sherwood, 1993; Vockell & Sweeney, 1993). The Research Advisory Committee provided a critical and systemic way of selecting proficient computer using teachers for further study.

4.2 PHASE ONE

The purpose of this initial phase was to gather information on teachers background experiences, practices and perceptions on the ways in which computers were being used in their classrooms.

4.2.1 Research Questions

This phase of the study was designed to address two specific research questions:

i) *What are the characteristics of 'nominated' proficient computer-using teachers in terms of their educational experience and background?*

ii) *How do 'nominated' proficient computer-using teachers use computers in their classroom?*

4.2.2 Sample Selection

The initial sample of 'nominated' proficient computer-using teachers was selected by a process adapted from that used by MacArther and Malouf (1991) and Sheingold and Hadley (1990). The sample was selected by the nomination of teachers who were perceived by three groups of professional educators to be proficient at using computers in their classroom. The professional educators included:

i) *All Palmerston North primary school principals (N=34);*

ii) *All Palmerston North primary school Board of Trustees (BOT) teacher representatives (N=34);*

iii) *A number of local consultants and experts in the computers in education field (N=8).*

There were no specific selection criteria given to these professional educators in an endeavour to make the initial sample as inclusive as possible. The researcher accepted, at this initial stage, the nominations of proficient computer-using teachers on the basis of the referral process.

4.2.3 Justification for Sample Selection

The three groups were chosen on the grounds that they had personal knowledge of which teachers were using computers, and had different perspectives on what constitutes

proficiency with computers and associated educational software. The inclusion of a range of professionals with contrasting experiences was judged necessary to address the shortcomings of previous research which had depended upon undefined and/or restricted nomination processes. The nomination process provided an inclusive sample and means to replicate the selection of computer-using teachers for the purpose of a future study.

4.2.4 Preliminary Phase

A letter was sent to principals, BOT teacher representatives, educational computing consultants and experts explaining the purpose of the research, and requesting the nomination of teachers who in their opinion were 'proficient' at using computers in their classroom (see Appendix B). A stamped return addressed envelope along with a nomination form was included with this letter (see Appendix B). The nomination forms were colour coded according to the three groups of professional educators and numbered for administrative purposes only. To ascertain and increase the response rate, respondents were asked to return the nomination forms regardless of whether or not they were able to nominate any proficient computer-using teachers.

After three weeks, a follow up letter and additional nomination form was sent to those who had not returned the original material (see Appendix B). A telephone call was made two weeks later to people who had not returned nomination forms to check that the material had been received and whether they wished to nominate any proficient computer-using teachers for the study. Finally, a letter of appreciation was sent to all those who returned nomination forms, whether or not they nominated a proficient computer-using teacher for the study (see Appendix B).

4.2.5 Profile of 'Nominated' Teachers

There were 39 teachers (27 female and 12 male) nominated as proficient at using computers in their classroom. These consisted of: (a) 22 nominated teachers by principals; (b) 20 nominated teachers by BOT teacher representatives; (c) seven nominated teachers by computer consultants and experts; and, (d) three teachers nominated directly over the telephone (see Table 4.1). There were two people only who were unable to be contacted by telephone. Three of the nominated teachers worked in schools outside the area selected for study. The remaining 36 'nominated' proficient computer-using teachers (25 female and 11 male) constituted the initial research sample. These teachers worked in 16 different schools with several (N=11) nominated by more than one person. This indicated that there was some consensus on a core of teachers who were perceived to be proficient at using computers in the classroom.

Table 4.1

Summary Of Returns For Nominated Proficient Computer-Using Teachers

Professional Groups	Forms Sent	Forms Returned	Response Rate	Nominated Teachers	Nominated By Phone
School Principals	34	27	80%	22	1
Teacher BOT Representative	34	29	85%	20	-
Consultants and Experts	8	7	87%	7	2

4.2.6 Procedure

A letter was sent to the 36 computer-using teachers explaining the purpose of the research and that they had been nominated by other professional educators as someone suitable for the study (see Appendix B). The teachers were invited to complete an enclosed questionnaire and return this using a stamped addressed envelope provided for this purpose (see Appendix B). Teachers who had not returned the questionnaire after a period of four weeks were sent another letter, with a copy of the questionnaire and stamped return addressed envelope, again inviting them to participate in the study (see Appendix B). Because this material was sent out just before a holiday break, when teachers were particularly busy, a final letter was posted four weeks latter to check that the questionnaire had been received and whether the teachers wished to participate in the study (see Appendix B). A letter of appreciation was sent to all nominated computer-using teachers within two days of receiving their returned questionnaire (see Appendix B).

4.2.7 Data Collection

A questionnaire was designed to collect relevant contextual information on teachers background experiences, practices and perceptions on the use of computers in schools. The questions were prepared with reference to previous surveys of computer-using teachers (see for example, Adams, Adams, Chen, and Sutherland, 1992; Happs & Kinnear, 1990; Mathinos & Woodward, 1988; Nightingale & Chamberlain, 1991; Sheingold & Hadley, 1990; Woodrow, 1991a; Zammit, 1992), and the style of questionnaire and specific questions were informed by a review of the research methods literature on questionnaire construction (see for example, Anderson, 1990; De Vaus, 1991; Foddy, 1993; Fowler, 1988). The questionnaire was designed with a mix of open and closed questions in order to collect baseline written data on the ways that computers were being used in the classroom.

4.2.8 Pilot Questionnaire

A draft questionnaire was piloted with 10 computer-using teachers outside of the Palmerston North area. These teachers were asked to complete the questionnaire and note on the questionnaire any questions they had difficulty answering. A follow-up discussion with these teachers as a whole group enabled the researcher to determine the time the questionnaire took to complete, whether the sequencing and nature of the questions were appropriate and if the questions could be clearly understood. The pilot questionnaires, and further consultation with other researchers, assisted with refining the final questionnaire used in phase one of the study (see Appendix B).

4.2.9 Description of the Questionnaire

The questionnaire consisted of four main sections: (a) background information on teaching experience; (b) personal computer experience; (c) information on classroom computer use; and, (d) teachers' perceptions concerning the role of computers in the classroom. The questionnaires were presented in a booklet format with each one individually numbered for administrative purposes. The questions were separately numbered within each section and consisted of a mixture of likert-type scales, ranking and list formats, and fill-in-the-blank short answers. There was no space provided for coding responses as it is claimed this can de-personalise the questionnaire and adversely affect the quality of responses and overall response rate (Anderson, 1990).

4.2.10 Justification for Data Collection

The questionnaire provided an efficient means, over a short space of time, of gathering descriptive information on teachers' background experiences, practices and perceptions concerning the use of computers in the classroom. The questionnaire is claimed to be a valuable research technique when it is used to gather baseline information from a relatively large sample (Anderson, 1990; De Vaus, 1991). It was beyond the resources of the researcher to interview all of the nominated teachers, and because a number of questionnaires had previously been designed for such a purpose, it was considered the best way to yield a large amount of descriptive information that could also be used also for the selection of participants for the next phase of the study.

4.2.11 Data Analysis

The responses to the questionnaire were coded and tabulated with the use of a spreadsheet, and preliminary results were summarised for presentation to the Research Advisory Committee. The questionnaire responses were later re-analysed with some basic statistical calculations, and presented in figure and table format according the research questions.

4.3 PHASE TWO

The purpose of this phase was to gather more precise information on teachers' perceptions and beliefs about the role of computers in the learning process and factors that inhibit and enhance the use of computers in the regular classroom.

4.3.1 Research Questions

The second phase of the study was designed to address five specific research questions:

i) *What perceptions do 'perceived' proficient computer-using teachers have of how they use computers to support learning in their classroom?*

ii) *What changes to their practice do 'perceived' proficient computer-using teachers report as a result of using computers in the classroom?*

iii) *What beliefs do 'perceived' proficient computer-using teachers have about the teaching and learning process?*

iv) *What beliefs do 'perceived' proficient computer-using teachers have about how computers support the teaching and learning process?*

v) *What factors do 'perceived' proficient computer-using teachers believe enhance and/or inhibit the use of computers in their classroom?*

4.3.2 Sample Selection

The sample of 'perceived' proficient computer-using teachers for this phase of the study was selected by the Research Advisory Committee on the basis of the responses to the questionnaire and the preliminary analysis of the results. It was considered that the questionnaire results provided sufficient data for making a valid selection of teachers for further study.

Table 4.2

Summary Of Questionnaire Responses

Nominated Teachers	Returned Questionnaires	Response Rate
36	31	86%

The 31 teachers (from 16 different schools) who returned questionnaires in the first phase of the study were deemed a sufficient number for the selection of a purposive sample of 'perceived' proficient computer-using teachers (see Table 4.2).

4.3.3 Selection Criteria

The Research Advisory Committee were guided by general criteria in their selection of teachers who were 'perceived' to be proficient at using computers in the classroom. These criteria were developed by the researcher and attempted to identify teachers with: (a) access to computers in the classroom; (b) experience using computer in the classroom; (c) knowledge of how to use different computer applications; (d) knowledge of teaching and learning processes; (e) knowledge of how computers can be used for learning purposes; and, (f) a high level of confidence and self-efficacy when using computers in the classroom. There were 10 specific criteria:

i) *The teacher has full-time employment in a Palmerston North primary or intermediate school;*

ii) *The teacher has full-time access to a computer(s) and students within the regular classroom;*

iii) *The teacher has at least three years teaching experience in the classroom;*

iv) *The teacher has at least three years teaching experience with computers in the classroom;*

v) *The teacher has a qualification related to educational computing or some type of professional development on the use of computers in education;*

vi) *The teacher makes use of a computer with students in the classroom most days of the week;*

vii) *The teacher makes use of more than one computer application most weeks of the year in the classroom;*

viii) *The teacher values 'tool' applications of the computer and uses these in the classroom;*

ix) *The teacher recognises the importance and opportunities computers provide for the development of thinking and social skills in the classroom, and the chance to give children more control over their own learning;*

x) *The teacher feels confident about using computers in the classroom, is sure how to best use them, and believes that their teaching has been positively affected as a result of computer use.*

4.3.4 Justification for Criteria

These criteria were based on information and experiences from previous research on accomplished and successful computer using-teachers. In particular, Shavelson *et al.*, (1984) study of successful computer-using mathematics and science teachers, Sheingold and Hadley's (1990) research on accomplished computer using-teachers, and Chamberlain and Kennedy's (1991) selection of schools successful in using computers for teaching and learning purposes. Criteria for this phase of the study were designed to be as inclusive as possible, but unlike previous research it was also informed by the literature on proficient pedagogy *per se*. There is a wealth of literature on proficient teaching practice and in developing the criteria the researcher was mindful of such work.

4.3.5 Selection Process

The members of the Research Advisory Committee were contacted to arrange a suitable time for the first advisory committee meeting. The first committee meeting was held in August, 1993 in the Social Science Tower at Massey University. There were eight items on the agenda (see Appendix C). The meeting started with brief introductions by individual members of the Research Advisory Committee followed by the election of a chairperson. The chairperson then facilitated the meeting with the researcher providing background information on the problem and research objective. A written summary of the research problem and the work completed thus far was given to each member of the Research Advisory Committee (see Appendix C).

The selection criteria were then justified by the researcher and an outline of the criteria was issued to committee members (see Appendix C). After a brief discussion the criteria were accepted by the committee with one minor modification. There was some concern expressed that there could be a proficient computer-using teacher who had not received any formal professional development and/or gained qualifications in this area. Because the study did not want to exclude any potentially proficient computer-using teachers it was agreed that the Research Advisory Committee ignore this as an initial criterion. The researcher justified this

decision based on the literature and the problematic nature of defining what constitutes a proficient teacher. It is worth noting that this decision did not result in any additional teachers being included in the sample for the second phase of the study.

The researcher provided a brief overview of the questionnaire results and a copy of the preliminary analysis was given to each member of the Research Advisory Committee. The researcher eliminated, with the permission of the committee, the computer-using teachers who did not meet the first four criteria (N=12). The remaining completed questionnaires (N=19) were circulated around the committee members in order to evaluate the relative merits of each computer-using teacher. The names of the participants and their respective schools were covered on the questionnaire to maintain their anonymity and the integrity of the selection process. The participants were referred too only according to the number that appeared on their respective questionnaire.

The committee then discussed each computer-using teacher's response in terms of the agreed criteria. The participants were systematically assigned to one of two groups: (a) those who met the criteria; and, (b) those who did not. Where initially unanimous decisions could not be reached, the committee deferred the final decision until all of the teachers had been considered. These contentious responses were then re-examined and in all cases it was possible to reach an unanimous decision. The researcher thanked the committee for their dedication to the task and a letter of appreciation was sent the following day to each member of the Research Advisory Committee (see Appendix C).

4.3.6 Profile of 'Perceived' Proficient Teachers

There were 13 teachers 'perceived' by the Research Advisory Committee to be proficient at using computers in the classroom (see Table 4.3). One of these teachers indicated on their questionnaire that they did not wish to participate any further in the study. This teacher was contacted by telephone to confirm that this was still the case. The teacher expressed an interest in the research, but declined a further invitation to participate in the study. One other teacher declined to be interviewed as they had just been appointed to a new position in another school. The teacher did not consider there was much point in continuing to participate. Despite efforts to persuade the teacher otherwise, the researcher respected their right to make this decision.

Table 4.3

Sample Of Perceived Proficient Computer-Using Teachers

Perceived Proficient Teachers	Participating Teachers	Sample %
13	11	84%

The remaining 11 teachers, at 10 different schools, constituted the research sample for the second phase of the study (see Table 4.4). There were 7 female and 4 male teachers with a wide range of teaching experience at differents levels within school.

Table 4.4

Profile Of Perceived Proficient Computer-Using Teachers

Characteristics	Nominated Proficient Computer-Using Teachers
Age Range of Teachers	20 - 59
Gender	7 Females / 4 Males
Number of European/Pakeha Teachers	11
Mean Years Teaching in all Schools	14.75
Mean Years Teaching in Current School	6.16
Number Teaching in Junior School	4
Number Teaching in Middle School	4
Number Teaching in Senior School	3
Number of Scale A Teachers	4
Number of Senior Teachers	2
Number of AP/DP and Principals	5
Number of Teachers with a Home Computer	10
Number of Teachers with a Degree	7
Number of Teachers Completed a Formal Course or Qualification on Computers in Education	11
Number of Teachers with Special Responsibilty for Computers in their School	8

4.3.7 Procedure

The 11 'perceived' proficient computer-using teachers were sent a letter inviting them to participate further in the research (see Appendix C). This letter restated the overall purpose of the study and explained the need for more detailed and precise information. The teachers were telephoned over the next two weeks to see if they wished to continue to participate in the study. An affirmative response was followed by an invitation to select the time and location for the interview to take place. The participants were reminded of the need for the interviews to have uninterrupted time, and in all but one case (where it was in their home) these were scheduled at the teacher's school. The interviews were completed over a period of six weeks with the last interview conducted in early November, 1993. A letter of appreciation was sent to all the teachers who participated in the interview within two days after the interview (see Appendix C).

4.3.8 Data Collection

An interview technique was selected to collect relevant contextual information concerning teachers' perceptions and beliefs about teaching, the ways that computers support teaching and learning processes and factors that inhibit and enhance the use of computers in schools. The themes and related questions that the interview was designed to explore were prepared with reference to previous research on computer-using teachers, particularly studies which had utilised interview techniques (see for example, Krendl & Broihier, 1992; MacArther & Malouf, 1991; Selby, Ryba & Williams, 1993). The style and structure of the interview schedule was also informed by the research methods literature on conducting interviews (see for example, Foddy, 1993; Minichiello, Aroni, Timewell & Alexander, 1990; Mishler, 1986; Morton-Williams, 1993; Powley & Watts, 1987; Sax, 1979). The interviews were designed as much as possible to follow an informant style (Powney & Watts, 1987). This style encourages the interviewee to express their own opinions, beliefs and concerns and to converse in such a way that the control of the interview, or at least the perception of control, lies with the participant rather than the interviewer. The intention was to get participants to tell their 'story' of how they have used computers in education.

4.3.9 Pilot Interview

A pilot interview schedule was trialed with three teachers known by the researcher and who taught at schools outside of the Palmerston North region. These teachers were informed of the purpose of the research and asked to comment on the style of the interview and the related questions immediately after the interview. While the pilot interview was a little artificial it enabled the researcher to: (a) gain experience using the audio recording equipment; (b) get valuable practice at the informant technique; (c) determine which questions were most likely to draw out teachers' perceptions and beliefs; and, (d) ascertain the approximate time it took to explore the different interview themes. A section of one interview was later transcribed and coded according to the interview themes to judge the effectiveness of the interview technique in answering the research questions. After further consultation with other researchers, and a number of refinements, a more open ended interview schedule was finalised for use in phase two of the study (see Appendix C).

4.3.10 Description of the Interview

The interview schedule explored five main themes: (a) the use of computers to support teaching and learning in the classroom; (b) changes to teaching practice as a result of using computers in the classroom; (c) beliefs about teaching and learning processes; (d) beliefs about how computers support teaching and learning processes; and, (e) factors that enhance and/or inhibit the use of computers in the classroom. The researcher was free to ask

questions and probe responses under each of these themes as and when appropriate, but a number of potential questions were developed as a way of helping the researcher to explore the issues related to each theme. These questions were not, however, designed to constrain the interview, but were prepared as a way of ensuring that at least some common questions were asked of every participant at some stage during the interview.

At the beginning of each interview the participants were reminded of the purposes of the research and asked to sign a consent form granting permission for the interview to take place (see Appendix C). A copy of this consent form was given to the participants. The interview was then taped with the participants' permission on an audio cassette recorder. The interview began with the researcher handing back the teacher's completed questionnaire and asking the participant if they had any comments about the questionnaire and/or whether there were any questions that should have been asked, but were not in the questionnaire. This was done as a symbolic way of giving control to the interviewee, and as an initial strategy for getting the participant to converse about their use of computers in the classroom. In most instances the interviews followed a conversational style with spontaneous and open ended discussion, where the main research themes were explored in a non-linear way. The interviews varied in length from 30 to 95 minutes, with a mean time of 43 minutes. Immediately after each interview the researcher recorded, on the same tape, his general impressions of the interview.

4.3.11 Justification for Data Collection

The interview provided a way of gathering in-depth contextual information on teachers perceptions and beliefs about teaching and learning with computers. It is claimed that unstructured and semi-structured interviews are an invaluable research technique in eliciting qualitative data on teachers' perceptions and beliefs (Kagan, 1990). In discussing their practice in a conversational way teachers were likely to reveal some commitment to particular beliefs about the nature and value of certain kinds of knowledge. The value of qualitative research in eliciting beliefs is well documented (see for example, Kagan, 1992; Pajares, 1992), and the interview technique complemented and built upon the written data already gathered through the semi-structured questionnaire. Interviewers are more than just 'speaking' questionnaires, they are active participants (Potter & Wetherell, 1987). The interview allowed the researcher to have an active role in the data collection process where responses could be drawn out and fully explored in relation to the research questions. Furthermore, the interview enabled the researcher to remain open to the emergence of other possible themes that were important to the teachers in their use of computers in the classrooms. Happs & Kinnear (1990) maintain that interviews help to present teachers voices and are an important technique in helping to understand the gap between the theory and practice in the use of computers in education.

4.3.12 Follow-Up Interview

A follow-up interview was conducted in the middle of 1994 for the purpose of validating the interview transcripts and to re-establish contact with the participants. A letter was initially sent to the 11 'perceived' proficient computer-using teachers outlining the progress of the study (see Appendix C). In this letter the researcher indicated that the participants would be contacted to give them the opportunity to view the interview transcripts and clarify any interpretations. The participants were contacted over the following weeks in order to arrange the follow-up interview. Again, it proved difficult to arrange a time of mutual convenience and the follow-up interviews took seven weeks to complete. The follow-up interviews were informal and generally quite brief. The participants were given a copy of the interview transcript and the opportunity to clarify their view and/or expand upon any points. There was no set interview schedule just the transcript of the first interview as a basis for further discussion. These interviews were not recorded, although the researcher made notes immediately after each interview. The researcher again thanked the participants and invited them to further check the transcripts and request any changes as required. No changes were later requested. The complete interview transcripts are not included in the appendix for reasons of confidentiality.

4.3.13 Data Analysis

The informant interviews were fully transcribed by the researcher, coded, and then thematically analysed in terms of the interview themes. The researcher personally transcribed the interviews as this was considered to be an important part of the coding and analysis process (Mishler, 1986). This proved to be invaluable in helping the researcher to code and analyse the responses within their appropriate context. The coding process began by carefully reading through each transcript and highlighting in different colours any comments or phrases which appeared to relate to one of the interview themes. A separate colour was used to highlight any points that emerged, but that did not fit, within these themes. A word processor was then used to re-arrange selected extracts of transcript under the respective interview themes. These coded interview summaries were later analysed in terms of the research questions with cogent points selected and presented as extracts and direct quotes in the results.

4.4 PHASE THREE

The purpose of this phase was to gather even more precise information on teachers' perceptions and beliefs about learning, the role of computers in the learning process and the way that computers contribute to conditions for better classroom learning.

4.4.1 Research Questions

This phase of the study was designed to address a number of specific research questions:

i) What is the physical arrangement of a 'proficient' computer-using teacher's classroom?

ii) What specific computer applications do 'proficient' computer-using teachers use to support student learning in their classroom?

iii) How do 'proficient' computer-using teachers use different computer applications to support learning in their classroom?

iv) What beliefs do 'proficient' computer-using teachers have about the teaching and learning process?

v) What beliefs do 'proficient' computer-using teachers have about how computers support the teaching and learning process?

vi) What role do 'proficient' computer-using teachers adopt during computer-related activities in their classroom?

vii) How competent are students at using computers in the classrooms of 'proficient' computer-using teachers?

viii) What perceptions of how computers support their learning do students have within the classrooms of 'proficient' computer-using teachers?

4.4.2 Sample Selection

The sample of 'proficient' computer-using teachers for this phase of the study was selected by the Research Advisory Committee on the basis of the interview responses. It was considered that the interview summaries provided sufficient data for making a trustworthy selection of two proficient computer-using teachers for further study. The decision to select just two teachers from phase two of the study and examine them in more depth was based on the rationale that: (a) a smaller sample offered the best means of answering the research questions; (b) the small sample had greater potential for gathering fine grain data on the practice of proficient computer-using teachers; (c) the study of two teachers provided some basis for comparison and enhanced the validity of the research and potential generalisability

of the results; and, (d) the study of two teachers was all that was feasible within the resources of the researcher.

4.4.3 Selection Criteria

The Research Advisory Committee were guided by general criteria in their selection of teachers who were 'judged' to be proficient at using computers in the classroom. These criteria were developed by the researcher and attempted to identify teachers with: (a) a clear philosophy of education and sound understanding of teaching and learning processes; (b) a thorough knowledge of how computers can be used to support learning within and across the curriculum; (c) a commitment to a learner-centred and reflective approach to their teaching; and, (d) a clear aim for using computers in the classroom and a high level of confidence in their ability to achieve such aims. The were eight specific criteria:

i) A clear and well articulated philosophy of education which is tested against their personal practice.

ii) A sound knowledge of the teaching and learning processes and factors that have an influence on these processes.

iii) A sound knowledge of the different ways that computers can be used within and across the curriculum to support teaching and learning processes.

iv) A learner-centred approach to teaching where students are encouraged to set their own goals, to challenge and solve problems and to have lots of fun.

v) A highly reflective approach to their teaching practice with a passionate and intrinsic commitment toward becoming a better classroom and computer-using teacher.

vi) A clear and well informed aim related to the use of computers in the classroom and a high level of confidence in their own ability to successfully achieve such aims.

vii) A high level of analysis when discussing their classroom practice and the problems experienced as students learn with computers.

viii) A sound understanding of classroom organisation and management techniques and evidence of these techniques being used in the classroom.

4.4.4 Justification for Selection Criteria

These criteria were based on two separate but equally important areas of literature: (a) proficient pedagogy *per se;* and (b) proficient pedagogy with computers. It was assumed that proficient computer-using teachers would have a sound understanding of general pedagogy and a well-developed repertoire of teaching strategies, as well as specialised skills and knowledge of using computers in the classroom. Criteria attempted to combine recent theory and research on expert (Berliner, 1986), good (Knight & Smith, 1989) and quality pedagogue (Ramsay & Oliver, 1993) with that on the study of successful (Shavelson *et al.*, 1984) accomplished (Sheingold & Hadley, 1990), competent (Vockell & Sweeney, 1993), effective (Sherwood, 1993) and exemplary (Becker, 1994) computer-using teachers. In the past research on computer-using teachers has tended to ignore that on teaching *per se* and the criteria sought to address this deficiency. Although the criteria was still problematic, in that the definition of proficiency was dependant upon the emphasis placed on the literature and the way it was interpreted, the above criteria at least provided an explicit basis that could be replicated in the selection of 'proficient' computer-using teachers.

4.4.5 Selection Process

A letter was sent to the members of the Research Advisory Committee seeking their assistance with the selection of teachers for the final phase of the research (see Appendix D). A copy of the selection criteria and interview summaries were included with this letter to give the committee members an opportunity to become familiar, in advance, with this information (see Appendix D). A Research Advisory Committee meeting was held at the beginning of November, 1994 in the Faculty of Education Boardroom at Massey University. There were six items on the agenda (see Appendix D). The researcher provided background information on the study thus far and then outlined and justified the selection criteria. After a brief discussion of the weighting of the respective criteria, the committee considered the most appropriate sample selection process. It was decided to examine the interview responses in a systematic way judging the merits of each participant on a case by case basis.

The researcher presented without any elaboration an overhead transparency with selected extracts from each interview summary. The Research Advisory Committee members were invited, after each presentation, to give their own interpretation of data. The chairperson facilitated the discussion in terms of the selection criteria to gain a consensus on whether the

participant was: (a) suitable; or, (b) unsuitable for further study. If there was any doubt, the decision was deferred until all the interview summaries had been considered. The doubtful responses were then re-examined and in all cases it was possible to make unanimous and clear-cut decisions on the suitability of the participants for further study.

The researcher thanked the members of the Research Advisory Committee for their assistance with the sample selection process and promised them an executive summary of the results on the completion of the research.

4.4.6 Profile of 'Proficient' Computer-Using Teachers

There were two teachers 'judged' by the Research Advisory Committee to be proficient at using computers in their classroom. If more than two computer-using teachers had been judged proficient then the researcher would have selected the final sample on the basis of the respective teachers' experience, gender, teaching level, etc. The validity of the final sample was supported by the fact that these teachers were nominated by more than one person in the original sample selection process. This enhanced the overall credibility of the sample selection process and, in particular, the role of the Research Advisory Committee. The following section describes the different background characteristics and teaching experiences of the two selected proficient computer-using teachers and respective students.

4.4.7 Anne

Anne was a Scale A teacher of year 4, 5 and 6 students in a small primary school in a low to middle socio-economic area which had in recent years only purchased computers for each classroom. She was of European descent and relatively new to the teaching profession. Anne was well-qualified with a Bachelor of Education degree (BEd), which included several computer-related courses including one specially on the use of computers in education. She owned a home computer for more than 5 years and had considerable experience using a range of hardware and software for both personal and educational purposes. Anne was enthusiastic about integrating computers into her classroom and had special responsibility for the use of computers and technology education within the school. She had taught other teachers how to use computers in the classroom and given a formal presentation to parents on the benefits of using computers in education. Anne had been involved in several computer-related professional development initiatives within the region.

4.4.8 Anne's Students

There were 31 students in Anne's class consisting of 15 boys and 16 girls. The mean age for the class was 9.4 years.

4.9 Barry

ırry was a Senior teacher of year 5 and 6 students in a large primary school in a middle to ɜh socio-economic area, which had a long tradition of using computers in the classroom. : was of European descent with a Diploma of Teaching and more than a decade experience a classroom teacher. Barry had attended several workshops, over a number of years, on : use of computers in education and recently completed a tertiary level course in this area. : owned a home computer for more than 8 years and had considerable experience using a riety of educational software for learning purposes. Barry enjoyed teaching with mputers, but was often frustrated in his role as the school's technology coordinator by the :k of resources and direction in the area. Other teachers relied heavily upon his technical pertise and he acted as the general computer 'trouble shooter' within the school. Barry ıs in a leadership role that required him to plan and initiate a number school-based mputer-related professional development experiences.

4.10 Barry's Students

ere were 33 students in Barry's class consisting of 16 boys and 17 girls. The mean age · the class was 9.11years.

4.11 Microethnographic Case Studies

:e final phase of the research involved microethnographic cases studies of the two oficient' computer-using teachers. A microethnographic case study is defined as a croscopic level of ethnography (Levine, 1990. These case studies were designed to gain a tter insight into the teachers' perceptions and beliefs and to investigate their practice with mputers in the classroom. The researcher spent one week in each computer-using ıcher's classroom in order to observe them in action and understand the social practice of ɔficient computer use in the classroom.

.e boundaries of each case were defined in terms of: (a) the physical confines of the ɔficient' computer-using teacher's classroom; and, (b) the period of the researcher's rticipant-observation in the classroom. There was a two week break between the case ıdies to allow the researcher to fully document the first case and prepare himself for the mands of the second study.

4.12 Justification for Case Studies

ıe microethnographic case study approach was deemed the most appropriate in terms of:) the research questions; (b) the size of the sample; (c) the limited resources and experience the researcher; and, (d) the time-frame of the research. The microethnographic method

helped to define the unit of analysis while retaining the overall complexity of the dynamic interactions within the computer learning environment. A microethnographic case study differs from ethnography primarily in its focus on a more microscopic level of analysis (Levine, 1990). In this regard the method was ideally suited toward an exploratory investigation that sought to observe, understand and yield insights into the practice of proficient computer-using teachers in the context of their classroom. The strength of case study was that it allowed the researcher to be a participant-observer and gather a rich range of descriptive information on teaching practice in the natural setting of the classroom (Zaharlick, 1992). This style of research helped to overcome the limitations of prior research in artificial and/or contrived conditions and acknowledged the reciprocity between theory and practice.

The microethnographic case studies offered the researcher a flexible and adaptive methodology that gave the opportunity to build theory with those who worked within the culture of the classroom. It allowed multiple research techniques and data sources to be used in the construction of tentative theory based on 'reflection-in-action' (Altricher & Posch, 1989). This type of research is credited with helping to build more authentic and mutually comprehensible theories (Cohen & Manion, 1985). In other words, theories that can be directly interpreted and translated into classroom practice. The multi-site case study of two proficient computer-using teachers gave the chance to critique theory and compare the similarities and differences between the viewpoints held by the participants within each case. Furthermore, the decision to complete two case studies was based on the need to validate data and obtain more robust information on computer-using teachers proficient practice. It is claimed that a collective of case studies, each with a high level of construct validity, has potential to provide a more secure basis for generalisation across the research population (Ebbutt, 1988). The case study material may, therefore, ultimately provide a cumulative resource that with further replication could have the potential for more widespread generalisation.

4.4.13 Procedure

The two proficient computer-using teachers were sent a letter inviting them to participate further in the research (see Appendix D). This letter restated the overall purpose of the research and explained the need for more in-depth information that could be gathered through case study. The teachers were telephoned several days later to see if they were willing to participate in the follow-up study. Both teachers were enthusiastic about their further participation and arrangements were made to negotiate appropriate access. The school principals were sent a letter that outlined the nature of the research and which sought their permission for the study to take place (see Appendix D). The principals were telephoned a few days later to provide further information about the research and ascertain whether they were willing for one of their staff to participate in the study. Both principals gave permission

for the teachers to be involved and the researcher subsequently obtained their formal consent (see Appendix D). Prior to each case study the students involved in the research were given a letter to take home to their respective parents and/or caregivers (see Appendix D). This letter outlined the purpose of the research and informed them that the researcher would be a participant-observer in the class over the coming week. It invited parents and/or caregivers to contact the researcher if they had any concerns or wanted any more information about the nature of the research. The case studies commenced and continued throughout November, 1994 with the researcher participating for one teaching week in each of the two classroom programmes. Finally, on completion of the case study phase a letter of appreciation was sent to the two participating teachers (see Appendix D).

4.4.14 Data Collection

The case studies followed a specific research protocol that involved a multiple range of qualitative and quantitative data collection techniques (see Appendix D). This protocol was designed to systematically answer the research questions while at the same time allowing an open ended exploratory investigation of the teachers proficient practice with computers. The research protocol contained four main sections: (a) the research objective; (b) an overall plan of the case study; (c) the research questions that the case was designed to investigate; and, (d) the specific research techniques that would be used for data collection.

The protocol and data collection techniques were prepared with reference to previous research on computer-using teachers, particularly prior case studies (see for example, Blomeyer & Martin, 1991; Happs & Kinnear, 1990; MacArther & Malouf, 1991; Miller & Olsen, 1994) along with the research methods literature on doing qualitative (see for example, Bogdan & Biklen, 1982; Burgess, 1985; Delamont, 1992; Ely, 1991), ethnographic (see for example, Coe, 1991; Wolcott, 1988; Zaharlick, 1992) and case study research (see for example, Kenny & Grotelueschen, 1984; Lincoln & Guba, 1990; Merriam, 1988; Yin, 1989).

The microethnographic case studies were designed, as much as possible, to allow the researcher to fully participate in the classroom programme and to converse with the teacher and students in a natural and unobtrusive way. This type of participant-observation was made easier in that the class were use to frequent visitors, including a regular number of pre-service student teachers.

4.4.15 Description of the Research Techniques

This section outlines the different research techniques that were employed in the data collection process. It describes nine specific research techniques: (a) Participant-Observation;

(b) Self-Reflection Record; (c) Research Diary; (d) Teacher Diary; (e) Teacher Interview; (f) Computer Competency Schedule; (g) Computer Perceptions Questionnaire; (h) Student Interview; and, (i) Classroom Documentation Schedule.

4.4.16 Participant-Observation

A participant-observation role was adopted by the researcher to immerse himself within the culture and social practice of the classroom. The researcher prepared for the participant-observation by accepting an invitation to help out in another teacher's classroom while students were involved in several computer-related activities. This experience was invaluable in understanding the demands of ethnography and in determining the style of participant-observation that was later adopted in the case study. It was decided, on the basis of the research objective and resource constraints, that the most appropriate style was to act as a privileged observer (Wolcott, 1988). This style of participant-observation provided opportunities for natural interaction within the classroom and the chance to access and collect a range of data using various other research techniques.

4.4.17 Self-Reflection Record

A record of the researcher's self-reflections was maintained using a small personal tape recorder. This machine was used during periods of participant-observation and at other moments throughout the study to quickly record analytical memos (Delamont, 1992). These memos included any thoughts that came to mind from classroom observations and/or anecdotal discussions. The tape recorder was also used for administrative purposes and to accurately record specific classroom events where it was not practical to immediately note these in the research diary. At the end of each day the researcher listened to these self-reflections, recorded any further insights and where appropriate added relevant material in the research diary.

4.4.18 Research Diary

A Research Diary was prepared by the researcher to record anecdotal experiences, keep field notes and log classroom observations (see Appendix D). A pilot diary was trialed during a computer-related activity by a teacher within a local school. It was structured in terms of the research questions with a separate and different coloured page, for each question, for each day of the week. An additional page was included for notes and classroom observations that were not specifically related to the research questions, but still within the focus of the study. The pilot demonstrated that the structure of the diary was not practical and it was subsequently revised and restructured with four main sections: (a) the teacher; (b) the students; (c) the computer; and, (d) general observations. The researcher used these sections

within the diary to help focus observations and to maintain a chronological record of observations throughout the case study.

4.4.19 Teacher Diary

A Teacher Diary was designed by the researcher to gather specific data on student computer use and encourage the proficient computer-using teacher to reflect on issues related to using computers for learning purposes within the classroom (see Appendix D). A pilot diary was given to three local teachers, known by the researcher, for comment and after further consultation with other researchers this diary was revised with four main questions: (a) What was the purpose of using the computer in the classroom today? (b) What were the main learning outcomes from computer-related activities in the classroom today? (c) Were there any problems resulting from computer-related activities in the classroom today? and, (d) Do you have any other reflections on the use of computers in the classroom today? The diary was presented in a booklet form with separate coloured pages for each day of the week. This diary was presented to the teacher at the first teacher interview prior to any actual classroom observations.

4.4.20 Teacher Interview Schedule

A pre and post-observation Teacher Interview Schedule was developed to collect data on the nature of the classroom programme, the teacher's role in this programme and their perceptions of how computers support the teaching and learning process within the classroom. These interviews were not piloted with another group of teachers because of the nature of the purposive sample and due to time and resource constraints.

A semi-structured pre-observation interview was specifically designed to gather a range of baseline data about the classroom programme, its organisation and the integration of computers within the classroom (see Appendix D). A semi-structured interview was considered the most efficient way to obtain this type of factual information. The researcher made brief notes during the interview of key points and conversation was also recorded on audio tape. At the end of the interview administrative details were outlined relating to the case study.

An informant post-observation interview was used to discuss the entries within the teacher's diary, their beliefs about the teaching and learning process and the role of computers within this process (see Appendix D). An unstructured interview was deemed the best way to get the teacher to converse about their classroom practice and to reflect on the computer-related activities over the course of the week. The interview was recorded on audio tape and commenced with the researcher inviting the teacher to elaborate on any significant reflections

thin their diary. The interviews were spontaneous from the outset with a lively discussion the teachers practice and their use of computers within the classroom programme.

ıere were numerous other informal and anecdotal discussions with the classroom teacher ·oughout the study. It was clear from these that the teachers thoroughly enjoyed their rticipation in the study. The final interview provided the participant with not only an portant sense of closure, but gave the opportunity for researcher to thank the teacher for ːir contribution to the study.

4.21 Computer Competency Schedule

Computer Competency Schedule (CCS) was constructed to determine the students pability and perceived knowledge of how to operate different software features using the mputer (see Appendix D). A pilot schedule was trialed with a class of students accessible the researcher at a local primary school. The schedule was originally designed such that ıdents could self-report on their capability to perform a number of prescribed computer erations. The pilot demonstrated that a self-report checklist was problematic, in that ıdents did not understand some of the specialised terminology, and that more valid and ːaningful results would be obtained from a schedule that was administrated by the ːearcher on an individualised basis. The revised *tell me what you can do* CCS was mpleted by individual students, with the help of the researcher, at suitable times over the riod of the case study.

4.22 Computer Perceptions Questionnaire

Computer Perceptions Questionnaire was adapted from Riggs and Enochs' (1993) icrocomputer Beliefs Inventory (MBI) to gather data on students' self-efficacy and ıtcome expectancy beliefs toward computers (see Appendix D). The MBI was claimed to a reliable and validated instrument for determining such perceptions (Riggs & Enochs, ·93). A pilot questionnaire was initially trialed with three students known by the researcher .th disappointing results. It was obvious that the original instrument needed to be adapted suit the New Zealand context and students of a younger age. A number of similar ːtruments were reviewed (see for example, Gardner, Discenza & Dukes, 1993; Ransley, ·91; Woodrow, 1991b), and after further revision an adapted computer perceptions ıestionnaire was piloted with a class of local students, that were accessible to the searcher. The results of this pilot were sufficiently encouraging for the instrument to be ·ed within the case study. The participating students were invited to complete the computer ːrceptions questionnaire (CPQ) on the last morning of each case. The researcher discussed e style of question, emphasising that there were no right or wrong answers, and gave ›propriate instructions on how to complete the questionnaire. The questionnaires were

distributed to all students in the class and after a short period of reading time the individual questions were read aloud by the classroom teacher. There were few problems with the instrument and all of the students present at the time were able to complete the questionnaire.

4.4.23 Student Interview Schedule

A Student Interview Schedule was constructed to elicit data on their perceptions toward computers as well as further information on their computer competence (see Appendix D). A pilot informant interview was trialed with two students of an appropriate age known by the researcher. The pilot interview indicated that it was problematic to converse with all the students within the case in the time available. For this reason, the interview schedule was refined to be used with an existing focus group within the classroom (Anderson, 1990). It was considered that under the circumstances a focus group was the best means of gathering data on the views of students' toward computers. The focus groups were the normal reading groups within the classroom, and informal interviews took place at suitable moments over the duration of the case.

4.4.24 Classroom Documentation Schedule

A Classroom Documentation Schedule was prepared to collect a range of information from the school policy, teacher work plans, and sample computer-based student projects (see Appendix D). This schedule also included the documentation of the available educational software and any other material that was used by the teacher in the course of preparing and teaching computer-related activities in the classroom. It was suggested, in conversations with other teachers known by the researcher, that such material was important in the overall use of computers in schools. The relevant classroom documentation was collected and notes were made about this material throughout the period of the case.

4.4.25 Data Analysis

The case study data analysis was an ongoing and simultaneous process throughout the period of participant-observation. During this period the researcher was mindful of, and guided by, Ely's (1991) inductive and deductive account of the qualitative data analysis process. At the end of this period data were organised for more intensive analysis according to each research technique.

The case qualitative data were analysed by systematic documentation and thematic coding of each research technique in accordance with the research questions. The self-reflection record and research diary were transferred to a computer document and the data subsequently coded with separate colours according to the research questions. A separate colour was used to

code any points that emerged, but that did not fit, within the framework of these questions. The teacher diary was also transferred to a computer document and coded with colours relating to the research questions. In a similar way notes and tapes taken during teacher and students interviews were collated and when poignant transcribed by the researcher. The transcriptions were coded by highlighting in different colours any comment or phrase which appeared to relate to one or more of the research questions. Classroom documentation data were also coded in this way.

Case quantitative data were coded and tabulated with a spreadsheet and the research questions were later examined through the use of some basic statistical calculations. The computer competency schedule was coded according to students' gender and their ability to preform each computer operation, with the data presented in a table of varying capabilities. The responses to the computer perceptions questionnaire were coded according to gender and the students' self-efficacy and outcome expectancy, with the data presented in both figure and table format.

The combined qualitative and quantitative case study database was then systematically categorised in terms of five main areas: (a) the teacher; (b) the computer; (c) the students; (d) the classroom, and, (e) the curriculum with several sub categories. In categorising this data for further analysis the researcher explored the potential of several software data management packages (for example, Nudist & Hyperqual). An evaluation of several commercially available software packages suggested that these needed to be integrated into the case study methodology from the outset of the research. For this reason, it was decided to use an existing computer database with fields for each research question and a coding system relating back to raw data. The subsequent analysis involved collaboration with the participating teacher and the triangulation of data in terms of the five broad categories. Cogent points and emerging themes were presented in the results as a combination of direct quotes, examples of classroom discourse, narrative of the teacher's voice and where appropriate figures and tables.

4.5 ETHICAL CONSIDERATIONS

The design of the research was guided by the ethical requirements of the American Educational Research Association and the work of Burgess (1989). The study presented a number of potential ethical concerns. The main concern related to the anonymity of the participants, but there were also important issues related to the sample selection process, the collection of data during the regular classroom programme and the potential misuse of the research conclusions.

At each phase of the research and throughout the sample selection process the names of the computer-using teachers' were kept anonymous. The teachers were known by members of the Research Advisory Committee only by codes that appeared on their questionnaire and interview responses. In the data analysis care was taken to avoid reporting information that would identify the participating teachers and their respective schools. The transcripts and interview summaries were not included in the appendix to further protect the participants anonymity. The schools and participating teachers were guaranteed the right to privacy. At all times the information provided was treated as confidential and the participants had the right to view their own data on request. Teachers were given opportunities to comment on the data and no one was involved in the study without appropriate prior permission. The participants were fully informed of the purpose of the research and were free to withdraw at any point.

The school principals granted their consent prior to the case study and the researcher did not examine documents, files or correspondence during this phase without explicit permission from the participants. The students' parents were informed about the research and given the opportunity to request that their child did not take part in the study. Every effort was made to minimise disruption to the normal classroom programme. The researcher attempted to collect data in as unobtrusive way as possible and assisted both the teacher and students whenever asked. In keeping with contemporary views of social science (see for example, Lather, 1986; Reinharz, 1992; Soltis, 1989) the researcher was conscious of including an emancipatory dimension throughout the research and deliberately encouraged teachers to critically self-reflect on their practice.

The interpretations of case study data were discussed with the teachers and the narrative of their voice was collaboratively written and approved by the participants. The teacher's names were changed in the final report to honour the promise of anonymity and limit any harm from the potential misuse of the conclusions. There was a commitment that no participant in the research would be disadvantaged in the publication of the results. The researcher intends to disseminate an accurate and fair account of the study to both the teaching and research community through publications in appropriate professional journals. Finally, all the participants at each phase of the study will receive an executive summary of the research findings on the conclusion of the thesis.

4.6 ISSUES OF TRUSTWORTHINESS

The research was designed to ensure that it was, as much as possible, a trustworthy study of proficient computer-using teachers. The study attempted to satisfy four main criteria of trustworthiness: (a) confirmability; (b) credibility; (c) dependability; and, (d) transferability (Lincoln and Guba, 1985, 1990).

The criterion of confirmability (objectivity) refers to the degree with which the method and data were shown to reflect and further the researcher's self-interest. This criterion was meet by ensuring that the researcher's theoretical orientation and philosophical assumptions were made clear in reporting the findings of the study. The decisions made throughout the research process were visable and fully justified, and the involvement of the Research Advisory Committee enabled a systematic sample selection process. There remains an adequate record of data such that someone else could follow the transactions and decisions in relation to the study's findings. There is sufficient residue of material to justify the interpretations derived from data.

The criterion of credibility (internal validity) refers to when the findings, interpretations and analysis are found to be acceptable by the research participants and by other researchers who judge the reported results as being faithful to data. In this regard the researcher was involved in the study over a prolonged period and developed considerable rapport with many of the participants. The completed questionnaires, interview transcripts and case interpretations were offered to the participants for validation. The triangulation of different research and data gathering techniques in several contexts, and the involvement of a Research Advisory Committee enhanced the overall precision of the research process.

The criterion of dependability (reliability) refers to the consistency of the research findings and the fit between the reported data and what actually occurred in the collection of data. The study involved a number of research and data gathering techniques in several contexts, over a period of time. There was every indication that the findings would be consistent if the research were replicated with the same participants. As part of fulfilling the requirements of a masterate thesis the research was supervised (and to some extent audited) by staff with expertise on methodological issues and knowledge on the use of computers in educational settings.

The criterion of transferability (external validity) refers to the researcher giving sufficient descriptive information for another researcher to be able to transfer the research design to a similar site such that they could produce similar conclusions. The study involved a purposive sample that could easily be replicated and the methodology chapter provides a detailed account of the procedures and research techniques with more than enough information to permit another person contemplating application in another setting to make the needed comparisons of similarity.

In addition to the above criteria the research was designed to maximise catalytic validity. Lather (1986) states that catalytic validity represents the degree to which praxis research reorients, focuses and energises participants toward knowing reality in order to transform it,

a process Freire (1973) terms 'conscientisation'. It was hoped that the research would encourage the participants to reflect on their own practice and gain new insights and self-understandings about the role of computers in education. However, due to the limited resources of the researcher, and the relatively short period of the case study, this criterion was difficult to demonstrate.

4.7 METHODOLOGICAL LIMITATIONS

A number of limitations with this research must be acknowledged before the presentation, interpretation and discussion of the results. The following section outlines the major methodological limitations for each phase of the research.

4.7.1 Phase One

In phase one the nomination process may not have been sufficiently inclusive to have canvassed the full range of people with knowledge of teachers who were proficient at using computers in the classroom. The study did not seek the views of parents and/or caregivers nor all the members of the BOT. The opinion of teachers within the region were obtained only from the staff representative on the BOT and in some schools these members were not actually teachers. Moreover, the research techniques may have been too crude or insensitive for the purpose of selecting a purposive sample for further research. The questionnaire sought written data only which may not have been able to convey teachers' perceptions of their own reality and, therefore, provide trustworthy contextual information for the sample selection process.

4.7.2 Phase Two

In phase two there was a similar problem in that the teacher interviews were open to misconceptions of what actually happens in the classroom. The teacher's 'story' of their classroom computer use could be based on a false consciousness of their own reality and subsequently not provide an accurate account of actual practice. There were potential limitations resulting from the researcher's gender, inexperience with the interview technique and prior knowledge of the participants. The coding of interviews in terms of the main research themes may have been insensitive to the context specific nature of the discourse, and the interview summaries might inadvertently have become the researcher's 'story' of the participating teachers' 'story'. Finally, because of time constraints the Research Advisory Committee may not have had long enough to study the interview summaries in order to make valid judgements on the individual teachers proficiency.

4.7.3 Phase Three

In this phase it was not possible because of time constraints and the nature of the purposive sample to pilot the case study protocol. Furthermore, the case boundaries may have been too restrictive in that the important unit of analysis was not necessarily just the teachers classroom. The case study was limited by the time of year and the restricted period of participant-observation. At best it would provide a snap-shot only of proficient practice with computers in a given week. Moreover, the methodology was potentially a study that used ethnographic techniques as opposed to research that did ethnography (Wolcott, 1988). There were limitations in relation to the time available for participation and observation, and the amount of data that could be collected on the complex interactions within the case. Furthermore, the effects of the researcher were difficult to ascertain and the design of the study took little account of the prior experience of the students, their existing knowledge, motivation and approaches towards learning.

The study of two only single cases meant that the generalisation of results was potentially weak, with poor transfer to other contexts, at least without further replication of the research. The dynamic nature of the field made the potential to replicate and generalise the results over-time problematic. The observations and interpretations of data were not free, despite the participatory nature of the research, from convert imposition of theory, and ultimately reflected the researchers gaze into these classrooms. Other researchers may well observe different phenomena and come to different conclusions. Finally, the case studies were not designed solely for the purpose of critique. Although the researcher intended to encourage a critical perspective, the method did not prescribe for action. The participants may have critically reflected on their computer use, but there was no guarantee that this reflection translated into better classroom practice.

4.8 SUMMARY

This chapter has outlined the overall methodological approach and described the three main phases of the research. It has detailed the specific research questions and the sample selection process, and provided a description of the sample participants. An extensive justification has been given for the decisions made throughout the research process with a full account of the procedures and techniques used for piloting, gathering and analysing data within each phase. The ethical considerations of the study were discussed along with issues of trustworthiness and the potential methodological limitations of the research.

The following chapter presents the results of the research for the first questionnaire phase of the study.

CHAPTER FIVE

Results: Phase One

"We can all learn from teachers who are very effective" (McInerney & McInerney, 1994, p.28).

5.0 INTRODUCTION

This chapter provides the results for the first phase of the research. It presents responses to a questionnaire on the experiences, practices and perceptions of 'nominated' proficient computer-using teachers. The findings are divided into four sections that relate to the main research questions. The first section outlines the background teaching experience of the participants. The second section supplies information on their background computer experience. The third section examines the way computers are being used in the classroom, and the final section presents data on teachers' opinions and perceptions about using computers for teaching and learning purposes. Data are presented in a range of figures and tables with brief descriptions and explanatory notes of significant points.

5.1 BACKGROUND TEACHING EXPERIENCE

This section presents data on the background teaching experience of the participants. A series of figures and tables are given pertaining to the research question: *What are the characteristics of 'nominated' proficient computer-using teachers in terms of their educational background and experience?*

Table 5.1 states the total number of 'nominated' proficient computer-using teachers participating in the study. Percentages in tables that follow were calculated from the returned questionnaire responses only.

Table 5.1

Sample Of Nominated Proficient Computer-Using Teachers

Nominated Teachers	Participating Teachers	Sample %
36	31	86%

The percentages shown in Table 5.2 outline the overall ratio of women and men involved in the study as 'nominated' proficient computer-using teachers.

Table 5.2

Gender Profile Of Nominated Proficient Computer-Using Teachers

Teachers	Female %	Male %
Nominated Proficient Computer-Using Teachers	61 (N=19)	39 (N=12)

Table 5.3 shows the age profile of the 'nominated' proficient computer-using teachers. It was notable that the sample of teachers spanned a wide age, but that the largest group fell within the 40-49 age range. There were no men in the 20-29 age range.

Table 5.3

Age Profile Of Nominated Proficient Computer-Using Teachers

Nominated Teachers	Age 20-29 %	Age 30-39 %	Age 40-49 %	Age 50-60+ %
All Teachers	13 (N=4)	29 (N=9)	45 (N=14)	13 (N=4)
Female Teachers	13 (N=4)	13 (N=4)	29 (N=9)	6.5 (N=2)
Male Teachers	0 (N=0)	16 (N=5)	16 (N=5)	6.5 (N=2)

The ethnicity profile of the 'nominated' proficient computer-using teachers is shown in Table 5.4. The majority of teachers were of Pakeha or European decent.

Table 5.4

Ethnicity Profile Of Nominated Proficient Computer-Using Teachers

Nominated Teachers	Pakeha European %	Maori %	Polynesian %	Other %
All Teachers	94 (N=29)	3 (N=1)	0 (N=0)	3 (N=1)

The mean number of years teaching in all schools, as well as the mean in the current school, is shown in Figure 5.1. The men had considerable more teaching experience than the women teachers. There was little difference, however, between the male and female teachers in terms of their experience in the current school.

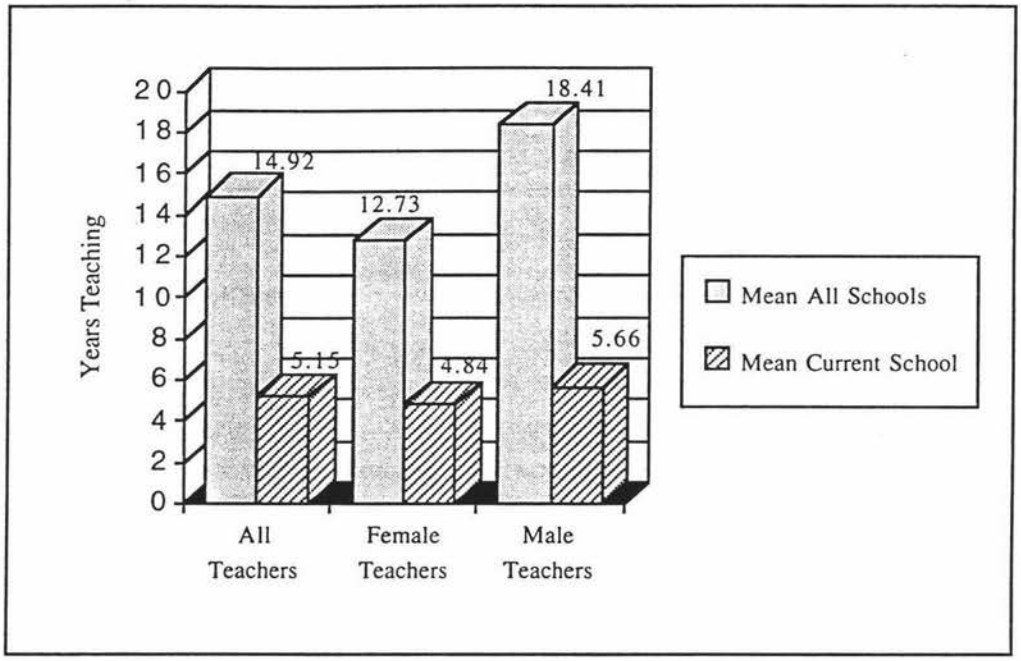

Figure 5.1
Prior Teaching Experience Of Nominated Proficient Computer-Using Teachers

Table 5.5 presents the teaching positions of the participating teachers within their current school. There were a broad range of teachers at different positions within school, but the majority of the participants (65%) were either scale A or senior teaching staff.

Table 5.5

Teaching Position Of Nominated Proficient Computer-Using Teachers Within Their Own School

Nominated Teachers	Scale A Teacher %	Senior Teacher %	Assistant Principal %	Deputy Principal %	Teaching Principal %
All Teachers	42 (N=13)	23 (N=7)	13 (N=4)	13 (N=4)	10 (N=3)
Female Teachers	32 (N=10)	13 (N=4)	10 (N=3)	6.5 (N=2)	0 (N=0)
Male Teachers	10 (N=3)	10 (N=3)	3 (N=1)	6.5 (N=2)	10 (N=3)

The teaching level of the 'nominated' proficient computer-using teachers within their school is presented in Table 5.6. The majority of the teachers (71%) were either in the lower or middle level of the primary school. Note that there were three special needs teachers who were not attached to any particular level within the school.

Table 5.6

Teaching Level Of Nominated Proficient Computer-Using Teachers Within Their Own School

Nominated Teachers	Lower School %	Middle School %	Upper School %	Special Needs %
All Teachers	39 (N=12)	32 (N=10)	19 (N=6)	10 (N=3)
Female Teachers	29 (N=9)	16 (N=5)	6 (N=2)	10 (N=3)
Male Teachers	10 (N=3)	16 (N=5)	13 (N=4)	0 (N=0)

Table 5.7 shows the most advanced teaching qualification held by the 'nominated' proficient computer-using teachers. The participating teachers were well qualified with 74% having completed a further qualification beyond their teaching diploma. Some teachers had several additional qualifications and three were in the early stages of a masters degree.

Table 5.7

Most Advanced Teaching Qualification Of Nominated Proficient Computer-Using Teachers

Nominated Teachers	Diploma of Teaching %	High/Advan Diploma of Teaching %	Bachelor of Education %	Diploma of Education %	Master of Education %
All Teachers	26 (N=8)	26 (N=8)	32 (N=10)	13 (N=4)	3 (N=1)
Female Teachers	10 (N=3)	19 (N=6)	19 (N=6)	13 (N=4)	0 (N=0)
Male Teachers	16 (N=5)	6 (N=2)	13 (N=4)	0 (N=0)	3 (N=1)

5.2 BACKGROUND COMPUTER EXPERIENCE

This section reports on the background computer experience of the 'nominated' proficient computer-using teachers. The year that teachers first used a computer with a class of students is presented in Figure 5.2. Comparatively, the men nominated themselves as having more years of computer experience than the women teachers.

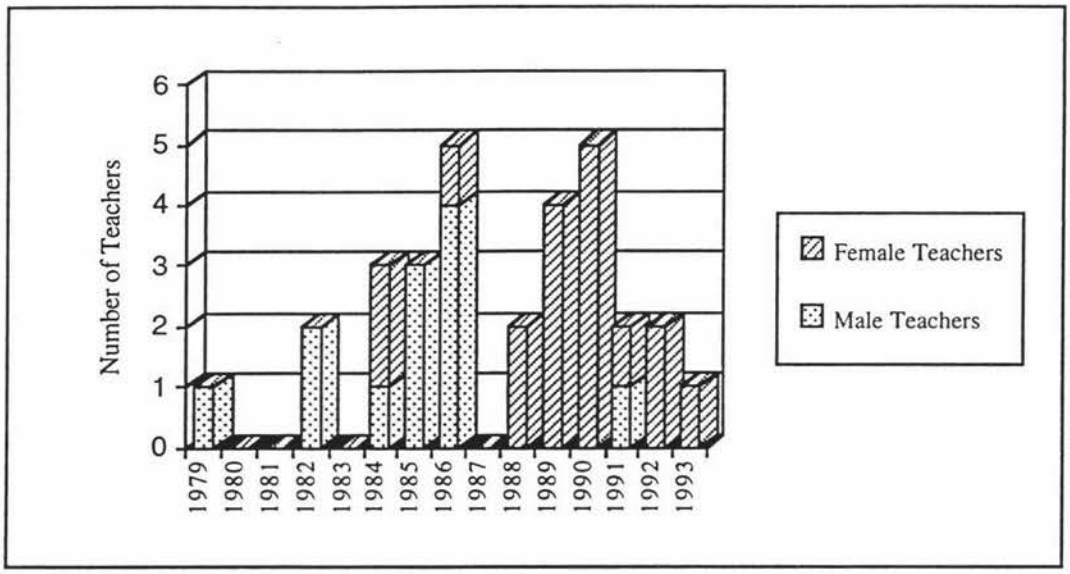

Figure 5.2
Year Nominated Proficient Computer-Using Teachers First Used A Computer

Figure 5.3 shows the percentage of teachers with access to a home computer. Although 92% of the men had access to a home computer in comparison with 68% of the women, there was little variation in access at different levels within school. The least access was in the lower school (75%) and the highest access was in the upper school (83%). The main use of the home computer was as a word processor for completing assignment work, and for school planning and administration tasks. It was also used for reviewing software for school use.

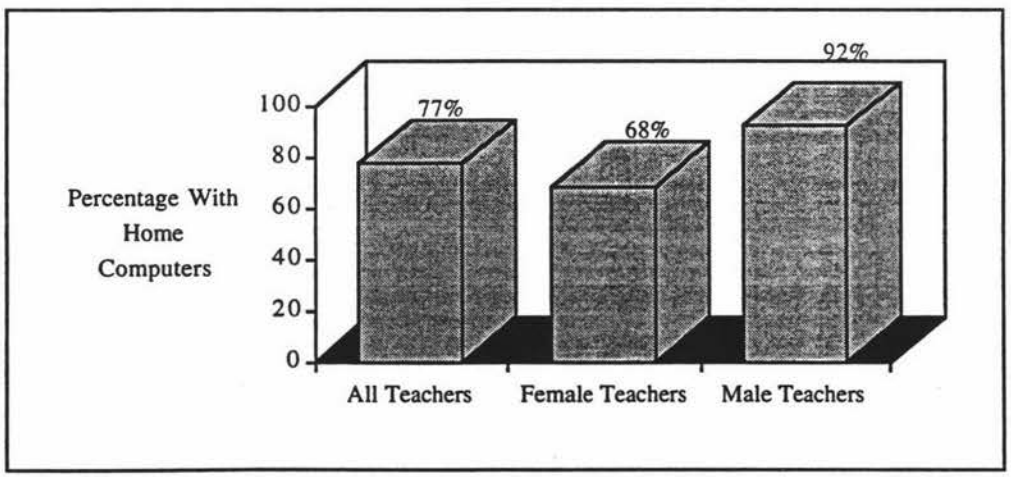

Figure 5.3
Percentage Of Nominated Proficient Computer-Using Teachers With Access To A Home Computer

The membership of the 'nominated' proficient computer-using teachers to an organisation or computer club is shown in Table 5.8. Only 19% of all teachers had any association with such an organisation or club, but of those who did they were from the middle and upper school and predominantly members of the local Apple Users Group.

Table 5.8

Membership Of Nominated Proficient Computer-Using Teachers To A Computer Organisation Or Club

Question	Yes All Teachers %	Yes Female %	Yes Male %	Lower School %	Middle School %	Upper School %
Have you ever been a member of a computer organisation or club?	19 (N=6)	16 (N=3)	25 (N=3)	0 (N=0)	30 (N=3)	33 (N=2)

Table 5.9 gives information on the teachers who had special responsibility for computers in their school. A high percentage of the participating teachers (68%) were either the Teacher in Charge of Computers in their school or a member of the school's Computer Committee. Notably, 83% of the male computer-using teachers fell within this category.

Table 5.9

Special Responsibility Of Nominated Proficient Computer-Using Teachers For Computer Use In Their School

Question	Yes All Teachers %	Yes Female %	Yes Male %	Lower School %	Middle School %	Upper School %
Do you have any special responsibility for the use of computers in your school?	68 (N=21)	58 (N=11)	83 (N=10)	50 (N=6)	70 (N=7)	83 (N=5)

The percentage of teachers who had completed a formal course or qualification on computers in education is shown in Table 5.10. The majority of teachers (65%) had participated in such a course or qualification. The most common type of course was as part of a higher teaching diploma at a College of Education (N=9) or as a paper toward a University degree (N=8).

Table 5.10

Nominated Proficient Computer-Using Teachers Having Completed A Formal Course Or Qualification On Computers In Education

Question	Yes All Teachers %	Yes Female %	Yes Male %	Lower School %	Middle School %	Upper School %
Have you ever completed a formal course or tertiary qualification on the use of computers in education?	65 (N=20)	58 (N=11)	75 (N=9)	50 (N=6)	70 (N=7)	83 (N=5)

It was noteworthy that a higher percentage of men (75%) and teachers at the upper school (83%) had completed a course or qualification on the use of computers in education. A number of teachers (N=7) reported that they had attended other types of courses or training opportunities related to computers, other than those on using computers in education. The main type was a polytechnic or evening school course on how to use different computer applications for personal use.

Table 5.11 presents the percentage of 'nominated' proficient computer-using teachers having participated in some type of teacher development in the last two years and those involved in teaching other teachers about using computers in education.

Table 5.11

Nominated Proficient Computer-Using Teachers Having Participated In Some Type Of Teacher Development On Computers In Education

Question	Yes All Teachers %	Yes Female %	Yes Male %	Junior School %	Middle School %	Senior School %
Have you attended in the last two years any type of inservice course on the use of computers in education?	61 (N=19)	63 (N=12)	58 (N=7)	50 (N=6)	70 (N=7)	66 (N=4)
Have you ever been involved in the training of other teachers on the use of computers in education?	55 (N=17)	58 (N=11)	50 (N=6)	50 (N=6)	50 (N=5)	66 (N=4)

The majority of teachers (61%) had received some type of teacher development in the area of educational computing. Many of these had participated in a recent 'IT' inservice teacher development course offered through the local College of Education. There were, however, many other teachers who had not received support for using computers in the classroom beyond their study towards a higher qualification. It is worth noting that there may not have been the same inservice teacher development opportunities available when these teachers completed their courses as part of their further study.

More than half the teachers (55%) had been formally involved in teaching other teachers how to use the computer for educational purposes. This involvement was usually in running courses for teachers within their own school on how to use specific software applications in the classroom. The most common type of course was an after school 'hands on' session on using the different features of a word processor.

Table 5.12 shows other informal ways that 'nominated' proficient computer-using teachers acquired knowledge about the use of computers in education. A few teachers (N=6) reported that their school subscribed to the journal *Computers in New Zealand Schools.* Most teachers did not, however, receive publications or magazines in the area (74%), nor give presentations or attend conferences on the educational use of computers (87%).

Table 5.12

Nominated Proficient Computer-Using Teachers With Informal Types Of Knowledge About The Use Of Computers In Education

Question	Yes All Teachers %	Yes Female %	Yes Male %
Do you, or does your school, receive any journals and/or magazines on the use of computers in education?	26 (N=8)	21 (N=4)	33 (N=4)
Have you ever attended a conference and/or given a formal presentation on the use of computers in education?	13 (N=4)	16 (N=3)	8 (N=1)

Nonetheless, many teachers (N=11) commented on the importance of informal learning opportunities through friends and colleagues. One teacher stated that this type of support was the most important reason for having introduced the computer into the classroom. These opportunities appear to have been particularly important in helping teachers to cope with the technical demands of using computers in the classroom.

5.3 CLASSROOM COMPUTER USE

This section presents a number of figures and tables pertaining to the research question: *How do 'nominated' proficient computer-using teachers use computers in their classroom?*

The percentages shown in Table 5.13 summarise the access that teachers have to computers in their classroom. Twenty nine of the 31 teachers had full-time access to a computer in their classroom. Six of the lower school teachers had access to more than one machine. The number of machines in the lower school may be misleading in that these computers could have been located in an open plan area, and/or might be quite old having been pasted down from other areas of the school during the purchase of new hardware. One teacher in the middle school had access to six pocket book computers in addition to a stand alone machine. Two teachers taught at a school that gave students access to a computer lab facility. The majority of teachers (71%), however, had access to just one computer in their classroom.

Table 5.13

Nominated Proficient Computer-Using Teachers' Access To Classroom Computers

Question	Yes All Teachers %	Lower School %	Middle School %	Upper School %
Do children have full-time access to a computer in your classroom?	97 (N=30)	100 (N=12)	100 (N=10)	83 (N=5)
Do children have regular access to a computer lab in your school?	6.5 (N=2)	0 (N=0)	0 (N=0)	33 (N=2)

Table 5.14 indicates the frequency of computer use for each level of school. Most teachers (84%) used the computer most days or every day of the school week. The computer was used most frequently (75%) every day of the week by teachers in the lower school.

Table 5.14

Frequency Of Computer Use In Nominated Proficient Computer-Using Teachers' Classrooms

Nominated Teachers	No Days %	Some Days %	Most Days %	Every Day %
All Teachers	0 (N=0)	16 (N=5)	23 (N=7)	61 (N=19)
Junior School Teachers	0 (N=0)	8 (N=1)	17 (N=2)	75 (N=9)
Middle School Teachers	0 (N=0)	30 (N=3)	20 (N=2)	50 (N=5)
Senior School Teachers	0 (N=0)	17 (N=1)	50 (N=3)	33 (N=2)
Special Needs Teachers	0 (N=0)	0 (N=0)	0 (N=0)	100 (N=3)

The mean number of hours the computer was used by teachers in the last week is shown in Figure 5.4. The computer was used for significantly more hours per week in the lower school (19.66 hours) than the upper school (8.41 hours). Before and after school use of the computer was common as well as lunch time use. Several teachers (N=6) indicated that the number of hours per week was very difficult to calculate and for this reason these results should be interpreted as general estimates only.

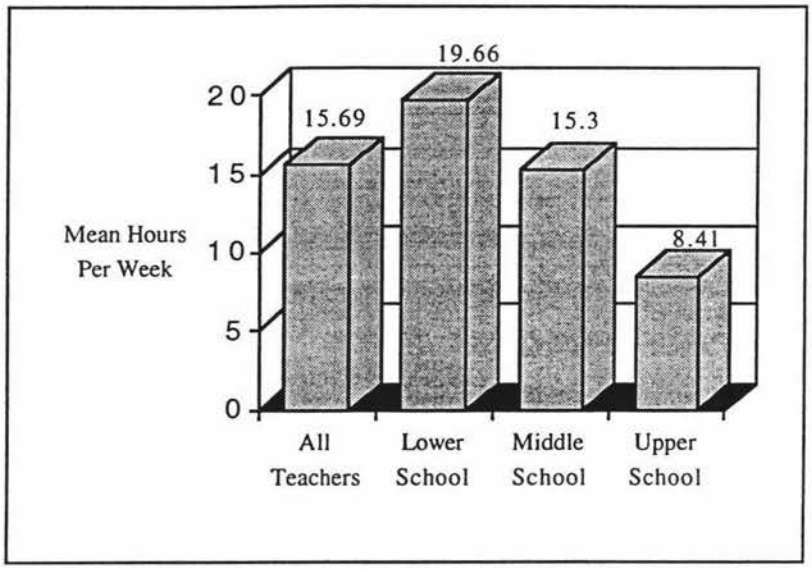

Figure 5.4
Number Of Hours The Computer Was Used In Nominated
Proficient Computers-Using Teachers' Classrooms In The Last Week

The most common way students work on the computer in 'nominated' proficient computer-using teachers classrooms is shown in Table 5.15. The majority of teachers (65%), at all levels, use the computer with pairs or small groups of students. The individual use of computers is more common in the upper school than the lower school.

Table 5.15

Method Of Computer-Based Instruction In Nominated Proficient Computer-Using Teachers' Classrooms

Nominated Teachers	Individuals %	Pairs %	Small Groups %	Other %
All Teachers	25 (N=7)	54 (N=15)	21 (N=6)	0 (N=0)
Junior School Teachers	17 (N=2)	50 (N=6)	33 (N=4)	0 (N=0)
Middle School Teachers	30 (N=3)	50 (N=5)	20 (N=2)	0 (N=0)
Senior School Teachers	33 (N=2)	67 (N=4)	0 (N=0)	0 (N=0)

Table 5.16 presents data on whether teachers have a specific method to manage the time students spend working on the computer in their classroom. The majority (89%) of 'nominated' proficient computer-using teachers had such a method with a wide variation of approaches. The main approach was the 'stack system' where each student had a coloured peg with their name on it, where their time on the computer was determined by the order of the pegs. Several (N=5) teachers commented on the arbitrary nature of different rotation systems and of the need to be flexible in order for students to get time to complete their work over several days.

Table 5.16

Management Of Computers In Nominated Proficient Computer-Using Teachers' Classrooms

Question	Yes All Teacher %	Junior School %	Middle School %	Senior School %
Do you have a method to manage the time children spend working with the computer?	89 (N=25)	92 (N=11)	100 (N=10)	66 (N=4)

Figure 5.5. shows the percentage of teachers using specific types of software in the classroom. The most common type of software used by 'nominated' proficient computer-using teachers was a word processor (97%) followed by educational games (90%).

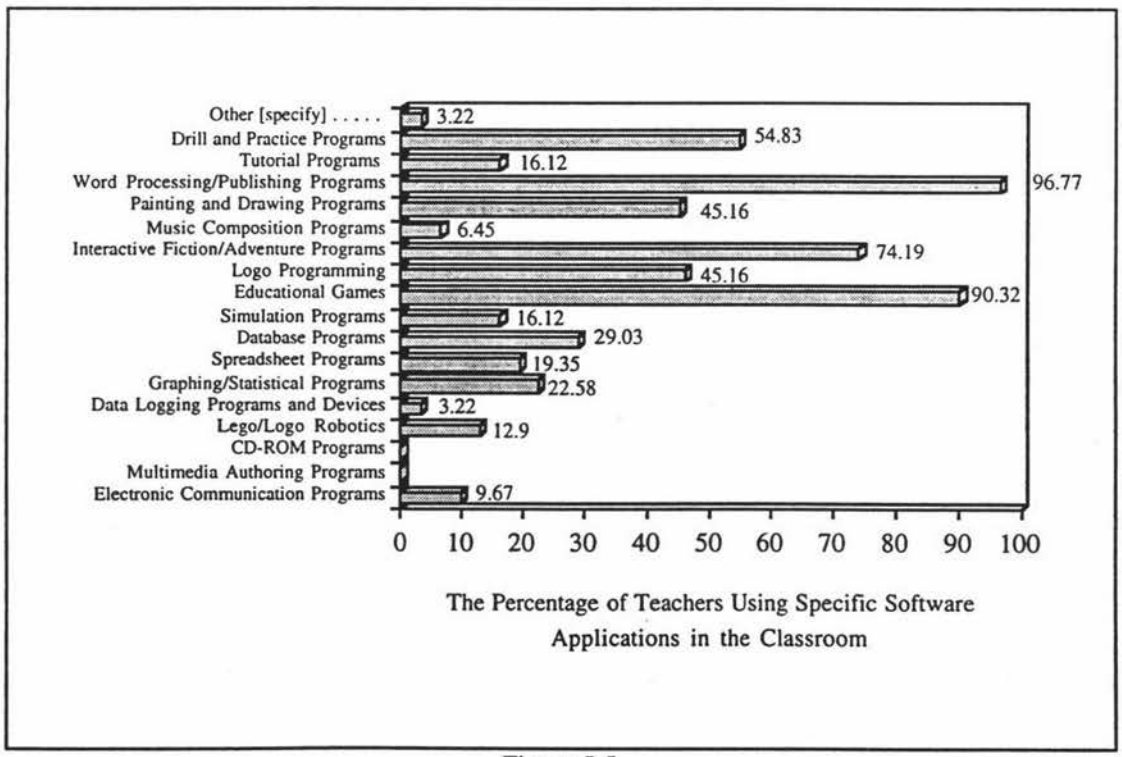

Figure 5.5
Ways Nominated Proficient
Computers-Using Teachers Used Computers In The Classroom

It is difficult to draw too many conclusions from the high use of educational games as the definition of this software remains problematic. Two different teachers may have defined the same software package within two quite different categories. For example, one teacher may have defined the package *Math and Me* as a tutorial, whereas another teacher could have considered this to have been an educational game. The teachers were, however, asked to list in order the names of the three software packages most frequently used in the classroom and from these data it was obvious that instructional software packages, such as *Maths Blaster* and *Counting Critters,* were particularly common in the classroom. Another common usage of the computer was for interaction fiction. Data on software titles confirmed that interaction fiction was very popular among the participating teachers. The two most common listed titles were *Carmin Sandeigo* and *Dinosaur Discovery.*

Table 5.17 shows how 'nominated' proficient computer-using teachers used computers in the lower school. Notably, word processing and educational games were common, but so to was Logo™ which was used by 50% of the teachers for some weeks of the year.

Table 5.17

Ways Computers Were Used In The Classroom By Teachers In The Lower School

Ways of Use	Never %	Some Weeks %	Most Weeks %	Every Week %
Drill and Practice Programs	33	50	17	0
Tutorial Programs	92	0	8	0
Word Processing/Publishing Programs	9	8	0	83
Painting and Drawing Programs	58	42	0	0
Music Composition Programs	100	0	0	0
Interactive Fiction/Adventure Programs	33	42	0	25
Logo Programming	50	50	0	0
Simulation Programs	100	0	0	0
Educational Games	16	42	25	17
Database Programs	92	8	0	0
Spreadsheet Programs	100	0	0	0
Graphing/Statistical Programs	100	0	0	0
Data Logging Programs and Devices	100	0	0	0
Lego/Logo Robotics	92	8	0	0
CD-ROM Programs	100	0	0	0
Multimedia Authoring Programs	100	0	0	0
Electronic Communication Programs	100	0	0	0
Other [specify]	100	0	0	0

The type of software packages used by teachers in the middle school is presented in Table 5.18. Once again word processing is the most common software application used in the classroom, but painting and drawing programs are also used on a regular basis. A number of teachers made use of database, spreadsheet and statistical programs as well as electronic communications in the classroom.

Table 5.18

Ways Computers Were Used In The Classroom By Teachers In The Middle School

Ways of Use	Never %	Some Weeks %	Most Weeks %	Every Week %
Drill and Practice Programs	50	40	10	0
Tutorial Programs	60	40	0	0
Word Processing/Publishing Programs	0	20	20	60
Painting and Drawing Programs	30	40	10	20
Music Composition Programs	90	10	0	0
Interactive Fiction/Adventure Programs	0	70	10	20
Logo Programming	60	50	0	0
Simulation Programs	80	20	0	0
Educational Games	10	60	20	10
Database Programs	50	30	20	0
Spreadsheet Programs	70	30	0	0
Graphing/Statistical Programs	70	30	0	0
Data Logging Programs and Devices	90	10	10	0
Lego/Logo Robotics	92	8	0	0
CD-ROM Programs	100	0	0	0
Multimedia Authoring Programs	100	0	0	0
Electronic Communication Programs	70	0	0	30
Other [specify]	100	0	0	0

Table 5.19 shows the ways that 'nominated' proficient computer-using teachers used computers in the upper primary level. Although word processing was used on a regular basis, the percentage of teachers using the computer for this purpose every week was less than in the lower and middle school. There was a wider diversity of software applications used, however, on a regular basis in the upper school. It was noteworthy that few teachers used information processing tools such as databases and spreadsheets on a regular basis in the classroom.

ıble 5.19

'ays Computers Were Used In The Classroom By Teachers In The Upper School

Ways of Use	Never %	Some Weeks %	Most Weeks %	Every Week %
Drill and Practice Programs	50	50	0	0
Tutorial Programs	83	17	0	0
Word Processing/Publishing Programs	0	33	17	50
Painting and Drawing Programs	50	33	0	17
Music Composition Programs	83	17	0	0
Interactive Fiction/Adventure Programs	17	50	0	33
Logo Programming	17	66	0	17
Simulation Programs	50	33	0	17
Educational Games	17	33	33	17
Database Programs	50	50	0	0
Spreadsheet Programs	50	50	0	0
Graphing/Statistical Programs	70	30	0	0
Data Logging Programs and Devices	34	66	0	0
Lego/Logo Robotics	66	17	0	17
CD-ROM Programs	100	0	0	0
Multimedia Authoring Programs	100	0	0	0
Electronic Communication Programs	100	0	0	0
Other [specify] Library Reference Work	83	0	0	17

ıe 'nominated' proficient computer-using teachers were asked to list in order the three main 'eas of the curriculum where the computer was used in the classroom. All of the ırticipating teachers listed either Language or Process Writing as the main curriculum ›plication. Data was consistent with the reported usage of the computer for word 'ocessing and interactive fiction type activities.

.4 PERCEPTIONS ABOUT COMPUTERS IN EDUCATION

his section presents general data on the opinions and perceptions of 'nominated' proficient ›mputer-using teachers about the use of computers in education.

igure 5.6 shows the two software applications that teachers ranked as having the most lucational value in the classroom. Word processing was ranked by 77% of the participating

teachers as the most valuable use of the computer in the classroom. Interactive fiction was ranked by 17% of the teachers as being most valuable. The software application ranked by 'nominated' proficient computer-using teachers as second most valuable was also interactive fiction (40%) followed by educational games (23%).

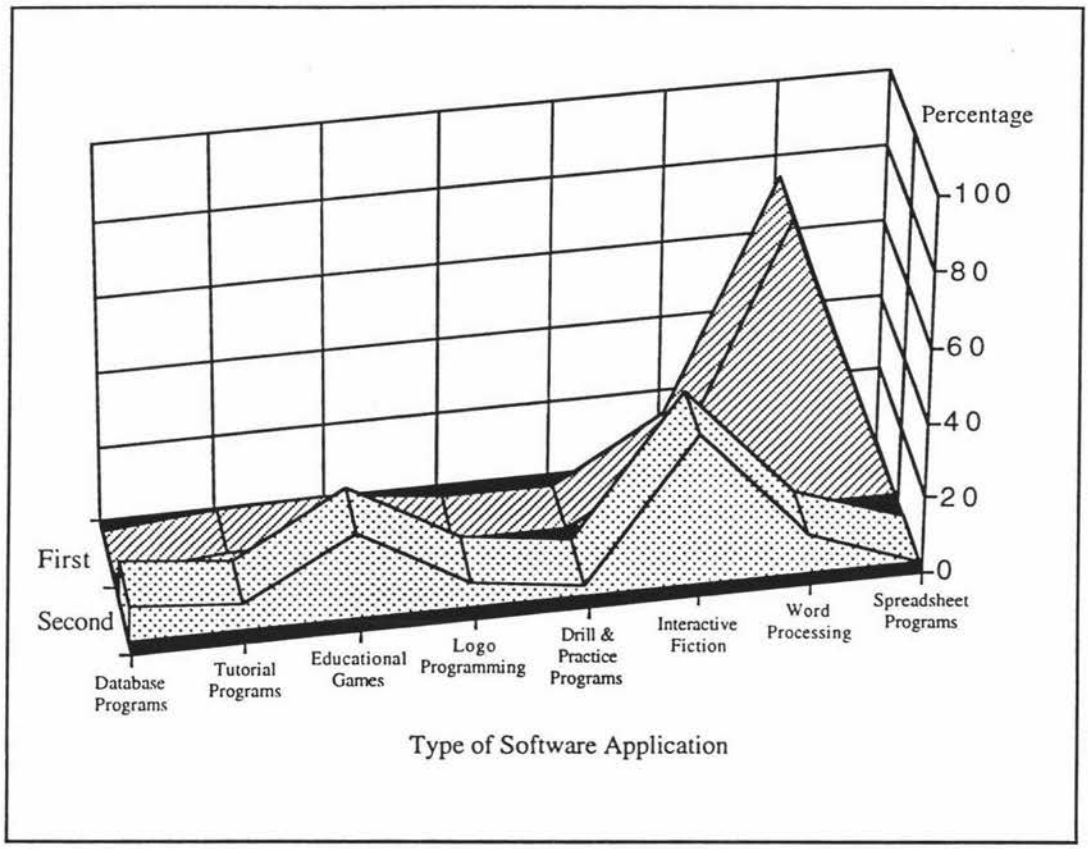

Figure 5.6
Type Of Software That Proficient Computer-Using
Teachers Ranked As Having The Most Educational Value

The two statements that 'nominated' proficient computer-using teachers ranked as having the most educational importance for using computers in schools are shown in Figure 5.7. The top ranking statement with 39% of the participating teachers was *to develop children's thinking and problem solving skills.* This was followed equally with 26% of the teachers by the statements *to give children more responsibility and control over their own learning* and *to develop children's experience and computer awareness.* The thinking and problem solving statement was also ranked second highest in terms of educational importance by 26% of the teachers, and was closely followed by *to develop social skills for collaboration and working with others* with 23% support. It was notable that 19% of teachers ranked the statement *to support the individualised and personal instruction of children* as the second most important reason for using computers in schools. It appeared that few teachers gave the statement *to develop skills useful for future education and employment* their support.

A gender analysis of the responses showed, however, that men were more inclined to state reasons of future education and employment with 25% of them ranking this as the most important reason for using computers. Data has to be seen in the context that 42% of male teachers ranked the aim *to develop experience and computer awareness* as the most important reason, as opposed to 33% for thinking and problem solving. The female teachers ranked reasons of thinking and problem solving (42%) and the chance to give students more responsibility for their learning (37%) as the most important statements for the educational use of computers in schools. These data indicate that female and male teachers in this study have somewhat different perceptions of the most important reasons for using computers in schools.

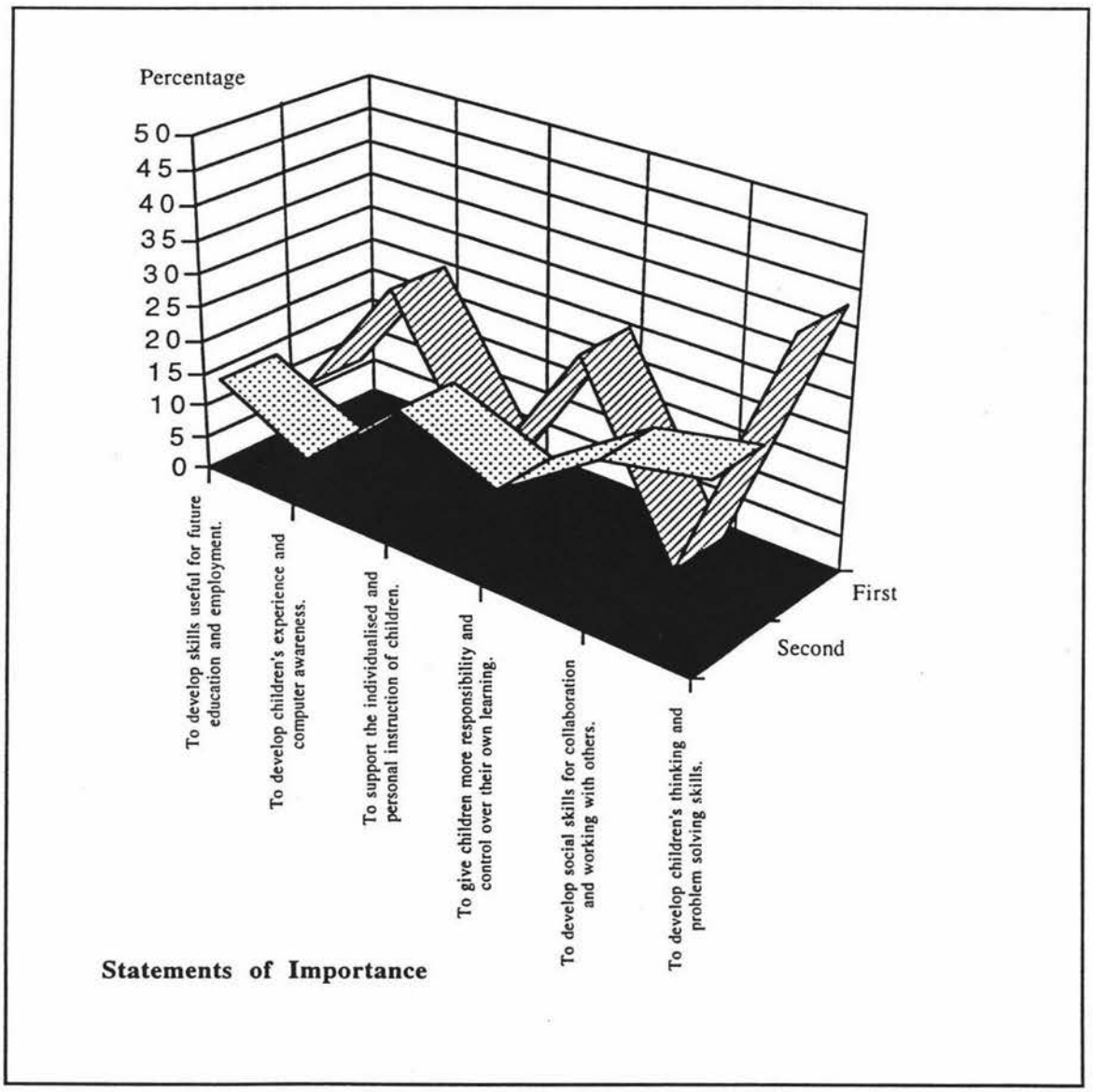

Figure 5.7
Reasons That Proficient Computer-Using Teachers Ranked
As Having The Most Educational Importance For Using Computers In New Zealand Schools

The teachers were asked what they considered were the 'main' benefits of using computers with their students. Table 5.20 summarises their responses with a thematic analysis based on the main cognitive, affective and/or social, physical and future benefits.

Table 5.20

Main Benefits That Teachers Stated For Students In Their Class Using The Computer

Cognitive Benefits	Physical Benefits	Affective/Social Benefits
"Learning to read and write words."	"They learn to turn on-off and load programs and learn the basic functions."	"Social agent."
"The computer in the writing process works well."	"Learning the word processor and keyboarding skills."	"The cooperation and perseverance on tasks."
"The writing process and to be able to learn to constantly read back the written word."	"Learn skills and keyboarding for later computer use."	"Motivation, learning through enjoyment, their self esteem."
"Give ease to the writing process and therefore seeing children revising and editing."	"Keyboarding skills and familiarity with computers."	"It develops children's confidence -- not only in the computer but in other areas too."
"Development of written skills."	"Familiarity with operation and ability to manage the equipment."	"The children are comfortable and have a feeling of success when using the computer."
"Word processing and writing."	"Learning keyboarding skills."	"They feel in control of process and don't worry so much if mistakes occur."
"Word processing facilities to create and present their stories and the ability to alter/change work."		"Their enthusiasm for writing is one of the main benefits."
	Future Benefits	
"The understanding pupils gain of the writing process by using the computer as a word processor."	"Preparing them for the future."	"Learning social skills, peer modelling, socialising."
"Wording processing and problem solving skills."	"Introduction to new technologies."	"Motivates children to concentrate and extends and enhances self-esteem."
"The assistance it gives children in developing problem solving strategies."	"Learning the technology of the future."	"Self-paced learning that is non threatening."
"Learning a different method and helping for extension of learners."	"It will help them in the future."	"Confidence of using the computer and working in small groups."
"A thought provoker, tool to ease the load presenting ideas."		"A non threatening interactive resource."

The main benefits of using the computer with students was the machines' ability to: (a) support the writing process and develop problem solving strategies; (b) enhance the

confidence and self-esteem of learners; and (c) help students acquire keyboarding skills and expertise for the future. The responses on the main benefits were closely related to what teachers enjoyed most about using computers in the classroom. The comments in Table 5.21 were typical of how teachers particularly enjoyed the affective and social dimensions of using the computer in their classroom.

Table 5.21

What Nominated Proficient Computer-Using Teachers Enjoyed Most About Using A Computer In Their Classroom

Pride In Learning	"The pride that children in my class show when displaying their work". "Seeing the satisfaction that my young pupils get from writing their stories and how proudly they read out and display them".
Confidence To Learn	"Watching confidence and skills grow and seeing students share this with others". "Seeing students gaining confidence on the computer and able/willing to use it as a tool to make use of". "Seeing children develop confidence to explore and experiment in the use of computers". "Seeing the children confident and keen to use the computer at all times of the day".
Motivation To Learn	"Seeing the children gain so much confidence in using it. Gaining their licence to use it and being so motivated to use a computer". "The children's own intrinsic motivation and their questioning". "The children's enthusiasm and enjoyment of using the computer".
Control Of Learning	"I enjoy the cooperative learning that takes place in small groups on the computer especially with interactive fiction". "Children working together; sharing new processes in thinking; seeing previously shy children become computer able". "Empowering children to find out for themselves, be responsible for their own learning".

The teachers were generally enthusiastic about using computers, but one participant warned that educational software was only valuable if it was used as a tool and not as a glorified Sega™ system unrelated to the rest of the classroom programme. A number of other teachers commented on problems with using computers in schools. These problems included: (a) a lack of hardware and good quality software; (b) the frustration with technical requirements

of getting the machine to work; (c) the dominance of boys over girls; (d) the time it takes to integrate the computer into the classroom; and, (e) the lack of support among colleagues. As one teacher stated:

> *"I am frustrated at the limited time that I have had to make use of computers. I am even more frustrated at trying to get other teachers see the possibilities and just get started!"*

Table 5.22 summaries the teachers' perceptions about the educational use of computers. Data provides strong evidence that a high percentage (94%) of the nominated sample of participating teachers were confident about using computers in the classroom. There was unanimous disagreement that computers reduced social interaction between students, but the majority (71%) of teachers also considered that computers allowed for more individualised forms of instruction. A high percentage of teachers (78%) perceived that computers had positively affected their teaching.

Table 5.22

Opinions Of All Nominated Proficient Computer-Using Teachers About The Use Of Computers In The Classroom

Statement	Strongly Agree %	Agree %	Not Sure %	Disagree %	Strongly Disagree %
I feel confident about using computers with my pupils	55 F=13/ M=4	39 F=6 / M=6	6 F=0 / M=2	0 F=0 / M=0	0 F=0 / M=0
I find computers reduce the social interaction between children in my class.	0 F=0 / M=0	0 F=0 / M=0	0 F=0 / M=0	45 F=7 / M=7	55 F=12 / M=5
I am unsure of how to best use the computer with my class.	0 F=0 / M=0	13 F=1 / M=3	9 F=3 / M=0	65 F=12 / M=8	13 F=3 / M=1
I find computers useful in only a few areas of the school curriculum.	0 F=0 / M=0	13 F=3 / M=1	13 F=2 / M=2	55 F=10 / M=7	19 F=4 / M=2
I believe computers allow more individualised instruction of children in my class.	6 F=1 / M=1	65 F=13 / M=7	23 F=4 / M=3	6 F=1 / M=1	0 F=0 / M=0
I find computers allow me in my teaching to link different subjects of the curriculum.	16 F=3 / M=2	65 N=12 / M=8	9 F=2 / M=1	9 F=2 / M=1	0 F=0 / M=0
I believe my way of teaching is positively affected when using a computer with my class.	23 F=4 / M=3	55 F=10 / M=7	19 F=4 / M=2	0 F=0 / M=0	0 F=0 / M=0

Note. F = the number of female teachers and M = the number of male teachers.

A gender analysis of the responses revealed that 68% of female teachers (13/19) as opposed to 33% of male teachers (4/12), strongly agreed that they were confident using the computer with their students. In response to the statement *computers reduce social interaction,* 63% of the women compared with 42% of the men registered strong disagreement. For other items, there were few differences in the responses of women and men.

5.5 SUMMARY

Participating 'nominated' proficient computer-using teachers were predominantly of Pakeha or European decent. The teachers were well-qualified with considerable practical teaching experience. Male teachers had greater access to a computer at home and were more likely to have special responsibility for computers in the school. The majority of teachers had access to just one computer in their classroom, but this computer was normally utilised most or every day of the school week. A greater diversity of educational software was used in the upper school as opposed to the lower school. The computer was used at each level of school most often by pairs or small groups of students for word processing, educational games and interactive fiction activities. Women had different perceptions of the reasons for using computers in the classroom than men. The majority of the participating teachers were confident about using the hardware and software in the classroom and perceived that the computer supported greater social interaction among students.

The following chapter presents the results of the research for the second interview phase of the study.

CHAPTER SIX

Results: Phase Two

"Wide-scale innovation should avoid extreme demands on teachers' skills and talents" (Perkins, 1992, p.207).

6.0 INTRODUCTION

This chapter provides the results for the second phase of the research. It presents the informant interview data on the practices, perceptions and beliefs of 'perceived' proficient computer-using teachers. Data are offered as selected extracts and direct quotes of cogent points according to the main research questions. The findings are divided into six sections. The first section describes teachers' perceptions of their practice and uses of different software applications in the classroom. The second section outlines how teachers perceive their practice has changed as a result of computer use. The third section examines teachers' beliefs about learning, and the fourth section considers their beliefs about how computers support the teaching and learning process. The fifth and sixth section present a range of factors that teachers believe inhibit and/or enhance the use of computers in education. Finally, data are given on two distinct characteristics of 'perceived' proficient computer-using teachers.

6.1 PERCEPTIONS OF CLASSROOM PRACTICE

This section presents data pertaining to the research question: *What perceptions do 'perceived' proficient computer-using teachers have of how they use computers to support learning in their classroom?* The question is addressed in terms of the social nature of educational computing and the multitude of ways teachers make use of computers for learning. It describes teachers' perceptions on four main software applications used in the classroom: (a) word processing; (b) educational games; (c) interactive fiction; and, (d) electronic mail.

6.1.1 Social Nature of Computers

A common perception was that educational computing activities were highly social in nature. The participating teachers perceived that the use of computers in their classrooms generated much discussion, talk and social interaction among students. The computer was a centre of attention for cooperation and collaboration regardless of the teaching level. Teachers in the

lower school used a range of software applications on a regular basis to support the development and direct teaching of social skills. In the middle school teachers made extensive use of software such as interaction fiction to deliberately promote shared decision making and the exchange of ideas between students. Teachers in the upper school favoured more independent activities, but always in a social setting where the computer was used as a 'tool' by both individuals and groups of students working on a common theme. The following description epitomises the social dimension of the computer in the participating teachers' classrooms:

> *"Yeah always together, as much as anything it's learning how to share, taking turns and interacting talking about what's happening. It's very rarely that there's just one child on the computer."*

The social interaction 'at' and 'in relation to' the computer was characterised by a high level of enthusiasm and excitement shown by students. The participating teachers considered that there was much enjoyment associated with computer activities in the classroom. It was a novel experience. Computers were seen to be 'fun' and something that enriched the classroom programme as a whole. It was not just the students who enjoyed the computer. This was how one teacher described the experience:

> *"We have a very fun filled classroom. If I enjoy teaching then the children also usually enjoy what they're doing and it's very satisfying all round."*

The teacher perceived that students gained a great deal of satisfaction from helping each other and showing the rest of the class what they could do with the computer. The level of cooperation among students and the celebration of their learning achievements were particularly rewarding for the teacher. Not everyone involved in the study enjoyed the experience to the same degree, but there was unanimous agreement that students thrived on computer-related activities. Some teachers found the enthusiasm of students for the computer a challenge:

> *"I hate them, I hate the buggers, (...) They're like Murphies Law when you want something to hum along something will go wrong. But I know the kids love them and I got to incorporate them into my programme."*

The demand to use the computer in the classroom meant that some teachers perceived they were only one step ahead of the class, and often had to rely upon the knowledge of the students. This learning from each other was attributed to the greater social interaction generated by computers. The main reason given, however, for the level of social interaction

'at' the computer was that it was a limited resource and the equipment had to shared by the whole class. The sharing of equipment between students was perceived to be a particularly desirable outcome. This was how one teacher described the collaboration and interaction that occurs around a computer:

> *"Taking turns, solving problems (...) and having fun with other people. I mean that's important the kids have their own friends, but sometimes they work with someone who isn't a normal friend and that's real nice. Actually I think they learn a lot from each and that's really important."*

The learning of social skills and the knowledge that students gained from one another was perceived by the participating teachers to be the most obvious feature of classroom computer use. There were few other common perceptions as the practice of 'perceived' proficient computer-using teachers were characterised by a diversity of software applications being used in a range of different ways in the classroom.

6.1.2 Word Processing

The word processor was the most common software application used by the participating teachers. It was used at each level of the school and perceived to have the most versatility of any application within the classroom. The majority of teachers considered that word processing was the 'bread and butter' of educational computing. As one teacher stated:

> *"I guess I'm sold on word processing and I think that's where the computer for me is at in the classroom (...) Word processing is the most important thing I think that a computer can do in a classroom."*

In justifying a similar view another teacher described how the word processor provided a structured way for students to manipulate language and take risks that was not otherwise possible through conventional methods of writing. Although word processing dominated teaching practice, there was no one way teachers used the word processor in the classroom. The limited access to the computer meant that for some teachers word processing was not feasible in terms of the accepted process writing approach. The students did not get sufficient time to directly write on the computer to edit, conference and revise their work through the stages of writing. As one teacher complained:

> *"I don't actually use the word processor as a process writing thing. Not as one person on and writing. I initially started like that and went through the stack phase and all that sort of stuff but I actually found that quite crappy".*

This teacher now used the word processor for collaborative writing activities where groups of three or four students wrote directly onto the computer over several days or even weeks. There was considerable support for the claim that it was not feasible to integrate the computer into the traditional writing process. As far as one teacher was concerned access to a single computer made the process contrived and of little educational value. Students simply used the machine for the presentation of their work.

> *"For me with just the one computer there are better uses than just word processing (...) It's the time factor. If I had three or four computers it would be just brilliant . But I mean we just don't have the facility."*

One teacher suggested that we might be expecting too much from students in that they do not always write enough to use the advanced 'cut and paste' features of a word processor. This teacher experimented with numerous attempts to utilise the computer as part of the language programme and concluded that:

> *"I guess word processing to me has not simply now or isn't anything simply to do with writing time in the classroom. Anything across the curriculum can be word processed. Therefore no longer am I faced with the agony of the huge long list of names on the blackboard at language time, but there are opportunities all through the day. Some kids might have six or seven pieces of work going at once across the curriculum."*

Using the computer in this way helped to overcome problems of access and made the experience more meaningful for students. The teacher considered that the computer was no longer an adjunct to the curriculum. The use of graphics packages in combination with the word processor was common practice in a range of curriculum areas. This practice attracted strong criticism from one teacher in particular, who claimed that students do not have the same pride in their work and often have to settle for inappropriate graphics. This criticism was indicative of the lack of consensus among participating teachers about the use of the word processor in the classroom.

6.1.3 Educational Games

The 'perceived' proficient computer-using teachers had varying perceptions about the use of educational games. The teachers were often guarded in their comments about this type of software and it was difficult to establish a common definition. Despite these problems many teachers admitted they allowed students to play games on the computer out of school time. A

few teachers, mainly in the lower school, used games as part of the teaching programme. The games were predominantly used for gaining familiarity with the computer and teaching of social skills. One teacher described how games were used in the classroom as a type of reward:

> *"We do have some games and on a Friday afternoon the group that does best with points from 2 to 3 o'clock they choose to do what they want. It's a reward for children who have performed well during the week."*

Not all of the teachers were comfortable about the use of games for such purposes. The dilemma that many teachers perceived about using educational games in the classroom was demonstrated by the following comment:

> *"Games, yeah I restrict my kids with the games side. I look at the reaction of the kids in the other rooms and I think am I being cruel. Should I let them go. But then I don't. I stick to my ..."*

The majority of teachers did not perceive educational games as having high priority in the classroom. That is not to say that the teachers were not using games in the classroom. The use of educational games was, nonetheless, criticised by one teacher in particular. This teacher argued that most students:

> *"... like to create and they'd rather sit down and turn over flash cards or make triangla things or something rather than static push buttons. Sure it's got music and stuff but they soon see through that. Probably with younger kids there's a place for it but I wouldn't use it in the classroom."*

The use of games was obviously popular among students in the participants' classrooms, but the perceptions of the teachers about this software remain somewhat obscure.

6.1.4 Interactive Fiction

In a similar way to educational games and word processing the use of interactive fiction in the classroom evoked contrasting perceptions. For some teachers interactive fiction was the most dynamic and exciting application of the computer in schools. It was the students favourite computer activity outside of games. The use of interactive fiction involved much planning on the part of the teacher and an intensive amount of time on the computer. Typically, teachers used an interactive fiction package only once per school term. Despite the

time required for students to successfully complete an interactive fiction package within the regular school programme, the experience was claimed to be really worth the effort:

> *"The amount of work kids will produce during interactive fiction is I mean probably double from what they would do normally. And not just because of the computer, but I think it's a motivation within it ... -but it tends to be you get into and find the extra resources to go with it (...) I mean Interactive Fiction would probably be the most enhancing thing I've done with my programme for years."*

It was significant that interactive fiction motivated this teacher to put more time and effort into preparation and planning in the classroom. Whether the learning experience was successful because of the software alone or the additional effort of the teacher is of course problematic to determine. Although interaction fiction was popular among the majority of the participants, several teachers were quite circumspect about its educational value. It was not linked to real experiences and was more of a novelty than anything else. As one teacher asserted:

> *"The kids still enjoy it but I think in lots of cases it's sort of window dress. Well that's not window dressing but it's ... you can go over board with it. If you did it all the time the kids would just get bored with it (...) It's not my priority of using computers. I'd rather see it used as a proper tool (...) you can basically only use it once which is a bit of a waste of money."*

This teacher perceived that interactive fiction did not empower students in the same way as when the computer was used as a tool. The computer as a 'tool' was more related to the real world and much less of a gimmick. Again, the use of educational software in the classroom was characterised by the lack of accord among the participants.

6.1.5 Electronic Mail

A few teachers were experimenting with using electronic mail in the classroom. A class of students were exchanging local legends with a school in England and integrating the experience into their process writing. The teacher regarded this as an authentic use of the computer in a way that was going to prepare students for the future. Other teachers were not totally convinced about the educational value of such experiences. According to one teacher it involved much effort and was highly over rated:

> *"Well I don't know, I mean I didn't see the need of it someone would write us a story and we'd read it as a class and we'd write a story and send it to*

them. What difference is it for my kids writing a letter and sending it to someone over there than sending it to the principal? I mean that's more of a buzz for them."

There were obvious problems using electronic mail in the classroom and this teacher's perception of the technology was not unique. Another teacher had experienced considerable technical problems getting electronic mail to work in the classroom. The teacher stated:

"It really hasn't been that successful. There's lots of people problems in it as well as lots of technical problems. I guess I can't see a lot of benefits at the moment. I honestly can't see a lot at this stage unless there's a lot more skilled people. I guess because it's new there seems to be so many things that go wrong with it and you just don't get replies -- it can be a real problem."

Although these comments came from a small sample of teachers using this medium, the contrasting perceptions were again obvious.

6.1.6 Summary

In sum, the practices and perceptions of 'perceived' proficient computer-using teachers were wide ranging and diverse. The computer was used by the participating teachers in a multitude of ways to support different types of learning opportunities in the classroom. There were few universal perceptions of teaching practice and there was no one way that the computer was being used in the classroom. The multi-faceted nature of classroom computer use was captured in the following observation:

"Whatever comes of using a computer it can't be generalised because it depends on whose operating it. So for some I would say yes database work has just made this child into a real person, for the reluctant writer sort of person I mean word processing and a graphic supporting package has to be the most wonderful thing that has hit them. For some the computer has been there saving grace in a social sense by asking them to work on one computer as part of a group has taught them to be more tolerant cooperative. It really depends I think on what your hopes and aspirations are."

6.2 PERCEPTIONS OF CHANGES TO PRACTICE

This section presents data pertaining to the research question: *What changes to their practice do 'perceived' proficient computer-using teachers report as a result of using computers in the classroom?* Data are presented in terms of teachers who perceived a number of changes to their method of teaching and those who considered that there had been few or no changes to their teaching practice.

6.2.1 Changes to Practice

There were few teachers who considered that their teaching practice had changed as a result of computer use. The common perception was that there were changes to the way teachers integrated the computer into the classroom programme, but not fundamental changes towards their way of teaching. The teachers acknowledged that after an initial settling down period the main changes were really only refinements to how the computer fitted within the regular programme. A frequent comment by teachers was that they were now less inclined to help students with their computer-related problems:

> *"I've stopped getting up and helping them. I would edit with them on the computer and I use to be very conscious of the fact that it had to be correct all the time. Whereas now I don't touch it and if it's not correct that doesn't matter it's more important they're using it. And it's more important that they're solving their problems on it. And that they're not afraid to have a go on it. My attitude now is if they've deleted something they've leant something."*

The attitude of letting students learn from their mistakes was quite common among the participating teachers. It was one of the reasons put forward for using interactive fiction in the classroom. Interactive fiction was perhaps the one software application that challenged some teachers existing preconceptions of teaching. As one teacher confessed:

> *"I suppose in a way it has. I mean interactive fiction is like sort of learning centre based isn't it. I sort of dabbled with it but I didn't do it often. But because of the computer I suppose I do it now far more often. I can't say I do it that often I mean I suppose I might only do three or four Interactive Fiction units a year. But I mean that's a hell of a lot more than I use to do."*

The introduction of interactive fiction into this teacher's programme offers evidence that the computer has resulted in some modifications, if not a dramatic change, to their overall

teaching approach. For another teacher interactive fiction was an important software application that helped to amplify the 'good' features of their existing practice.

> *"These integrated units were a bit of an eye opener. Yeah. Especially from the kids' reaction. I try not to run a well I never run a chalk and talk with my kids. It's always been activity based -- I thought. But this integrated unit was more activity based and it was more positive to the kids. The kids were throwing it back at me and I had to think gee do I do enough of this. Yeah so it has changed my style. I guess it's brought out more of the social things. The social interaction with kids and that they can work in their groups more effectively. I've always valued those sort of things."*

This teacher acknowledged that the computer experience as a whole was an important catalyst for returning to academic study and that this work has had a major impact on other areas of teaching practice.

> *"It was only through the computers that I got back into study and that's carried on now with admin papers and things like that. And that came about only through the computers."*

In this instance the computer acted as a stimulus for deeper reflection on the teaching and learning process. Clearly, the computer challenged the teacher to obtain a better understanding of the technology's role in education. It remains problematic whether the machine itself was responsible for any fundamental changes to teaching practice. After thoughtful consideration of this question another teacher stated:

> *"I've changed in my way of using computers, but I don't know whether I've changed my teaching because of the use of computers. That's the question round isn't it. Yes but I've changed my way of using the computer. No I don't know whether that's influenced or changed my teaching in anyway."*

The perceptions of the participating teachers were characterised by the lack of reported changes to their teaching practice. It may have been that teachers automatised changes to their teaching in an intuitive way such that they were unable to articulate how the computer had changed their overall approach.

6.2.2 No Changes to Practice

The majority of teachers were adamant that their approach to teaching had not changed as a result of using computers in the classroom. Teachers perceived that the computer simply

complemented their existing orientation towards teaching. If the computer was removed from the classroom programme then nothing would really change.

> *"I think I'd teach the same way with or without a computer. It's just my way."*
>
> *"No because I haven't really taught in a situation where I haven't used a sort of child-centred approach. To me that's the only way to teach. I wouldn't want to teach any other way."*
>
> *"I mean this school is really big on social skills. And we group heaps and they work in groups of three to solve problems. And so I mean it's happening all the time this interaction it's not just on the computer. I'm very comfortable with this sort of approach and I wouldn't change anything really if I didn't have a computer in the classroom."*

There was a strong indication from these comments that the teachers assimilated the features of the computer into their existing practice. The melding of the computer with existing ways of teaching was especially the case when teachers already placed an emphasis on social development in the classroom.

> *"Well I started my teaching in the juniors where we always emphasised social development. With the different changing curriculum it has probably evolved over-time because we're committed to a child centred approach here at this school and to do that the kids have to control their own learning (...) the introduction of the computer is basically the way that I've taught in the classroom anyway."*

The limited impact of the computer on orientations towards teaching was explained by some teachers in that the computer was just a tool and hence no different from other things in the classroom. The perception was that the computer had no impact on practice as it merely supported teaching like the overhead projector and other modern teaching aids.

> *"I don't think so. I just think it's another tool we use. I just use it as another tool and we're always looking for something else to use. It's just another tool to use."*
>
> *"No not at all. It's just another device that I use as part of my overall classroom programme. It's really no different from other things I do. I use it as another learning centre."*

The perception that the computer was just another activity in the classroom was common among the participants. It was a common point of view that the teacher was important in the classroom not the computer.

6.2.3 Summary

In sum, it was notable that few of the participating teachers reported substantive changes to their practice. There remains the possibility that teachers were not aware of such changes or had false perceptions of how they used the computer in the classroom. The introduction of computers in the classroom made extra demands on teacher's time and changed the nature of their work. The beliefs underpinning this work did not appear to change. The computer was an important dimension of change, but not the sole source for a fundamental reconsideration of the teaching and learning process. As one teacher summarised the role of the computer:

> *" I think a classroom can function without a computer, perfectly well, but I think having a computer is an added advantage and it's something that makes it lively and exciting."*

6.3 BELIEFS ABOUT LEARNING

This section presents data pertaining to the research question: *What beliefs do 'perceived' proficient computer-using teachers have about the teaching and learning process?* The beliefs about teaching and learning are described under six different orientations towards practice: (a) intuitive teacher; (b) fun loving teacher; (c) innovative teacher; (d) potentiality teacher; (e) student centred teacher; and, (f) theoretical teacher. These orientations are used for descriptive purposes and are not intended to categorise teachers as being exclusively one type or another.

6.3.1 Intuitive Teacher

A few teachers expressed intuitive beliefs about the teaching and learning process. These beliefs were often based on 'common sense' knowledge and a 'down-to-earth' approach towards teaching.

> *"I sort of liken it you know to learning a bike. That you know you take the hand away from the seat the minute you think that the child has learnt what balance is -- and if they fall over that's fine. Because they fell over when they learnt to walk and they're still alive. And it's the same with computers you can't use them as a rote teacher (...) So you go in boots and all (...) and so I*

guess the natural nosiness, inquisitiveness of children needs to be ignited straight away so that they will quickly get the idea this is fun."

The emphasis was placed on the natural process of learning and teaching being largely ar extension of the parent's role.

6.3.2 Fun Loving Teacher

The inherent nature of learning was supported by the fun loving teacher. For this teacher learning was about always having fun. Activities should be enjoyable and students should want to learn.

"I always believe that education should be fun. Because if it's not fun if learning isn't fun and stimulating the kids don't want to do it. I mean you have to compete with the TV and all that now and I've always wanted to be fun (...) So my philosophy is that you know let them enjoy it and if they're not enjoying it then there's something wrong."

The emphasis was on capturing the natural inquisitiveness of students and promoting spontaneous behaviour in the classroom.

6.3.3 Innovative Teacher

The innovative teacher believed that learning was about change. These teachers thrived or change and were open to new and innovative approaches that helped prepare students for the future.

"I just accept change (...) if it's going to change it's going to change. You've just got to go on with the flow. The kids have to learn that change is a constant and we have a role to play here."

"I think there's constant change all of the time. I mean with everything we're constantly changing everything aren't we (...) I think we're conditioned to change. Just accept change as the norm now."

The emphasis was on accepting change as enviable and encouraging students to meet the challenge of constant change.

6.3.4 Potentiality Teacher

Some teachers were more concerned about helping individual students achieve their learning potential. Teaching was about offering quality learning experiences that would maximise the unique potential of individual students.

> *"To me quality learning it's not a phrase it's bringing out the potential that the child has and that will involve not only working with the child but with the whanau the parents as well. So that they understand what we're doing together (...) So quality to me is in terms of bringing the children to reach the potential of their abilities."*

The emphasis was on developing the strengths of the individual and meeting the student's needs whatever their background or culture.

6.3.5 Student Centred Teacher

The interests of the students were very much the concern of the student-centred teacher. Many of the 'perceived' proficient computer-using teachers were guided by the need for students to discover things for themselves and take responsibility for their own learning.

> *"I want them to take responsibility for their own work. I don't want to overly direct their learning because that's self-defeating. (...) I want them to learn and like learning (...) so that means they have to be given the freedom to learn by themselves. And yes also off each other. I think that's really important. You see them discussing their ideas and often they learn to compromise or sometimes they pick up new ideas from other children."*

The emphasis was on giving control to students and helping them to become independent thinkers and learners.

6.3.6 Theoretical Teacher

There were very few teachers who expressed their beliefs within an explicit theoretical framework. These teachers were all involved in further study and used their knowledge of educational theories to describe their beliefs.

> *"I definitely adopt a cognitive approach. I'm not behaviourist or humanist at all. What I do fits in, I read that in my study and say that's what I do that's*

what I do (...) and then I read behaviourism and I think yuk I'd never try that oh no no I'd never do that. Yes I'm definitely a cognitive teacher."

The same teacher then outlined what it meant to be a cognitive teacher in terms of modelling good learning in the classroom.

"I think being a model learner is an important part of being a good learner. So that's why I do it. I mean there's things that we don't tell kids and expect them to just pick it up. I think we can help kids a lot if we show them how we learn things (...) and that mistakes are just as important as getting it right. Learning isn't always about getting things right."

The emphasis for this teacher was on extending students thinking processes and modelling strategies for better learning. It was notable that these teachers were articulate about their beliefs and quite specific in describing their approach towards the teaching and learning process.

6.3.7 Summary

The different orientations towards teaching and learning were not mutually exclusive. The predominant orientation was the learner-centred teacher who was committed to a philosophy of creating a classroom for learning where students were at the centre of the teaching and learning process. This view was expressed through the metaphor of the teacher being a facilitator of learning and was the most common feature of the participants' beliefs.

"My role is as a facilitator -- definitely. I give the children the information they need and they have to process it and come out with the final product. I have high expectations but ultimately it's up to the children to learn. I can't make them learn."

6.4 BELIEFS ABOUT COMPUTERS AND LEARNING

This section presents data pertaining to the research question: *What beliefs do 'perceived' proficient computer-using teachers have about how computers support the teaching and learning process?* The question is addressed within four main domains of learning: (a) motivation; (b) social development; (c) affective development; and, (d) cognitive development. A number of teachers also commented on the way computers support students future development.

6.4.1 Motivation

A few teachers believed the attraction of students to the technology and its motivational value was the most important contribution that the computer made towards learning. This was how one teacher described the motivational benefits of the computer:

> *"The kids are just so motivated to use them [the computer] in the classroom. It gives them so much control every time someone passes the classroom they look in and see what they're doing and it's just so neat to see the kids getting on so well and to have something that gets them so keen and they want to do -- they're really in control and they love it."*

There was no indication among the participating teachers that the appeal of the computer was wearing off within their classrooms. There was always new software and never enough time or equipment for everyone to get access to the computer.

6.4.2 Social Development

The opportunity for social development was the main way that computers supported learning as far as most teachers were concerned. The computer was described as a social activity centre where students were required to work together and help one another with their problems.

> *"I think the social outcomes are just as important as the academic learning outcomes that we've had. I think for me the social skills is important because I always work them with a partner there's a lot of social skills and collaboration going on."*

The social benefits of the computer were perceived across all teaching levels and for some teachers even had a positive impact on gender interactions within the classroom. For example, according to one teacher as a result of interaction fiction activities the boys now valued the contribution of girls during collaborative group work. The boys recognised that the girls preferred to work in a group situation and the boys themselves were now functioning more effectively during such activities. There were particular advantages perceived in using the computer for students with special needs. The computer provided an opportunity for students to interact with others in a more natural way. The computer allowed special needs students to express themselves in ways that were otherwise impossible.

6.4.3 Affective Development

The other important dimension of using computers in the classroom that teachers identified was affective development. Teachers believed that the computer had resulted in a change in the way some students perceived themselves within the classroom. The 'buzz' of using the computer and producing word processed work of a professional appearance led to perceived gains in confidence and enhanced self-perceptions.

> *"There's the individuals own personal growth as they gain mastery over the computer. There's the fact that they're possibly achieving when they haven't been achieving before. That has a positive effect on the way they see themselves in terms of attribution theory."*

The participating teachers described how reluctant learners were not penalised for making mistakes when using the word processor. This feature of the computer improved their attitude to learning and empowered them to invest greater effort in these activities. The additional effort often resulted in work that the students (and the teacher) did not consider they were previously capable of publishing.

6.4.4 Cognitive Development

There were few specific cognitive benefits identified from the using computers in the classroom. Two teachers were notable for their reference to the way computers support metacognitive development. The computer was believed, by these teachers, to create opportunities for students to discuss different ways of thinking and learning in the classroom.

> *"I think developing thinking skills and problem solving is the most important because that's important in any schooling. To be able to think metacognitively they have to have someone or something to help them develop those skills and I think computers do have a big role to play there (...) especially with the sharing of ideas and things like databases which extend their thinking into the abstract."*

The concept of metacognition was relatively new to both of these teachers. The emphasis on thinking processes in the classroom were the result of recent study. It shows how for these teachers formalised theory was having an impact on their understanding of computers within the teaching and learning process. Whilst some participants referred to the attention now

being given to thinking and problem solving skills in recent curricula, these teachers were unable to articulate how computers supported such skills in the classroom.

6.4.5 Future Development

A cluster of teachers maintained that the computers real contribution to learning was in preparing students for the future. The computer in the classroom helped to overcome fears about the technology which would in the future enhance the learning and employment opportunities of students.

> *"It's the thing [the computer] that the kids are going to find when they get out in the work force. Really they're going to have a lot of contact with modern technology. Fair enough it won't be the same as they're using now but it's building up their understanding and they're seeing that it's not something to be scared of."*

The emphasis on using computers for the future was influenced by the perception that many parents were concerned their children gain such experience. There was an obligation perceived by some teachers to justify the money spent on computers in their school and the acquisition of skills for the future was one rationale supported by parents.

6.4.6 Summary

The 'perceived' proficient computer-using teachers were unanimous that computers supported social development in the classroom. Teachers were less able to convey how computers supported the cognitive development of students. The belief that computers facilitate social interaction was such that several teachers were concerned more hardware was not necessarily desirable. The perception was that additional computers would restrict the cooperation between students over what was still a limited resource.

> *"With one or two between 30 they can see a lot of value in sharing and cooperating so if they want a turn that's what they have to do (...) Whereas if they had one each they probably wouldn't have the same feelings toward it and sharing with each other."*

6.5 FACTORS THAT INHIBIT COMPUTER USE

This section presents data pertaining to the research question: *What factors do 'perceived' proficient computer-using teachers believe inhibit the use of computers in their classroom?* Data are presented on five main factors that inhibit computers in school: (a) physical

constraints; (b) insufficient hardware; (c) classroom management; (d) demands on the teacher and, (e) attitudes of the teacher.

6.5.1 Physical Constraints

An important inhibitor of using computers for learning purposes was the physical constraints of the classroom. Many teachers believed that the classroom was not adequately designed to cope with the requirements of the computer.

> *"Finding a place a physical place for it in the classroom although we have less and less chalk now. But it's finding a place where it can be set up where it's not going to be bumped off. It's actually quite a problem when you have 30 kids in a small room and the screen isn't going to be distracting (...) it's the little technical things which can be most irritating the noise of the printer."*

The lack of power points in classrooms and the need to locate the computer away from water basins and areas of sunlight were other frequent concerns. Variables were such that few teachers were satisfied with the location of the computer in their classroom.

6.5.2 Insufficient Hardware

The lack of sufficient hardware was a recurring theme among the participating teachers. There were limited opportunities for students to use the software effectively with just one computer in the classroom. The root of the problem for most teachers was one of inadequate funding.

> *"It all relates back to funding really because if we had more computers in the classroom then I could see we could go into more things. It's quite time consuming with the word processing and stuff it does tie the computer up. But it does sort of go back to the funding."*

Teachers were having to make do with their existing equipment which often involved sharing printers and software between classrooms. The resulting inconvenience was a disincentive to use the computer, and limited access to hardware and software was believed to severely limit the range of possible activities feasible in schools. A related problem was the difficulty teachers experienced in keeping up-to-date with new developments. Hardware was constantly changing. The purchase of more up-to-date hardware was not necessarily seen as the solution to the problem of using computers in the classroom.

"I actually feel and I might sound old fashion that we're buying a Jaguar when we only need a Mini. Ok. Because at this level of the school the Apple 2e's were ideal for everything I was doing. (...) I just sometimes wonder whether we're over powered and we're not using the full power of what we've got."

The key issue for most teachers was the number of computers in the classroom as opposed to having the latest 'bells and whistle' machine. There were, however, some teachers beginning to experience increasing technical problems with their aged and overused hardware. A common problem was obtaining reliable advice about what to do with this equipment and trying to understand the various promotional deals being offered to schools on new technology.

6.5.3 Classroom Management

The management of hardware and software was a challenge for many teachers. There were problems at both the school and classroom level. At the school level the teacher responsible for computers was often in a thankless job. Teachers described the time spent maintaining the equipment, keeping track of software and helping other teachers with their problems. The participants believed that few of their colleagues appreciated just what was involved in this role. This is how one teacher expressed frustration at the lack of appreciation for the effort involved in publishing a school newspaper:

"I swore for the first time in my life. I swore and I swore at the staff because I took the newspaper in and someone complained about something. I was just so full of this newspaper. I was just so upset."

At the classroom level teachers believed there were difficulties managing the equipment and allocating time on the computer to students on an equitable basis. Some students required more time than others as they had less knowledge of the keyboard and confidence at the computer. In particular, some teachers were concerned that girls were not getting the same opportunities as boys.

"The boys are definitely keen. The girls love writing stories but they aren't as overly keen to get on. I mean they're not interested at play-time or lunch-time. They're happy enough during class-time but they don't push like the boys do to get on before school."

The domination of the computer by some students was not always gender specific. For example, in one classroom the teacher trained a group of both boys and girls to help other students with their computer-related problems. The teacher now complained that these students were not always sharing the information about the computer.

> *"Those four that I trained which were two boys and two girls seem to have the sort of control (...) They probably do hold on to the knowledge a bit so that they can be called upon and be useful. I told them that they had to teach them but I think they often go and say here this is how you do it. (...) But that's not only the boys it's the girls that have got trained to."*

The students were in a privileged position and held onto the knowledge to maintain their special status in the classroom. This situation required adept management strategies on the part of the teacher. The lack of supporting management systems and official recognition for using educational software in schools was believed by teachers to be a key inhibitor in the successful use of computers.

6.5.4 Demands on the Teacher

The major inhibiting factor for the participating teachers was the demand that the computer placed on their time. Computers required a large commitment of teachers' time and energy. The most successful experiences of teachers were the results of hours of planning and preparation and usually relied upon extensive teacher and parental support. For example, in planning a two week unit incorporating an interaction fiction package the teacher spent two weeks of the holiday break previewing the software and preparing the related activities. The implementation of these activities required the help of several parents and the unit as a whole was supported throughout by a teacher's aid. Integrating the computer into the programme like this was perceived to be a huge undertaking and difficult to sustain on a regular basis. As one teacher stated:

> *"I like to know the software well enough so that I can direct kids. It's no good just poking it out. And it's no good just reading the book. I've got one at the moment that's five disks and I'm still trying to find the short cuts myself -- its horrendous. It's just a matter of finding the time (...) People just need time to play with the thing. I mean part of the success is being able to sit down and being able to know the programs well."*

The teacher's knowledge of the software was believed to be crucial to the success of an interactive fiction unit. There was no easy way for teachers to acquire knowledge about the

software packages apart from time at the keyboard. The 'perceived' proficient computer-using teachers agreed that interactive fiction was the most demanding of all the software applications.

> *"Its time consuming. If you get a new interactive fiction or something like that you can't just plug it in and say to the kids here go. I always go through it myself first and I feel guilty because I enjoy it so much. But you have to because you have to know what it's doing you have to know what it's teaching and what your curriculum areas are and all that sort of stuff. So you have to do it but teachers who aren't as enthusiastic as me see it as more of their time."*

This teacher enjoyed using interactive fiction in the classroom, but not all the participants were as enthusiastic about the time required to prepare such activities. The following comment demonstrates the way that many teachers perceived the task:

> *"I haven't got the technical skills or true interest, know how or knowledge (...) I haven't got enough time to sit down and ideally I should go through everything but I don't. If it's a lame excuse, it's a lame excuse, but I just haven't got enough time or my true interest in computers is not high enough to sit down and go through it."*

The success of using computers for learning was not only time, but also a high level of commitment. The teachers believed that this commitment was substantial and required the acquisition of technical and pedagogical expertise.

> *"And it does require commitment. It requires a commitment of time initially for you to become confident, competent and positive. It requires an on-going commitment of time and it also requires you to be prepared to be organised."*

Few teachers considered they were prepared to give the type of commitment to the computer area that it really required. There were still other priorities within the classroom. This is how one teacher described the competing activities within the classroom:

> *"It's just that we're we're too busy. At the moment we have a major production on and we have rehearsals and next week we might have a sports visit (...) I think that it may be old fashion but I think that it interferes a little bit with the three Rs."*

What this comment shows is that schools are busy places with a range of activities going on at any one time in the classroom. The combination of the time required for computers and the on-going commitment to the technology were significant factors why the participants believed teachers were not fully utilising educational software in schools.

6.5.5 Teachers' Attitudes

The attitudes of teachers were also identified by some participants as an important reason in inhibiting the adoption of computers in schools. Computers were an extra and something that took time off the core subjects within the curriculum. This attitude was common according to the participants among more experienced teachers. One teacher described the resistance to using computers in schools:

> *We did have staff resistance. Older ones who had never been involved with computers who in all honestly were actually afraid of computers. And it's been a bit of an up hill battle to get them to accept that this is part of the well materials they've got to use in their teaching process."*

The fears of using the technology and the traditional beliefs of teachers were considered to be a major hurdle in the more widespread and effective use of computers in the classroom.

6.5.6 Summary

The dominant belief among the sample of teachers was that proficient practice with computers could only be achieved through the dedication, motivation and perseverance of the teacher. It was not simply a matter of time and commitment, but also a state of mind where teachers needed to be prepared to try out new things and reshape the nature of the curriculum.

> *"I don't know. I just think you can lead a horse to water but you can't make it drink. But that doesn't help what the stumbling block is. I suppose any teachers, but primary school teachers in particular because we're jack of all trades, it becomes probably in our minds. We may think that it's teaching them the three Rs. The reading the language (...) And this might look like the icing on the cake to use the computer. And it's the modern thing that a lot of people are doing and so let's have one when in actual fact in terms of my desire to learn to use it in terms of time it's fairly low down the scale. That's what I think ."*

6.6 FACTORS THAT ENHANCE COMPUTER USE

This section presents data pertaining to the research question: *What factors do 'perceived' proficient computer-using teachers believe enhance the use of computers in their classroom?* The question is addressed with data on six main factors: (a) skills of the teacher; (b) effective use of the hardware; (c) management strategies in the classroom; (d) school wide support; (e) knowledge networks; and, (f) teacher education.

6.6.1 Skills of the Teacher

The skills of the teacher were identified as a basic factor that enhanced the use of computers in schools. A skilful teacher was believed to be someone who knew how to operate the equipment and had a sound knowledge of educational software. It was important for teachers to become competent themselves in using the computer. The 'perceived' proficient computer-using teachers gave plenty of advice:

> *"Have time with the computer. Don't put the computer in the room and think that's going to run itself. You have to take the computer home for a holiday. You have to take it home at night and play with it or for a weekend or something like that. And have fun with it and enjoy it. That's the only way to find out about a computer."*

The key message was that teachers had to learn for themselves first before they could see the potential of the computer in the classroom. This did not mean that teachers had to become technical experts. Teachers just needed enough knowledge and confidence to learn from their mistakes. A major contributing factor to the enhancement of computer use was one or two teachers on the staff who were enthusiastic about the technology and were prepared to support their colleagues.

> *"I guess a balance of staff is a key thing. It's vital to have someone who is really stuck on computers -- it's a real crutch."*

It was pointed out that the enthusiasm of the teacher in charge of computers had to be matched by the genuine commitment of the whole school to using computers in the classroom. The commitment to integrate the technology into the school programme had to come from all the staff not just one or two isolated teachers.

6.6.2 Effective Use of the Hardware

The effective use of existing hardware was considered one way to enhance the success of computers in schools. It was suggested that teachers could make more use of existing equipment by borrowing machines from other classes within the school. The computers were not always being used by other teachers and this was one way to overcome the problems of limited access. As one teacher pointed out:

> *"I think sometimes more use of computers can be made by without realising. Like when someone is going to the library saying to the person next door hey I'm going to the library you can use my computer. Or we're going out to sports you can use my computer."*

A teacher at another school believed that the use of pocketbook computers was an effective way to maximise the existing stand alone machines. Access to six pocketbook computers meant that students were able to take these machines home and use the word processor with much greater flexibility. This school employed a property manager to look after the technical aspects of using the equipment in the school. The property manager performed the duties of a traditional caretaker and quasi-computer technician.

6.6.3 Management Strategies in the Classroom

The success of the computer was dependant upon well-defined management strategies in the classroom. It was believed to be crucial that teachers have a system to allocate computer time to students on an equitable basis. There was no one standardised system. The stack method was suggested as a sound approach, but many teachers perceived that the system for allocating time was really dependant upon the software and how it was being used at the time. The most elaborate method was the use a modified stack system with small groups of students. Each group negotiated among themselves for their time and order on the computer. The computer was carefully managed through an electronic timer where the groups were allocated 30 minutes on the machine each day. This system supported both interactive fiction and word processing and was designed to allow the same student to work on the computer over several days.

The use of students as computer consultants is believed to have merit. The participating teachers trained a handful of students to be experts who could help other students with their computer-related problems. This system helped to minimise the demand on the teacher's time and maximise the number of students using the computer. This was how one teacher described the system:

"They're my computer consultants. They've come to me -- we've had before and after school special learning times, and they're very proficient with it, they can do everything practically. If someone needs help they just get that person, but the thing is that they're called consultants because we talked about what consultants are in real life and that a consultant advises you and they give you the ideas but that you have to do it yourself. A consultant doesn't just do it for you."

It was believed that this method of using consultants could even be adopted across levels with students in the upper and middle school assisting those in the lower school. A system like this was considered by one teacher to be particularly effective in their own school.

"We scheduled the most competent children on a roster system in the five lower rooms. They only spent about an hour every day in the rooms but it was enough to get some of the smaller ones confident. We're still running the system of going down for an hour a day to help out where it's needed."

The aim was to put into place management systems that were feasible and on-going where both teachers and students knew the expectations and the procedures for using the computer in the classroom.

6.6.4 School-Wide Support

The support of the entire school was essential if computers were to be effectively used in the classroom. It was perceived that the BOT have an important role to play in developing a school policy on computer use. The value of this was not simply the policy, but the process of negotiating its contents. Few schools with teachers involved in the study had such a policy. Another important consideration was the placement of staff within the school. The placement of teachers with computer expertise had made an impact at one school:

"One is we've thought very hard and it wasn't the only consideration but it's one about the placement of our actual staff. We have placed a computer strong knowledgeable capable person at the year three area (...) And the difference it has been stunning."

The employment of new teachers was another area believed to assist with the greater integration of computers within a school. It was considered vital that all new staff have existing knowledge about computers or at the least a commitment to acquiring such knowledge.

6.6.5 Knowledge Networks

The existence of informal and formal knowledge networks were believed to have a positive affect on classroom computer use. For many teachers informal networks were perceived to be the best means of acquiring new knowledge and expertise. These networks allowed teachers to learn from each other and keep up-to-date with new developments.

> *"Those little things you find out from talking to other teachers, even the activities if you talk to them about what activity they used for a certain level. You find out which is better. So I think you need to talk to them to find out practical things which worked and why and why not."*

The contact between teachers was often irregular and some of the participants believed that more frequent and formal contract would help. The use of teacher release time for this purpose was given as a specific suggestion.

6.6.6 Teacher Education

The major factor that 'perceived' proficient computer-using teachers believed would enhance computer use in schools was teacher education. Teachers described how a range of professional development opportunities had contributed to their own understanding of using computers in education. The participation at an inservice course on computers had a significant impact on one teacher:

> *"Before I did that course I didn't even know how to start a computer up. I was not a computer whiz or anything like that (...) I've gone on from there because I've enjoyed it so much. But there needs to be more. Hands on, it has got to be hands on and it has to be successful for people."*

The successful experience of using a computer in the classroom was attributed by another teacher to the role of computer consultants and suppliers. The staff at one computer agency ran courses for the teachers in the school and offered invaluable advice and back up technical support.

> *"We've had excellent support from the suppliers of the computers. Both in helping to set up the programs and running courses, general back up even things like getting the computers cleaned free of charge (...) So we've had a fair amount of help from the supplier. We've had a number of courses run*

within the school for other teachers as well as ours and that's very valuable - a sharing of ideas with other teachers from other schools."

The Advanced Studies for Teachers Units at the College of Education were seen as another way of sharing ideas with other teachers. The courses on computers in education were considered excellent for teachers wanting to further their understanding about using educational software in the classroom. This was how one teacher described these courses:

"Brilliant, brilliant. I wouldn't have really, I mean up to that point I'd used the computer for games and a little bit of word processing (...) and that was it. But since I've done AST and that sort of thing you know it's the extension. Things like Logo that I absolutely hated (...) I can actually see some uses for now."

The computers in education course offered at Massey University was also believed to provide useful professional development for teachers. It was singled out for helping teachers to better understand their own theories for how and why they use computers in the classroom.

"I have found the Massey paper really interesting with the high technocentric emphasis because that's something that I haven't. Probably something you think about but not in that form. In that not to have the computer ruling the place. That is something I've found really helpful. It's given me the theory behind for what you sort of feel."

Teachers were not particularly discerning about the different types of professional development. Although, teachers suggested there was a need for a second tier of educational opportunities for those with existing expertise. The predominant belief was that teacher education was the key to more effective use of computers in schools.

6.6.7 Summary

There were a number of factors that the participating teachers identified as important in the successful use of computers in schools. The teachers believed that proficient practice with computers was the result of skilled teachers using well-developed management strategies in combination with the innovative use of the hardware. The key to enhancing these dimensions of proficient practice was the informal and formal education of teachers on how to use a range of software applications in the classroom. In the absence of a formal inservice

teacher development programme the opportunities for further study had fulfilled an important role.

> *"Doing further study has made a difference. Having to sit down and think a bit more in depth about why you did things the way you did. Having that extra knowledge I think has made me more confident especially with other teachers. I know I'm better than they are in many ways and I think if I didn't have the skills I've got from tertiary education the class would have lost out."*

6.7 ENTHUSIASTIC VERSUS FRUSTRATED TEACHERS

The 'perceived' proficient computer-using teachers were characterised by either their enthusiasm for computers or frustration at trying to integrate educational software in the classroom. The contrast between these two different outlooks was the most distinctive feature of the participating teachers. Enthusiastic teachers enjoyed using the software themselves and were passionate about the value of the computer in the classroom.

> *"I love it. It's a hobby doing things on the computer. I like it. I enjoy the computer so much that I'm happy for anyone to come in at anytime and say how do you do this (...) it's fun. We have lots of fun with the computer in my room."*

These teachers thrived on change in education and were always looking to improve their teaching practice. The need to keep up-to-date and try new things all the time was what the teachers enjoyed most about the job. In contrast, frustrated teachers were struggling to find the time to use the hardware and did not always enjoy using the computer in the classroom themselves.

> *"They're the most frustrating thing out computers. I keep telling staff that you wanta pull your hair out and just have to encourage yourself. I'm committed to doing my best for the kids and you have to give them all the possible range of experiences you can."*

These teachers recognised the benefits of using computers for learning purposes, but had become cynical or found the demands of integrating the hardware and software into the classroom programme a bit unrealistic. This group of teachers were often worn down by the negative attitude of other staff and some of them were beginning to question whether computers were worth all the effort. In discussing the problems and potentialities of using

educational software in the classroom one teacher made a poignant comment about the ultimate success of computers in schools:

> *"I guess it's like every other technical advance in education it's relegated to the realms of being a teaching aid and good teachers don't need lots of teaching aids. Or the guns use it all the time. Now that's not what it's about either the computer in the classroom isn't for the teacher it's for the pupils."*

6.8 SUMMARY

Data shows that 'perceived' proficient computer-using teachers found computers were highly social. The teachers were incorporating a range of software applications into the classroom programme. Word processing was the most common application, but there were a multitude of ways that computers were being used for this purpose, and varying perceptions about its educational value in the one computer classroom. The computer was not perceived to be a major agent of classroom change, in that few teachers reported transformations to their orientation towards teaching. The predominant orientation among the participating teachers was towards a learner-centred approach where the computer was believed to support social development in the classroom. A range of factors inhibits computer use in schools, especially demands on time, but teacher education was considered the most crucial element in leading to the successful use of educational software by teachers. There were two distinct types of teachers involved in the study; those enthusiastic about using computers in the classroom and another group frustrated at their attempts to integrate the technology into school.

The following chapter presents the results for the final case study phase of the research.

CHAPTER SEVEN

Results: Phase Three

"Meaning is radically plural, always open, (...) there is politics in every account" (Bruner, 1993, p.1).

7.0 INTRODUCTION

This chapter provides the results for the third phase of the research. It presents microethnographic case study data on the practices, perceptions and beliefs of two proficient computer-using teachers. The case studies offer a window into these teacher's classrooms and their proficient practice with computers. A range of both qualitative and quantitative data are described. Qualitative data are written as a narrative of the learning environment and the participating teachers' voice on different aspects of using computers in the classroom. Quantitative data reports background information on the experiences, competencies and perceptions of students' in using a range of educational software to support their learning.

7.1 CASE STUDY OF ANNE

The first part of the results describes a microethnographic case study of Anne and the students in her class. Anne was judged to be a proficient computer-using teacher who was highly enthusiastic about the use of computers for teaching and learning purposes. She was a Scale A teacher working in a small primary school and the person in charge of computers within this school. Anne could claim considerable personal experience and knowledge about the use of computers in education having completed several tertiary level courses in the area. The case study of Anne is divided into three main sections according to differing perspectives on classroom practice. The first section describes Anne's classroom from the researcher's own observations. The second section is devoted to Anne and her views about the role of computers within the classroom. The third section documents the perspective of students with information on their experiences, competencies and perceptions about using computers to enhance their learning. Finally, an interpretative summary is offered that brings together data and highlights the main features of the case study.

7.2 A WINDOW INTO ANNE'S CLASSROOM

This section presents data from the researcher's observations of Anne's learning environment, including information on the hardware and software used in the classroom and the general organisation of the curriculum.

7.2.1 Learning Environment

The physical arrangement of Anne's learning environment was characterised by its efficient utilisation of space (see Fig 7.1). The desks were positioned to maximise space and allow groups of students to work together. There were five groups within the class, each with a unique name and including a mixture of both boys and girls. There was a mat area at the front of the blackboard and this was used on a regular basis for class discussions. The teacher's table was to one side of the mat and this was where students conferenced with Anne during process writing. A special display area was located in the opposite corner of the classroom with books and materials relating to the current theme. At the rear of the classroom there was a sink unit and storage area as well as an old sofa that formed part of a reading centre. A computer and printer were located in the corner of the classroom close to one of only two power points. This equipment was blocked from the windows and nearby desks with a small screen, and the computer corner was lavishly decorated with displays of students' word processed work.

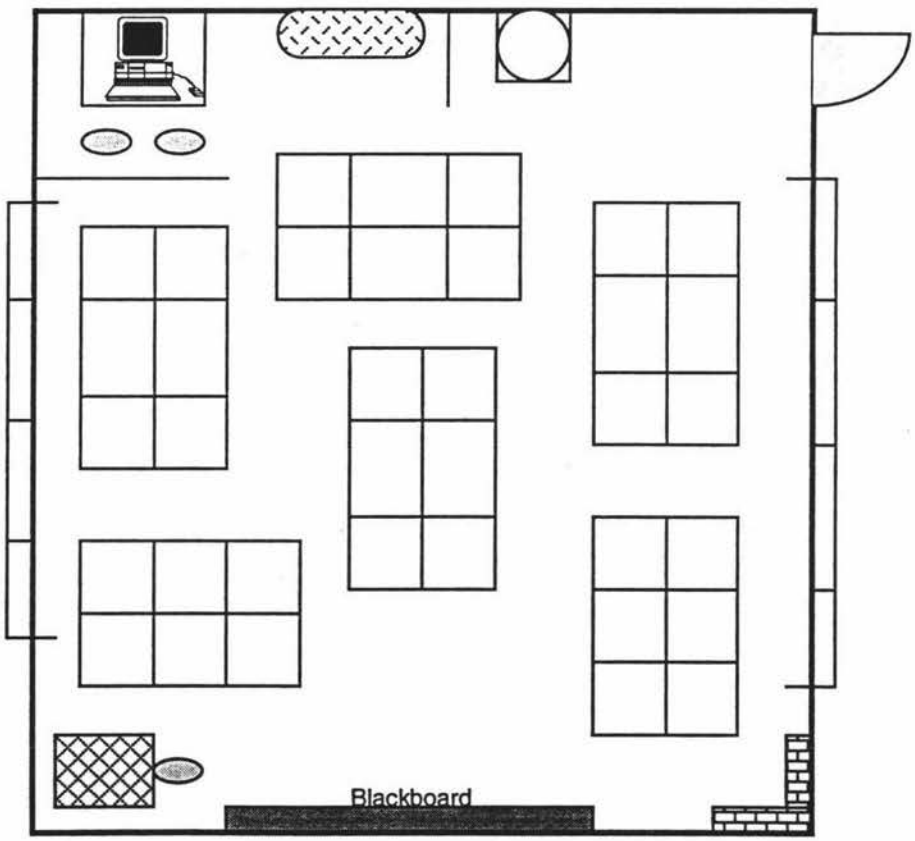

Figure 7.1
Layout Of Anne's Classroom

The entire classroom was extensively decorated on both the walls and ceiling with a range of student work samples. These samples of work gave the impression that this classroom was a lively and exciting learning environment.

7.2.2 Hardware and Software

The hardware consisted of a standard Macintosh Classic computer with a 40 megabyte hard drive connected to a panasonic dot matrix printer. The readily available software included, *Claris Works, Mac Draw, Hypercard, Storybook Weaver, Mathblaster, The Factory, The Bookstore* and *Kid Pix.* Other software located within the school and used during the year by the teacher included *Logo™, Sim City, Oregon Trail,* and *Where in the World is Carmen San Deigo.* There were individual folders on the computer named for each student in the class and a large storage box full of disks located beside the hardware. A floppy disk was inside this box for each class member. The procedure was for students to save and retrieve work from their own disk and make back up copies on the hard drive as required. Although the students were responsible for backing up their own work, Anne also did this for them at least once per term. For Anne, the individual disks provided a record of the students work over the year and minimised problems relating to the accidental loss of word processed material.

A chart divided into days of the week with veloce name tags for the different groups in the class displayed which group was allocated to the computer each day. The students in each group were responsible for deciding their own order for access to the computer. An egg timer was available near the computer to monitor time on the machine, but this was rarely used by the students. The breaks between activities within the classroom tended to act as a signal to students that their time was up on the computer. A small white board was on the wall beside the computer with messages and notes about specific problems on the computer. There was also a chart on the wall with a list of procedures and rules in relation to the computer including, 'be sensible', 'share with others', and 'seek help from the computer consultant'. A different student was the designated computer consultant for each week of the year. The consultant was responsible for helping other students with problems on the computer and maintaining the equipment. It was their responsibility to maintain a supply of paper in the printer and ensure that the computer was shut down at the end of each day. Anne did not allow students to play games on the computer before or after school.

7.2.3 Organisation of the Curriculum

The curriculum was organised to maximise opportunities for students to take responsibility for their own learning. Students were expected to set their own goals at the beginning of the week and report on their success at achieving their personal targets at the beginning of the following week. Anne allocated time once a week for teaching a social skills programme where students discussed different scenarios and the solutions to specific inter-personal conflicts. A feature of the classroom programme was the emphasis placed on social skills and

the range of group-based activities within a week. A typical day involved students in numerous group activities that encouraged much social interaction.

The day would normally start on the mat with a brief sharing time followed by a 10-15 minute fitness programme. Immediately after fitness, students completed 10 minutes of formal handwriting and then began language work. At the time of the study, language involved writing poems from observations of natural phenomena within the playground. Anne started writing her own poem at the beginning of the week and each day asked for comments from the students about this work. Throughout language one or two students worked on the computer using *Claris Works* as a word processor. The students were instructed at the beginning of the week to explore the shape of written text and to be innovative in the way they presented their final poem. A range of different media were introduced to students for this purpose including leaves, cloth and a variety of paper type material. The students working on the computer were using the hardware in a similar way to others in the class to rearrange words in a form that suited their poem.

The students began mathematics after the morning interval break. This involved some students departing to another classroom and others joining those within Anne's class. The students worked in groups with the teacher providing direct instruction to one or two groups each day. One group each day was allowed to 'play' a range of math games which always included the option of using *Math Blaster* or *The Factory*. At the time of the study the students were particularly keen on *The Factory* and took considerable delight in each other's ability to solve the various geometrical challenges within the software. Anne encouraged the students to design their own challenges and set these for other students to solve within the group. Maths usually finished just prior to the lunch break before which Anne would spend 10-15 minutes reading a story to the class. During this time, and throughout the lunch hour, students were allowed to complete written work using the word processor. It was typical for two or three students, often girls, to write stories on the computer over the lunch period.

After lunch the students spent 30 minutes on reading where one group would work with the teacher while other groups completed specific reading related activities. The computer was being used throughout this period by two students to complete a book or story review using a software package known as *The Bookstore*. *The Bookstore* enabled students to produce a professional looking review in response to answering a series of preset questions about the plot and characters within the story. The students were observed at different times during the week reading these reviews and comparing them with their own knowledge of the stories. Anne found this an excellent package for reluctant readers as it allowed students to publish a review regardless of their reading level, and the software maintained a database of all the books and reviewers over the year. The remainder of the afternoon was devoted to either art,

music, sport or the general theme being studied within the classroom programme. On one day of the study a small group of students used the computer to draw the house of the future. This activity was part of a space theme and involved the students collaboratively designing their house with a graphics package known as *Kid Pix.*

In sum, the nature of the curriculum was characterised by the range of activities within a given day and the lack of time that was available for integrating the one computer into the regular programme. The structure of the programme was constrained by the number of students in the classroom wanting to use the computer and the range of curriculum subjects covered in the course of a week. The computer was frequently used during the week, but Anne's classroom was a busy place and the hardware and software was simply one of many learned-centred activities going on within the routine of an ordinary day.

7.3 ANNE'S VOICE

This section presents Anne's views on different aspects of teaching, learning and the use of computers in education. It offers a personal insight into Anne's perceptions and beliefs about the processes of teaching and learning and the way that computers contribute to better learning in the classroom.

7.3.1 Views about Teaching

I like teaching. I see my role in the classroom as really important. If I'm enthusiastic about teaching I find the kids are enthusiastic about learning. I guess you could call me a kind of teaching evangelist! I mean if the children are coming to me to learn then I have a responsibility to help them learn and learning has to be fun. I try hard to make learning fun in my classroom and that's why I give the children as much responsibility as I can. I don't like being the teacher. It's much more enjoyable when I can work with the kids and we can learn together. I like to involve the children in as many of the decisions I can because that makes them responsible and makes my job easier. They can't complain if they've been involved in the decisions and it's a sort of joint thing. I find that I enjoy teaching when I don't have to do all of the work. I mean I do the work, but I guess it's the planning and that as opposed to the direct teaching.

I think a lot of the success of my teaching is the group activity work we do. I really value that in my teaching and wouldn't teach in any other way. It does take a lot of work and you have to really emphasise the social skills. I try and model that as much as possible in the classroom. I once read something about thinking aloud so what I do is always try and explain why we're doing something or what the

possibilities are and why this is better than that action. I'm always trying to improve my teaching. I probably try too much and should stay with the same for longer. For me teaching is about the kids and watching them learn is really what gives me a buzz and keeps me interested in the job. I like to think that I'm an innovative teacher!

7.3.2 Views about Learning

Well, I know the theory and that's good, but I guess it's hard to generalise. I think all kids learn differently. I definitely don't believe in that behavioural stuff. I mean learning that's a hard one. I guess what I've done is taken the best of the theory and shaped that to suit my own approach to teaching. I don't think I've ever come across something that totally explains my view of learning. I know that I'm a cognitive teacher but it's quite difficult to put it into words. When I read about the importance of language and how that was the key to learning I knew that was me. I see the kids talking and discussing their ideas and well I know they're learning. I think that social skills are really important if kids are going to learn anything. I mean you can't learn if you can't work with others. I think learning is about listening to others and respecting the views of other people.

I try and run an organised programme because a good learner is always organised and knows where they are. That's why we set goals each week and talk about what helps us to learn. I use to show them my study and that I had to do essays and stuff just like them. I tried to model my learning to show the kids that planning and making lists is really important. You know learning how to learn. We have class meetings where we discuss rules in the class and where things are getting in the way of learning. Taking responsibility that's important. Kids learn better when they have to accept the responsibility for their own actions. I see some teachers help kids and you know their work looks better but I don't. It's got to be their own. What's the point? If they get the satisfaction themselves then they get the buzz and that spurs them on to learn more. I think that's what helps to make learning fun. Learning has to be fun because I can't make the kids learn. That's probably the most important thing about learning for me.

7.3.3 Views about Computers

I really like working with computers. I always have since I first got over that initial apprehension. I mean I couldn't have done so well with my study without a computer. I don't think I would have survived. Computers are fun! I do heaps of my planning on the computer at home and its fun getting a new software package and learning how it works. I sometimes think it's more fun finding out how the

software works than actually using the software itself. It's the discovery part of it and I think that's what kids like as well. I see the computer in other classes and the kids just want to play games and I think why. I mean there's just as many exciting things kids can do with a word processor or graphics package if you're prepared to take the time. I guess that's the key to computers in schools. Games are fun, but when you know the software you know the possibilities. You do have to know the software if you're going to use it well and that does take time. But it's just part of your professional development -- I think.

That's the biggest problem. I would really like to go beyond what I'm doing now, but I find most of the courses are just word processing or interactive fiction and well I think there must be other things. Don't get me wrong, I think word processing especially things like Storybook Weaver are great, but well I'd like to move on a bit. I would love to try Hypercard or even databases or spreadsheets, but I suppose it's a matter of time and having someone else to learn from. I teach a lot of the other teachers and I guess they see me as the expert, but no one really teaches me. It would be nice to have an advanced course, but then when you see the others well I guess it's not the priority. The education of the teachers has to be the number one issue. Sure they use the computer, but it's really not the same. I don't know what it is really, for some reason they just don't use it well in a fun way. The kids respond to that and it's a vicious circle because then the teachers don't see how it can enhance your programme. I really resent collecting supermarket vouchers just to see computers being used like that. I don't see why I should have to collect them as that's not my job! Sorry a little hobby horse of mine.

It can help make your teaching and I guess learning more fun. The kids love it and they get a great deal of satisfaction from creating things on the computer. I place a lot of emphasis on kids working together and sharing and that, and that's where the computer is great. I got one boy who's not that academic, but for him The Factory or Sim City they're just a release. I mean he's good at it and the other kids see him succeeding and that's really important in terms of how he sees himself. I get him to teach the others and that gives him a real buzz. That's what I really like about computers -- the kids like to share their creations and everyone is interested in what everyone else can do. I encourage that and we always work as a whole team. I try to show the children the computer is just a tool and that real problems always require people working together. I would have to say that the social side is probably the most important part of using computers in my classroom.

In many ways I don't know if you can teach people that part of teaching. I've tried with some of the other staff, but they don't really have the same philosophy. Some do but they don't like change, I guess, as much me. You see I don't think the computer is really what is important. It's more your approach to teaching in the first place. I wouldn't use the computer if I only had drill. It's because the software supports the way I teach already -- that's why I like using the computer. Although it's hard to find good software as much of it's American. I don't actually think you need much anyway because there's just not the time and you're better to use two or three quality packages than heaps of rubbish. I think the tool software is the best because you can use it for any area. One of the problems I'm finding is with kids getting their own computers at home they're not as motivated, although perhaps it's me. Some of the kids say we did that or I've got that at home and I see that as an increasing problem. I suppose the biggest problem of all is the lack of policy. We all have different ideas about where computers are at, and the parents want them and all, but I think the reasons are different and there's still no real direction.

7.4 LISTENING TO ANNE'S STUDENTS

This section presents information from the students perspective on the use of computers in Anne's classroom. It outlines data pertaining to the students' prior computer experiences, their competencies at using computers in the classroom and perceptions about the role of educational software in the processes of teaching and learning.

7.4.1 Students Experience

The percentage of students with access to a computer at home is shown in Table 7.1. The boys (40%) reported greater access to a home machine than the girls (25%). In conversing with the students the predominant use of the home computer appeared to be for games. Few students reported that they used the computer for anything other than games.

Table 7.1

Percentage of Students With Access To A Home Computer In Anne's Classroom

Number of Students in Anne's Classroom N	Students With Access to a Home Computer %
31	32

Although Anne confirmed the results were reasonably accurate according to her knowledge, access to a home computer attracted considerable status among the students and the validity of data should be viewed in this light.

7.4.2 Students' Competence

The students reported a high level of competence at basic computer and word processor operations. Table 7.2 indicates the competency level of students at various operations on the computer within the classroom. Of note was the reported capability of students to 'cut and paste' text and use a 'spell checker' within a word processor application. The percentage of students capable of changing the paper in the printer was also noteworthy in that this represents a fairly even number of both boys and girls.

Table 7.2

Percentage Of Students Capable Of Performing A Range Of Basic Operations On The Computer In Anne's Classroom

What I Can Do With The Computer	Yes %	Not Sure %	No %
I can turn on and off the computer	100	0	0
I can use a word processor	100	0	0
I can change the font/style of text	100	0	0
I can move the cursor and correct errors	100	0	0
I can delete and replace words	100	0	0
I can delete large sections of work	90	10	0
I can move (cut & paste) a piece of text	66	11	23
I can copy (copy & paste) a piece of text	44	36	20
I can centre and adjust the margins of text	37	37	26
I can use a spell checker	100	0	0
I can add a picture or graphic to my text	66	0	34
I can use help to find out something new	23	50	27
I can print my work out	100	0	0
I can save a document to a disk	100	0	0
I can get a document from a disk	100	0	0
I can copy work onto another disk	27	30	43
I can format a blank disk	23	20	57
I can change paper in the printer	53	0	47

Whilst these results represent self-reports only, observations of classroom practice were consistent with data. Students were observed performing most of these operations including using a 'spell checker' and adding a 'graphic' to text. The use of the 'cut and paste' function

while word processing was not observed, but work samples of draft process writing material provided evidence that students did use this operation in the classroom.

7.4.3 Students' Perceptions

Table 7.3 shows students' perceptions about the computer in terms of self-efficacy. The majority of students were highly positive about their perceived ability to use the computer. There were no students who perceived that they used the computer poorly and 13% only found the computer difficult to use. As few as 13% reported that they tried to avoid the computer and 68% of students claimed that they liked to use the computer.

Table 7.3

Perceptions Of Students About The Computer In Terms Of Their Self-Efficacy In Anne's Classroom

Statement	Strongly Disagree %	Disagree %	Not Sure %	Agree %	Strongly Agree %
1 I know how to use the computer.	0	6	6	65	23
2 I am always finding better ways to use the computer.	3	23	23	38	13
3 I feel comfortable when I use a computer.	6	10	20	29	35
4 I like to use the computer in the classroom	6	6	20	32	36
5 I know how to use a computer as well as most children.	13	19	29	29	10
6 I find it difficult to use a computer.	32	36	19	10	3
7 Even when I try hard I do not use the computer as well as others do.	23	23	32	19	3
8 Whenever I can I try and avoid using a computer.	55	26	6	10	3
9 I am not very good at using a computer.	45	49	6	0	0
10 I generally use the computer poorly.	48	42	10	0	0

A gender analysis of data showed that there were no significant differences between the mean perceptions for boys and girls. The mean perceptions for each statement according to gender are shown in Figure 7.2.

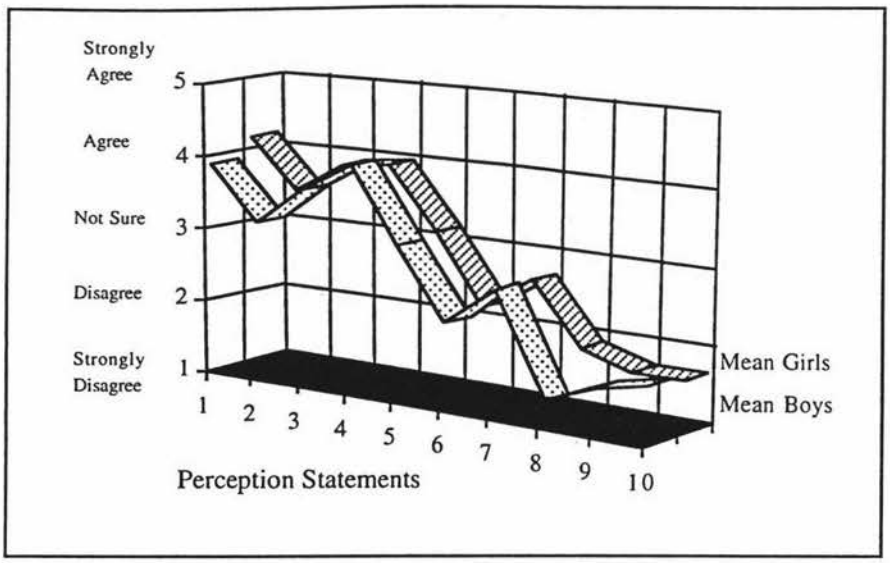

Figure 7.2
Mean Perceptions About The Computer In Terms Of Self-Efficacy By Gender In Anne's Classroom

Qualitative data supported the similarity between the perceptions of boys and girls. The girls were enthusiastic about using the computer and if anything more dominant than the boys in gaining access to the computer. The following comment from a conversation with a group of girls demonstrates that many of them were confident about using the hardware and software in the classroom.

> *"I think I'm pretty good at the computer. Most of the new things we find out come from us. We learnt to do newspaper margins before the others and put page numbers on. Some of us like it and others don't, but it's not really a big thing. It's easy really."*

In the same conversation another girl suggested that:

> *"I think that the only difference is that boys are really interested in is games. Games are ok but they get boring after a bit. We like using the computers for other things. It's good for writing and that sort of stuff."*

Outcome expectancy perceptions are shown in Table 7.4. The majority (52%) of students agreed that computers helped them to learn. As many as 61% of students agreed that learning how to use the computer helped with their school work. Less (28%) students considered that their success at school was related to their ability to use the computer. Few (13%) students perceived that it was not worth their time to learn how to use the computer. There were 29% of students who considered that learning to use the computer would not help them in the future and 33% who perceived that they would not use a computer when they left school.

Table 7.4

Perceptions Of Students About The Computer In Terms Of Their Outcome Expectancy In Anne's Classroom

Statement	Strongly Disagree %	Disagree %	Not Sure %	Agree %	Strongly Agree %
11 Most good jobs require some computer skills.	10	13	29	26	22
12 Learning how to use the computer helps me with my school work.	6	13	23	35	23
13 My success in school work is related to how well I can use a computer.	13	26	33	22	6
14 If I got better in using the computer it would help me do better in school.	3	16	39	26	16
15 Learning how to use the computer can help me learn.	3	16	29	36	16
16 It is not worth my time to use a computer.	39	32	16	13	0
17 It is not really necessary to use a computer.	36	32	29	3	0
18 Success at school has nothing to do with being able to use the computer.	16	36	36	12	0
19 I will probably never use a computer once I leave school.	19	16	32	20	13
20 Learning how to use a computer will not help my future.	19	23	29	19	10

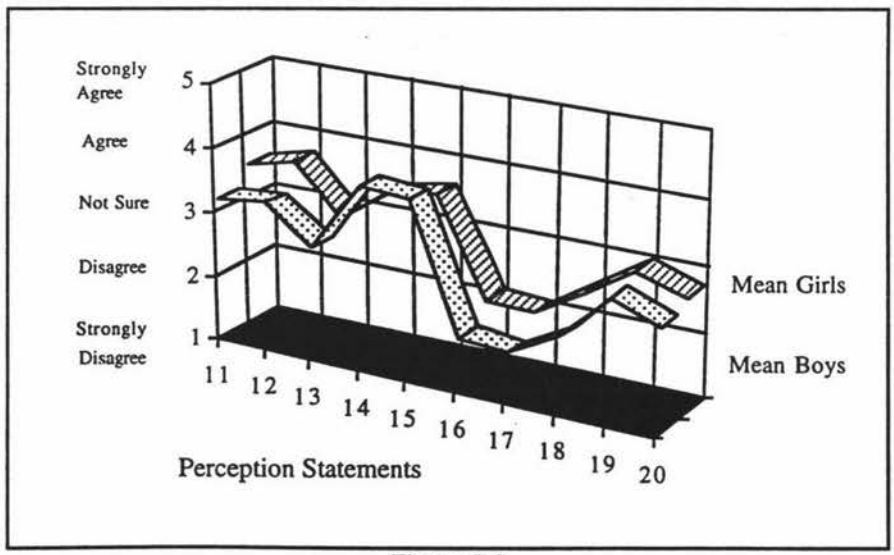

Figure 7.3

Mean Perceptions About The Computer In Terms Of Outcome Expectancy By Gender In Anne's Classroom

A gender analysis of data showed that outcome expectancies were similar for both boys and girls. Figure 7.3 shows the mean perceptions for each statement on the basis of gender. The similarity of perceptions between boys and girls was a distinctive feature of Anne's classroom.

7.5 ANNE: INTERPRETATIVE SUMMARY

Anne was an articulate teacher with a clear philosophy of teaching. Her philosophy was derived from personal experiences in the classroom and also informed by an increasing knowledge of formalised educational theory. The philosophy was generally eclectic in that it emphasised variety within a learner-centred approach. A balance is valued between students having fun and accepting responsibility for their own learning. The classroom was very social and in this regard there was every indication that Anne's personal philosophy of teaching was being put into practice. The researcher's observations were generally consistent with what Anne described as her approach towards teaching, learning and computers. The computer was used mainly as a 'tool' and students frequently worked together around the hardware. Students displayed a high level of cooperation and respect towards one another, and demonstrated a genuine interest in what others were doing in the classroom. It seemed a particularly harmonious learning environment. There were few disruptions to the programme and the classroom was very well organised to maximise learning opportunities. It was obvious that Anne spent a great amount of time planning and preparing for daily classroom activities. Although the lack of time for such activities was often a problem, the enjoyment that Anne derived from the students appears to compensate for this and motivate her to try out new ideas in the classroom. It is fair to say that Anne feels a sense of isolation and would welcome more direction in the way that she uses computers for learning in the classroom.

7.6 CASE STUDY OF BARRY

The remainder of this chapter describes a microethnographic case study of Barry and the students in his class. Barry was judged to be a proficient computer-using teacher who was generally enthusiastic about using computers within his teaching. He was a senior teacher working in a large primary school with a long tradition of using computers in the classroom. Barry was the school's technology coordinator and had recently completed a tertiary level course on the use of computers in education. He had owned a computer for many years and was considered to have a high level of educational and technical knowledge about using the equipment in the classroom. The case study of Barry is divided into three main sections with differing perspectives on classroom practice. The first section describes the researcher's own observations of Barry's classroom. The second section is devoted to Barry where he expresses his views about the role of computers within education. The third section provides information from the students perspective with details on their experiences, competencies and perceptions about the use of computers within the classroom. Finally, an interpretative summary is offered of data that highlights some of the main features of the case study.

7.7 A WINDOW INTO BARRY'S CLASSROOM

This section presents data from the researcher's observations of Barry's learning environment, including information on the hardware and software used in the classroom and the general organisation of the curriculum.

7.7.1 Learning Environment

The physical arrangement of Barry's learning environment was characterised by its innovative design and the range of available learning aids (see Fig 7.4). The traditional individual desks were positioned in clusters of six on the outer walls with two distinctive hexagonal tables dominating the middle of the room. There were four permanent groups within the class, but the seating pattern of students was not fixed according to these groupings. Rather, during group activities students moved to specific tables as and when appropriate. The aim at other times of day was to encourage interaction across groups with differing levels of ability. There was no mat area as such in the classroom, but on occasions small groups of students worked on the floor at the front of the class. It was typical for class discussions to take place while students were sitting at their desks. The teacher's table was located at the front of the classroom and an old stereo system was positioned near the entrance. The students were often allowed to listen to music while they worked or when they completed activities early. A display of library books was located on a shelf unit under the blackboard.

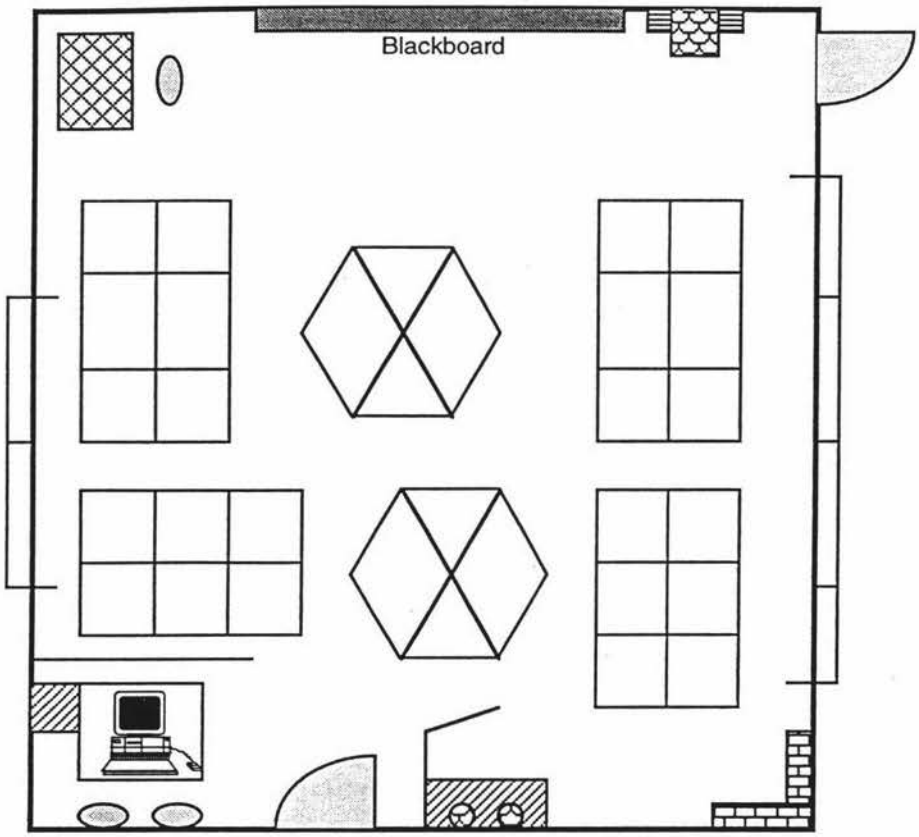

Figure 7.4
Layout Of Barry's Classroom

A display area at the rear of the classroom included a large aquarium in the corner and a 'learning centre' further along the wall. The learning centre included a tape recorder, purpose built electronic teaching machine and range of games and puzzles. In the other corner of the room was a computer that was free standing and facing the blackboard. The computer was screened from the nearby desks by a hanging divide which consisted of cloth material. The hardware included a colour printer and was located near one of four other power points within the classroom. The entire classroom was decorated with student work samples, and in combination with many other features gave the impression that this was a dynamic and innovative learning environment.

7.7.2 Hardware and Software

The hardware consisted of an Archimedes A4000 computer connected to a Star colour printer. The readily available software included, *Impressions Junior, ArtWorks, Magpie* and *Junior Pinpoint.* Other software located within the school and used during the year by the teacher included, *Crystal Rain Forest, Flowers of Crystal, Granny's Garden, Landmark Victorians, Second World War, Sea Rescue,* and *Logo™.* There were individual folders on the computer named for different areas of the curriculum and for each of the groups in the class. A storage box alongside the computer contained a floppy disk for each group and also

included an assortment of games and miscellaneous public domain software. The procedure was for students to save and retrieve work to their group folder on the hard drive and make back up copies on disk on a regular basis. The backing up of work was the responsibility of individual students and Barry never did this for members of the class.

A hanging string at the front of the classroom with pegged name tags indicated the order which students were allowed to use the computer. The six names at the top of the string were the students authorised to use the computer on a given day. The student at the top of the list had the first priority. If these students took up the opportunity on the computer then their names rotated to the bottom of the order. This system allowed students to wait until they were actually ready to use the computer. A feature of the system was that students always worked in pairs. Students were allowed to select another person within the top six names to work with them during collaborative writing activities. The use of the word processor for collaborative writing was the main way that the equipment was used in the classroom apart from one or two interactive fiction units per term.

The time that students spent on the computer was determined by the regular class timetable and the breaks between activities within the classroom. The rule was that students were entitled to 30 minutes each time they used the computer. A chart on the wall alongside the computer gave a number of hints and instructions on how to use the word processor. The name of the computer monitor of the week was displayed beside the hardware and the procedure was that students used this person when they encountered difficulties. The computer monitor was also responsible for turning the equipment on and off at the beginning and end of each day and for maintaining a supply of paper in the printer. Monitors were selected on a rotating basis. Barry allowed students to play games on the computer over the lunch break, one day per week and usually on wet days.

7.7.3 Organisation of the Curriculum

The curriculum was organised to encourage students to interact with one another and take an active role in the learning process. Barry expected students to manage their own work and to be responsible to each other for the completion of group activities. Most of the programme was based around group activities where there was a strong emphasis on social interaction between students. Each group of students had an elected leader who was responsible for the overall functioning of the group. At the end of the week the groups reported on how well they operated as a group during related activities. There were few whole class activities with most of the programme involving the groups or pairs of students working on specific projects. A feature of the programme was the use of calculators, electronic spell checkers and

other new technologies on a daily basis. A typical day involved many of these technologies, including the computer, in a range of student-centred activities.

The day would normally start with groups discussing for 15-20 minutes the community news. On alternative days this time was spent with groups brainstorming solutions to a specific community or world problem posed by the teacher. During this time the computer was available to students for written language work. A pair of students would continue writing their latest collaborative story. The news or problem solving activity was followed by mathematics. Mathematics did not involve the computer during the study, but sometimes included drill activities, graphing work or programming with *Logo*. There was 10 minutes of short equations and/or word problems after which students completed a range of pre-set activities in their groups. One group would always work with the teacher. Prior to the morning interval students would work in pairs checking each others spelling or knowledge on aspects of gramma or specific language conventions.

After the morning interval the students undertook 15-20 minutes of fitness and on return to the classroom commenced handwriting. The handwriting was followed by process writing where individuals worked on stories relevant to the current theme. This time involved students working at different stages of the writing process and conferencing with others in their group on aspects of their writing. It was a period of much activity in the classroom and little teacher intervention. That is to say that the teacher was available only for conferencing and students were expected to work without much supervision. Throughout this period the word processor was being used for collaborative writing and publishing of written work. It was normal for two groups to use the computer between the interval and lunch break. On most days just before lunch, Barry would read a chapter or section of a book to students.

After lunch the students spent 15 minutes on silent reading and would follow this with either a visit to the library, school assembly, religious instruction or a range of reading activities. The remainder of the afternoon was spent on theme work. At the time of the research Barry was involved in teaching a health unit on 'keeping ourselves safe'. The previous week, as part of this unit, the students completed a survey on the number of homes with smoke detectors. The survey form was created by Barry using *Pinpoint* after a discussion with the students. Data was entered into the computer by several students and later graphed as a pie chart. The graphed results were the basis for the weeks' activities with debates between students and several invited guests talking to the class. The word processor was used on one afternoon to prepare a letter to parents about the advantages of installing smoker detectors in their homes. The students would often finish the day with a sports or music activity.

In sum, the nature of the curriculum was characterised by a thematic approach to work and the independence given to students in completing a range of classroom activities. There was, despite the efficient use of time, a noticeable lack of time to complete the variety of activities within the classroom. The utilisation of the computer within the classroom programme was constrained by the limited hardware and the number of activities in different areas of the curriculum throughout the week. Barry fully utilised the computer for collaborative process writing, but the extent software was used in other curriculum areas was highly dependant on the type of activity. Although some activities were suited to using the technology, many others were not especially within the ordinary practice of a teaching day.

7.8 BARRY'S VOICE

This section presents Barry's views on different aspects of teaching, learning and the use of computers in education. It offers a personal insight into Barry's perceptions and beliefs about the processes of teaching and learning and the way that computers contribute to better learning in the classroom.

7.8.1 Views about Teaching

I see myself as a facilitator. I try to work with the children and not just teach the children. I have a responsibility to help the kids learn, but they also have a responsibility and I can't make them learn. I try to incorporate units into my teaching that the pupils are interested in and that are relevant to them. That's very important to me because it makes learning meaningful. I see part of my role is to prepare children for the future and there's no point in studying topics of no relevance to them and that are out-of-date. As a facilitator, I'm a bit like a conductor in an orchestra. I have to keep everyone together and create the opportunities for the pupils to perform and release their talent. I like that analogy! The pupils are all different with strengths in different areas of the orchestra -- or curriculum.

My view of teaching has evolved over the years, but the guts of it have pretty much stayed the same. I like the children to have lots of control and not to be the boss. It's interesting that recent curriculum developments support my approach to teaching. I feel vindicated in some ways because that's how I've always taught. You know the emphasis on group work and thematic integrated studies is the way it's going. I did a course once on interactive teaching and that was probably important in refining my approach. I think when you teach like that, teaching is a lot of fun, and that's what it should be as far as I'm concerned. I do like children to enjoy the classroom. We all enjoy it when they enjoy it.

7.8.2 Views about Learning

Everyone has their own view. I work on the basis that children learn best when learning is relevant and meaningful to them. For me children have to see how this helps them in the future and why it's important to learn. I have to ask that of myself sometimes. When the activity is related to their own experience they are more interested in it and more motivated. That's really important because you have to be motivated to learn. We can all learn anything we want when we're motivated to learn. I try and motivate them, but at the end of the day they have to do the learning. I believe that the more experiences you can give the children the better. I try and give them as many experiences as possible within my classroom. That's part of what education is all about. It makes sense that the more experiences you have the more you're going to learn.

The social side of learning is part of all that. I find that the children learn more when they can share experiences with each other. It's a bit like going on holiday -- it's much more fun going with other people. The children motivate each other and are genuinely interested in what's going on in the classroom. I think talk is very important because you've got to be able to express yourself. That's why we have a lot of group work and I have leaders in the class. The leaders change so that everyone has to take responsibility at some stage. There is more to learning than just the product. You know learning is both process and product. I also like experiences to be hands on because that's how you learn. That's my biggest problem with maths because there's too much book work irrelevant to the children. Back to that being relevant again. That and having fun are probably the guts of it for me.

7.8.3 Views about Computers

The computer is really just another learning experience. They're an important experience because the childrens future is going to rely upon these machines. The world is changing so fast and we have to prepare children for the world of the future. That's not the only reason, however, for using computers in education. The children are really motivated by them and there are so many things you can do on a computer in the classroom. Well, when you have the gear. Word processing is great. In the future it's the way children will all write. I use the word processor all the time in my work. You know for letters to parents and such I couldn't do without it. The children get to write like real people and that's important. The computer is great for writing because it fits so well within process writing. I use pairs because more get a turn and they have to learn from each other. The pupils enjoy it and I even try more collaborative writing now using pen and paper.

I try not to use the computer for just presentation. I know that's how it happens in some classrooms. I try and give the children enough time on the computer so as to write directly on the computer. You can't always, it's just not possible, but giving them enough time is crucial to its success. You have to make it fit within your existing writing programme. I don't like it when its an add on. It's a real challenge for some teachers, but I think the problem is they don't have the management in place and have the repour with the children. You just can't do it on your own. The children have to be involved in the whole process and you have to be committed to that approach of teaching. The way you teach is part of it I believe and you can't really teach that to people. It's a whole philosophy and you carry it right through your teaching.

Having fun with computers is great for your teaching. It keeps you fresh. I would have to say that the reason I enjoy computers is because they're part of the future and the children enjoy them so much. I don't mean by that children should all learn from computers. That's not it at all. In fact just give me three or four and I'd be happy. What I mean is that when you use a computer as a tool it fits with making learning relevant. That's the real value of databases in the class. We do quite a few surveys with the children and Pinpoint is great for that. Data is real and you can do so much with it using the computer. I don't think you really need much good software on a computer. Some of the Acorn stuff is good but you really can't go past the word processor and software like that. That's where I feel some teachers go wrong in that they introduce too much software in the classroom.

I like computers but it can be frustrating at times. You have to spend a lot of time on them to use them well, and I spend a lot of my time helping other teachers with the computer and often it's just simple problems. The computer can be a great time waster if you're not careful. The teacher in charge gets little thanks, although more now technology is becoming a big thing in the classroom. I hope the technology curriculum is going to give us the direction. That's what has been lacking in the past. I've done things in this school and we've got a policy and that, but we've been really working in the dark. The staff have put a trust in me and well sometimes you have doubts about where it's all going. That will be a big plus with the technology thing. Once the teachers know they have to teach with it then that will help change their attitude. That would have to be a number one problem. How do you get teachers to use the technology?

I suppose there's a gender issue and I'm conscious of that in the way the children use the computer. I believe some of that comes from home. The boys are the ones who really like the games. It's hard to stop and I'm not sure it's all bad. You do have to keep an eye on it however. Some teachers don't and that's another area where they have problems. I don't really think the courses have had much impact on the teachers. Actually if anything a negative impact. Some of the teachers now know enough that a little knowledge is a dangerous thing. They keep control of the computer now because they know how to use it -- at a basic level. Teacher training is really important, but it has to be the right sort. I found the study useful, but a bit removed from the classroom. On the other hand the courses are to low level and not challenging enough. Well, that's what I think. You need a balance, but someone with vision for the future. It's a waste of time to just learn how to use a word processor or database or whatever. The teachers need to rethink their whole approach to teaching. That's the type of course I believe we need if computers are going to have any real impact on the learning of children.

7.9 LISTENING TO BARRY'S STUDENTS

This section presents information from the students perspective on the use of computers in Barry's classroom. It outlines data pertaining to the students' prior computer experiences, their competencies at using computers in the classroom and perceptions about the role of this educational technology in the processes of teaching and learning.

7.9.1 Students Experience

The percentage of students with access to a computer at home is shown in Table 7.5. Boys (62%) reported greater access to a home computer than girls (24%). Discussions with the students indicated that the predominant use of the home computer was for games. Few students reported they used the computer for anything other than games. Many boys also claimed to own a Sega™ type game system in addition to a computer. The use of video games was a frequent topic of discussion among the boys.

Table 7.5

Percentage Of Students With Access To A Home Computer In Barry's Classroom

Number of Students in Barry's Classroom N	Students With Access to a Home Computer %
33	42

7.9.2 Students' Competence

A high level of competence at basic computer and word processor operations is shown in Table 7.6. Self-report data suggests that students were competent at performing a range of operations with the classroom computer. The majority of students reported their capability to 'cut and paste' text, use a 'spell checker' and add a 'graphic' with a word processor. The percentage of students capable of changing the paper in the printer was quite low and consisted predominantly of boys.

Table 7.6

Percentage Of Students Capable Of Performing A Range Of Basic Operations On The Computer In Barry's Classroom

What I Can Do With The Computer	Yes %	Not Sure %	No %
I can turn on and off the computer	100	0	0
I can use a word processor	100	0	0
I can change the font/style of text	100	0	0
I can move the cursor and correct errors	100	0	0
I can delete and replace words	100	0	0
I can delete large sections of work	100	0	0
I can move (cut & paste) a piece of text	84	3	13
I can copy (copy & paste) a piece of text	44	40	16
I can centre and adjust the margins of text	62	22	16
I can use a spell checker	100	0	0
I can add a picture or graphic to my text	75	0	25
I can use help to find out something new	25	50	25
I can print my work out	100	0	0
I can save a document to a disk	100	0	0
I can get a document from a disk	100	0	0
I can copy work onto another disk	18	22	60
I can format a blank disk	22	19	59
I can change paper in the printer	30	7	63

Observations of classroom practice were consistent with self-report data. Students were observed doing most computer operations, including using the 'cut and paste' and the 'spell checking' functions of a word processor and 'printing' out their own word processed documents. Samples of students' work also provided evidence that many of these operations were performed on a regular basis within the classroom.

7.9.3 Students' Perceptions

The perceptions of students about the computer in terms of their self-efficacy are shown in Table 7.7. Students were very positive in their perceived knowledge of how to use the computer. As few as 13% found it difficult to use a computer and 3% only reported that they tried to avoid the computer. The majority (67%) of students perceived that they liked to use the computer, with few (13%) considering that they used the hardware poorly.

Table 7.7

Perceptions Of Students About The Computer In Terms Of Their Self-Efficacy In Barry's Classroom

Statement	Strongly Disagree %	Disagree %	Not Sure %	Agree %	Strongly Agree %
1 I know how to use the computer.	0	3	7	63	27
2 I am always finding better ways to use the computer.	3	20	17	43	17
3 I feel comfortable when I use a computer.	0	7	17	43	33
4 I like to use the computer in the classroom	0	3	20	37	40
5 I know how to use a computer as well as most children.	17	17	36	20	10
6 I find it difficult to use a computer.	23	41	23	10	3
7 Even when I try hard I do not use the computer as well as others do.	20	26	30	17	7
8 Whenever I can I try and avoid using a computer.	47	37	13	3	0
9 I am not very good at using a computer.	23	40	10	20	7
10 I generally use the computer poorly.	27	43	17	10	3

A gender analysis of data showed that the perceptions of boys were more positive towards the computer than girls. Figure 7.5 displays the mean perceptions for each statement for both boys and girls. It was notable that girls were consistently less positive towards the computer in each of the 10 self-perception statements.

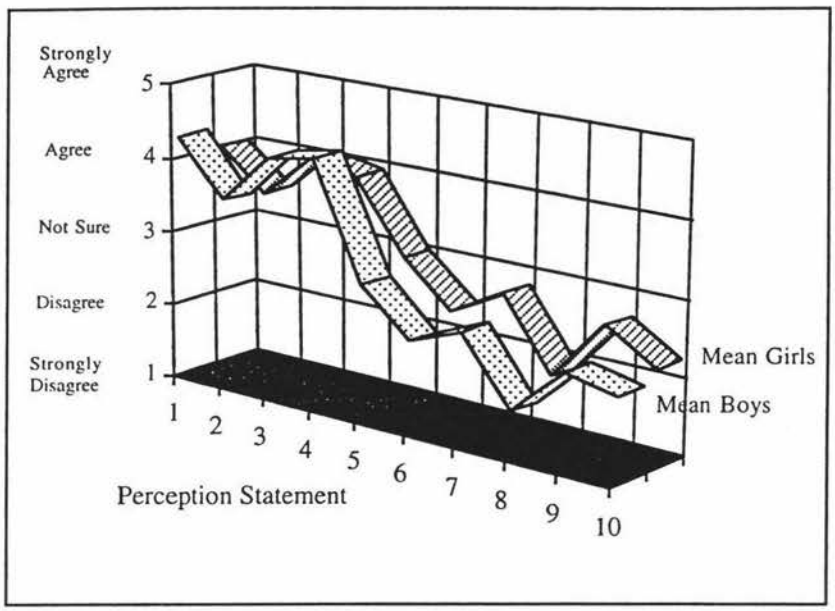

Figure 7.5
Mean Perceptions About The Computer In Terms Of Self-Efficacy By Gender In Barry's Classroom

Qualitative data supported the finding that boys' self-perceptions were notably more favourable towards the computer than girls. The boys were enthusiastic about using the computer and more eager than the girls to gain access to the hardware. In many ways the boys treated the computer as 'their' machine. This was how one student described the situation:

> *"I think it's not fair. We should have one computer and the girls their own. We use it more than them. It's rad. The girls don't like computers anyway."*

The students' perceptions about the computer in terms of outcome expectancy are shown in Table 7.8. Students were generally positive in their perceptions about the way the computer supported learning with 64% perceiving that it helped them to learn. The majority (80%) of students perceived that learning how to use the computer helped with their school work. Less (31%) students considered that success at school was related to their ability to use the computer. Few (10%) perceived that it was not worth their time to learn how to use the computer. Most (70%) students considered that learning to use the computer would help them in the future, but were not so sure whether good jobs were related to computer skills.

A gender analysis of data showed that outcome expectancies were more positive for boys than for girls. Figure 7.6 shows the mean perceptions for each statement for boys and girls. Girls were less positive about the need to use a computer in the future and whether learning how to use a computer would help them in later life. Boys perceived, more than girls, that good jobs were related to the ability to use the computer. This view was common among boys in qualitative data and was best reflected in a brief comment from one boy:

Table 7.8

Perceptions Of Students About The Computer In Terms Of Their Outcome Expectancy In Barry's Classroom

Statement	Strongly Disagree %	Disagree %	Not Sure %	Agree %	Strongly Agree %
11 Most good jobs require some computer skills.	10	23	17	17	33
12 Learning how to use the computer helps me with my school work.	0	3	17	40	40
13 My success in school work is related to how well I can use a computer.	3	23	33	31	10
14 If I got better in using the computer it would help me do better in school.	0	23	40	27	10
15 Learning how to use the computer can help me learn.	0	3	33	40	24
16 It is not worth my time to use a computer.	30	40	20	10	0
17 It is not really necessary to use a computer.	33	33	17	14	3
18 Success at school has nothing to do with being able to use the computer.	10	30	37	23	0
19 I will probably never use a computer once I leave school.	40	10	23	17	10
20 Learning how to use a computer will not help my future.	27	43	17	10	3

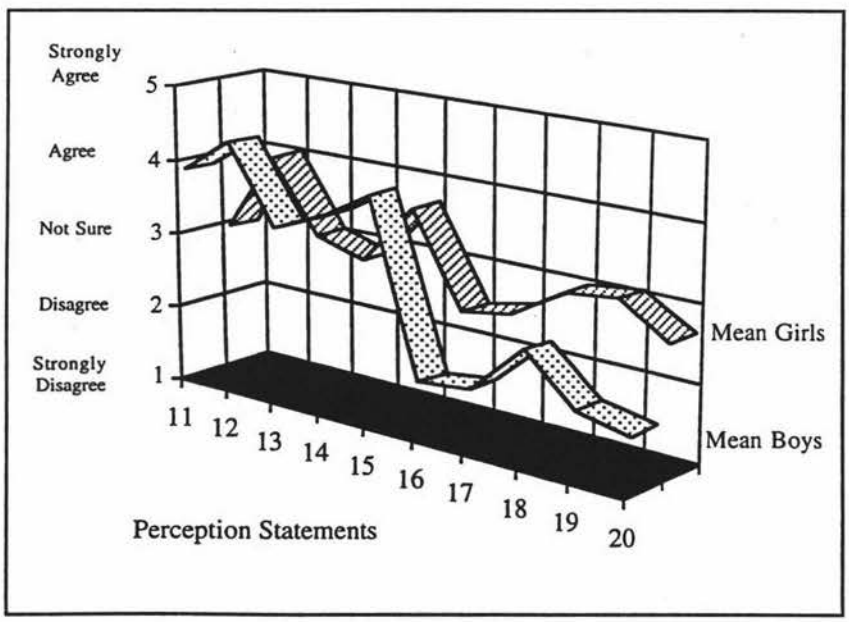

Figure 7.6
Mean Perceptions About The Computer In Terms Of Outcome Expectancy By Gender In Barry's Classroom

"I think that I need to use a computer because there won't be any jobs in the future without computers. Just about everyone uses a computer these days!"

7.10 BARRY: INTERPRETATIVE SUMMARY

Barry's teaching philosophy was based on the need to make learning relevant to the students and to their lives in the future. His philosophy was influenced by the notion that learning should be meaningful to students and that they should have control over their own learning. Learning should be fun and involve as many experiences as possible. It was not, however, obvious how this philosophy was informed by formalised educational theory, although many beliefs were consistent with contemporary views of teaching and learning processes. It is fair to state that Barry was sceptical of educational theory and based his own approach on experiences in the classroom built up over time. He was reluctant to direct learning activities and structured the curriculum such that students were responsible for their own learning. Classroom observations were generally consistent with what he described as his approach towards teaching, learning and computers. The computer was used mainly as a word and information processor in the context of a thematic approach. Within this approach students were given a great deal of independence and the computer was used to encourage social interaction. Whilst students demonstrated considerable knowledge about the computer, boys were clearly more enthusiastic than girls. Barry acknowledged this as a problem and was hopeful that pending curriculum developments would provide more direction for teachers on the use of computers in education.

7.11 SUMMARY

This chapter described the results for the final phase of the research. It presented microethnographic case studies on the practices, perceptions and beliefs of Anne and Barry -- two proficient computer-using teachers. A range of qualitative and quantitative data were given to profile the nature of proficient teaching practice with computers. Qualitative data outlined the main features of the learning environments and offered the participating teacher's voice on differing aspects of using computers in the classroom. Quantitative data reported background information on students' experiences, competencies and perceptions at using computers to support teaching and learning processes. It was found that computers are predominantly integrated into the classroom programme for word processing and writing activities. There was little time in the regular programme for all students to use the computer, but opportunities were maximised through learner-centred and thematic approaches to teaching as well as effective classroom management techniques.

The following chapter presents a discussion of the results in relation to a number of emergent themes from each phase of the study.

CHAPTER EIGHT

Discussion

"We must be wary of sweeping rulings on the success or failure of new technology" (Crook, 1994, p.8).

8.0 INTRODUCTION

This chapter discusses the results according to the main elements that contribute to the development of a computer learning culture. The role of the computer is considered and it is shown to be a multi-purpose technology that cannot be classified nor generalised as having a single contribution to the processes of teaching and learning. A review is undertaken of data on teachers 'nominated', 'perceived' and 'judged' to be proficient at using computers in the classroom. These teachers are summarised as dedicated professionals with considerable teaching experience and a range of beliefs that have in common an orientation towards a student-centred approach. Students in proficient computer-using teachers classrooms are compared in terms of their competencies and perceptions on how educational software supports better learning. A number of other factors perceived to effect computer use at different levels of the school system are discussed. Finally, several additional limitations are outlined with the methodology and the overall interpretation of the results.

8.1 THE COMPUTER

The computer was notable for the range of software applications being used in the classroom and the diversity of ways these were employed by teachers for learning purposes. A striking feature of the study is that the computer appears to be a personal and highly subjective experience for teachers. There are some commonalities amongst the proficient computer-using teachers, but few patterns in the ways different software applications are embedded within the classroom. A rich tapestry of practice allows some interesting lessons to be woven from the collective wisdom of the participating teachers. The following section discusses salient themes to emerge from the results in relation to the computer itself.

8.1.1 A Valuable Tool

The word processor was perceived by teachers to be a valuable writing tool. It was considered to have more educational value than any other type of computer application within the curriculum. Accordingly, consistent with prior research, the word processor was the most common type of software that teachers utilised in the classroom. Although the word

processor was more frequently used in the lower school, the important point is that it was the most prevalent software application at all levels of school. The results suggest that the computer is synonymous in the classrooms of proficient computer-using teachers with the development of written language and, in particular, the writing process. There were, however, a wide range of practices in integrating the word processor into the writing programme. The study shows that there is no standardised approach and methods of using the word processor are often unique to each teacher. It is worth noting that many teachers are still continuing to experiment with how to 'best' use a word processor in the classroom.

3.1.2 *Beyond Frequency Data*

The diversity of practices with the word processor highlights that frequency data on the type of software applications being used by teachers can be deceptive. This information is insensitive to the type of access that students have to the computer. Such data conveys very little insight into the context of practice in proficient computer-using teachers classrooms. Whilst it is interesting to know that the computer is predominantly used by teachers as a writing tool, what does this really tell us? The pen is also a writing tool, but it would be absurd to quantify, and draw conclusions from, how often students use pens in the classroom. It is meaningless for research of this type to rely upon frequency data alone when analysing the nature of educational software being used by teachers. This study went further than prior research by gathering a range of information on the perceived collaborative interactions between teachers, students and computers within the learning environment. As a consequence, it showed that the word processor is not a uni-dimensional 'tool' that has a singular impact on classroom practice. There are a diversity of practices that emphasise the need to be cautious when making generalisations about the benefits of a specific software application.

3.1.3 *Why Such Diversity?*

The fact that a word processor is utilised in diverse ways is not surprising given teachers are likely to modify their computer practices to fit their own conceptions on the functions and purposes of writing. Definitions of 'good' writing are largely subjective (Cochran-Smith, 1991). The use of a word processor is sure to reflect teacher's subjective and idiosyncratic understandings of the writing process. These understandings clearly have an important role in determining how a computer is used in the classroom. At the same time, there is also evidence that the features of the computer itself contributes to the diverse range of teaching practices with a word processor. Teachers appear to adjust the organisation of their writing programmes to suit the demands of their own hardware and software. For example, in trying to integrate the word processor into the regular writing programme various systems and organisational changes are usually devised to manage the computer. Hence, the computer is

merely assimilated into existing classroom practice. It helps to also shape and redefine nature of the writing programme and is part of a process of mutual adaptation (Knupfer, 3). The important lesson is that even within a sample of proficient computer-using hers there are complex interactions and relationships that result in variations of practice. se variations, in turn, make it very difficult to ascertain just how a word processor is ıg used to create conditions for better learning.

.4 *The Prominence of Educational Games*

second most frequently used software application by the majority of teachers in this y was educational games. It is interesting that despite the perceived benefits of using the ıputer as a 'tool', apart from word processing, few teachers employed the hardware and ware in this manner. Again, it is problematic to read too much from frequency data as hers no doubt have different perceptions of what constitutes an educational game. The ı 'educational games' was open to interpretation and likely to have included the computer g used in both the 'tutor' and the 'toy' modes. Regardless of which mode teachers were g when responding to questions about educational games, neither of these categories of puter use are considered to have the potential to create particularly empowering learning ronments -- as envisaged through the 'emancipatory' paradigm. On first impressions the uency of educational games in the classroom is somewhat surprising, given the range of e engaging ways computers can be used for learning purposes. It is clear, however, that benefits of using such software cannot be judged on this criterion alone. The teachers ared to use educational games to create social contexts for interactions 'at' the computer. se interactions involved pairs or small groups of students working together, and were cted to encourage cooperation and the development of social skills as much as anything

5 *Why Interactive Fiction?*

popularity of adventure games and interactive fiction software was based on this ınale. Those who used interactive fiction commented on how it changed the interactions elation to' computers, with the students learning from each other and the teacher ıting more of a facilitator role. Although interactive fiction was being used at a frequency . to Sherwood's (1993) research on Australian teachers, it is noteworthy that this ware does not appear as prevalent in data on North American schools. The significance ıis difference is not apparent; it may simply be a reflection of different methodologies and ınologies used in the description of educational software. There is, nonetheless, some ıte on the educational value of using interactive fiction in the classroom (see for example, ndy, 1991). The controversy about its use may have a bearing on comparative data. A ıber of teachers in this study certainly expressed reservations about the benefits of using

nteractive fiction in the classroom. The main concern was that interactive fiction activities vere removed from everyday life experiences. Given such contrasting perceptions, and that nteractive fiction appears the most intensive use of the computer by many teachers in this tudy, there is a distinct lack of research on its applicability to education. The current mphasis in the literature does not appear to accurately reflect the way that many proficient omputer-using teachers are utilising educational software in the classroom.

.1.6 A Cautionary Message

he message to draw from this conclusion, is that the growing interest in areas like nultimedia and computer mediated communications may be at the expense of understanding he conditions that traditional educational software creates for better learning. There is a anger that new computer innovations and software applications direct attention away from vhat is actually being used in schools. Whilst the hardware and software have undergone apid technological change in the last decade, it is salient to note that word processing emains the most common use of the computer in education. Furthermore, educational ames, including drill and practice, tutorial software, as well as interactive fiction, dominate he opportunities that students have to learn 'from' and 'with' computers. The study uggests that what is required is further research which investigates the benefits of software urrently being used in New Zealand schools, rather than a rush to examine the opportunities vailable from recent developments. It is obviously important that learning opportunities with ew hardware and software are evaluated, but there must continue to be an effort to study ow teachers are using existing equipment in the regular classroom. It would be unwise to ver emphasise new developments when many of the proficient computer-using teachers in his study are still grappling with integrating the current hardware and software into an lready crowded curriculum.

.2 THE TEACHERS

he teacher's role in the development of a computer learning culture is the central focus of nis thesis. Teachers were presumed to be a key actor in establishing the conditions for better earning as espoused through the inclusive learning perspective. Whilst increasing attention as been given to the role of the teacher, there are two aspects of this study that distinguish it rom previous such research. Firstly, it attempted an analysis of proficient teaching practice vhich transcends both the educational computing literature and that on effective teaching *per e*. A related point is that this analysis was undertaken within a multi-dimensional research aradigm, such that a range of data was gathered on the practices, perceptions and beliefs of roficient computer-using teachers. Secondly, the thesis sought to understand how teachers leeply rooted beliefs shape the patterns of practice with computers in the classroom. Unlike

earlier research the study endeavoured to adopt techniques consistent with this aim. Perhaps, not surprisingly, these are the main aspects of the study that warrant further discussion.

8.2.1 Profile of Proficient Computer-Using Teachers

The progressive sample of proficient computer-using teachers identified in this study provides an interesting profile on the characteristics of such practitioners. These teachers had considerable teaching experience; a finding consistent with previous research, but one not that surprising given the selection criteria. On the other hand there must be some concern that there were few teachers in the early stages of their career who met the proficiency criteria. It is a common perception that younger teachers adopt more innovative approaches to their teaching. Why do these teachers not reveal themselves in this study? It is certainly intriguing that there was a lack of men in the 20-29 age range, as computers are usually criticised as being a male machine (Elkjaer, 1992). A possible explanation is that less experienced teachers may be inadequately prepared for the demands of integrating the computer into the classroom. Many of the participants were critical of pre-service teacher education opportunities and it is only in recent years that the use of computers in education has gained more recognition in the preparation of teachers.

There are a number of implications from such an interpretation. We may have underestimated the time it takes to realise the claimed potential of the computer in education. A considerable time lag may exist between the provision of pre-service education, and the period when beginning teachers mature to become proficient at using the computer within the classroom. As a consequence, the full impact of the computer on the processes of teaching and learning may not be known for a number of years. It is premature to judge the computers' success or failure in education until teacher education initiatives have had time to work. In the meantime, if schools within the region want to promote the use of computers for learning, instead of employing recent graduates they may be better served opting for more experienced teachers with knowledge of both pedagogy and the use of educational software. Whilst this advice seems plausible, it is also likely to be overly simplistic. After all, there were less experienced teachers within the sample and it would be wrong to equate proficiency with simply years of experience. The sample no doubt excluded many experienced teachers, and there are other features that characterise a proficient computer-using teacher.

8.2.2 A Group of Dedicated and Well-Qualified Teachers

The participating teachers were dedicated and well-qualified professionals with the majority having completed a qualification beyond their teaching diploma. It is unlikely that these additional qualifications were merely a product of their experience as many of the credentials included course work specific to the computers in education area. This indicates a strong

commitment to the area as well as to their own continuing education and on-going improvement as a teacher. The propensity towards further study does not, however, appear to be motivated simply by personal gain as there was also a strong desire to do the best for their students. There were examples where teachers did not necessarily enjoy using the computer in the classroom. These teachers, nonetheless, recognised the need to acquire further expertise in the use of educational software for learning purposes. The results suggest, as in other studies of this type, that proficient practice is related to teachers' devotion to their work and the perceived benefits for students in learning 'from' and 'with' the computer. It is the level of satisfaction that teachers derive from the students that is an important factor in the integration of the computer into the classroom programme.

8.2.3 The Tension Between Satisfaction and Frustration

There was considerable tension between feelings of satisfaction and frustration among the participating teachers. Although most teachers gained satisfaction from using the hardware and software, and some were highly enthusiastic about educational computing, just as many were frustrated by their efforts to integrate the computer into the classroom. The dichotomy between these two different outlooks was a distinctive feature of the sample and it raises a number of interesting questions. If we assume that frustrated teachers were once enthusiastic then will many enthusiastic teachers also become discouraged over time? Why do teachers lose their enthusiasm for computers? Is there a cycle of implementation that reaches it pinnacle when teachers finally become disillusioned with using computers for learning? According to Cuban (1986) the history of educational technology is characterised by a cycle of high expectations, rhetoric, theory, increasing resources followed by dissatisfaction that initial expectations are not being realised. Marcinkiewicz (1994) describes a similar pattern with the brief history of computers in education.

There is evidence that the novelty of the computer may be wearing off among more experienced proficient computer-using teachers. The most enthusiastic teachers were generally the least experienced practitioners in terms of both years teaching and classroom computer use. Perhaps more experienced teachers have seen other educational innovations come and go and were never as enthused as their less experienced colleagues. It could also be a phenomenon of life-span development in that as teachers mature they are less enthusiastic about new educational innovations. Alternatively, these teachers may have put more work into the computer at a time when there was less recognition and fewer resources to support their efforts. Consequently, they have been worn down and become frustrated by the demands of the computer, and the more enthusiastic teachers represent a second wave of practitioners who are still keen to experiment with using educational software in the classroom. Whatever the conjecture, it is reasonable to assume that this enthusiasm is

essential if the computer is ultimately to have a major impact on teaching and learning processes.

8.2.4 The Emergence of a Second Wave

If the wave theory is a credible explanation, then the study indicates that the first wave of proficient computer-using teachers were largely men. There is a significant time difference between the year that male teachers first used a computer in the classroom and the period when most women began to use educational software for learning purposes. The fact that men have more experience using the computer explains in part why comparatively more male teachers have a formal qualification in the area. Moreover, why men are more likely to have special responsibility for the use of computers in their school. There are obviously other factors involved, and some exceptions, but the male teachers long-standing interest in the field is clearly shown in data on home computer use. A high percentage of men reported access to a home computer and those who participated in later phases of the research claimed to have owned a machine for a number of years. Although explanations for their waning enthusiasm are highly speculative, one could deduce that the computer was once a hobby, but now more of a burden. The male teachers may have subsequently been promoted into positions of responsibility and no longer have the same time to give toward the computer. A less favourable interpretation is that the initial mystic of the computer has been lost and the hardware does not attract the same status for teachers who have expertise in this area.

The second wave of proficient computer-using teachers provides some encouraging signs that women are now taking to the hardware and software. It even seems that their participation could be helping to reshape the predominant type of computer learning culture. Women teachers reported different perceptions with regard to their rationale for using computers in schools, and were more inclined to value the social interaction that was perceived to be generated from educational software. It would be exciting to think that the emergence of a group of women proficient computer-using teachers may provide positive role models for others, and, thereby, help overcome some of the documented inequities related to the technology (see for example, Sutton, 1991). This second group of teachers could be evidence that inservice teacher education initiatives and other types of educational opportunities are having a definite impact on the use of computers in schools. The lack of Maori teachers identified in the study is still a matter of concern and this is an area that needs to be addressed by schools within the region. It would seem, however, that within the population of the study there are now a core of women teachers who fit the genre of 'enthusiastic beginners' and are confident in their ability to use computers to create conditions for better learning.

8.2.5 A Group of Confident Teachers

The proficient computer-using teachers were, as in prior research of this type, confident about their perceived ability to use a computer in the classroom. It was notable that a higher percentage of women, as opposed to men, were highly confident in their own ability. This difference is surprising given the greater computer experience of the male teachers. On the other hand, there may be some inter-play between the higher level of enthusiasm of the less experienced teachers and their reported confidence. The enthusiasm of these teachers could well manifest itself in more self-assurance. Alternatively, it may be that experienced male computer-using teachers perceive that the more they know about computers, the less they realise they actually know! In other words, their confidence is tempered by the dynamic nature of the field and the knowledge that their skills and understandings can never remain up-to-date. There are other possible explanations, such as differences in pedagogical knowledge and the understanding of educational theory; the women were generally better qualified in the study of education than their male counter parts. It is problematic, however, to overly interpret data on the profile of proficient computer-using teachers. This profile is largely a reflection of the selection criteria. Rather than speculate on the differences between the background experiences of the teachers, it is more fruitful to focus on the beliefs that underpin their proficient teaching practice.

8.2.6 Teachers' Beliefs about Learning and Computers

The dominant orientation of the participating teachers was towards a learner-centred philosophy. It would be wrong, however, to describe this philosophy as a monolithic belief. There were different beliefs of teaching and learning based on quite contrary assumptions. The philosophy was highly theoretical for some teachers and expressed through explicit beliefs about their role in the classroom, whereas the emphasis on the learner was an intuitive and spontaneous outlook for others with no obvious underpinning formalised theory. Indeed, the majority of teachers were unable to fully articulate the theoretical basis of their own teaching philosophy. It is inappropriate to conclude that because these teachers could not express themselves according to formalised theory they have less developed ideas and less commitment to their beliefs. The Dreyfus brothers would argue that the computer-teacher partnership is so well developed that teachers have automatised their beliefs and intertwined them within their teaching practice. This shows how difficult it is to elicit teachers' beliefs and bridge the gap between the 'ways of knowing' and formalised theory.

The common denominator of the learner-centred philosophy was that the teacher should be a facilitator of learning. Although a useful metaphor, it does not really convey the actual differences in the proficient computer-using teacher's beliefs. There were significant differences between teachers with less explicit, or automatised, beliefs and those with a

definite teaching philosophy. The teachers with automatised beliefs tended to describe the role they adopt in the classroom as a co-learner with a strong emphasis on fun and discovery learning. It is possible to infer, albeit tentatively, that these teachers' beliefs fit comfortably within naive constructivist theory. The more lucid teachers, who coincidently were also those undertaking advanced study, believed that the teacher had a more pro-active role in the classroom. As facilitator, it was their role to scaffold and model 'good' learning. There is evidence that these beliefs were influenced by not only constructivist pedagogy, but also contemporary thinking underpinning cognitive apprenticeship and socio-cultural learning theory. It seems that the study of formalised theory was helping these teachers to refine their teaching philosophy and thereby better understand the potential benefits of using the computer in education.

8.2.7 The Role of Theory

The major difference between these teachers and others in the study is that they were using the 'conceptual language' of formalised theory to consciously reflect on their practice. Although 'reflection on action' is not the ultimate aim of teaching, it is highly desirable that teachers should be able to articulate and justify decisions they make in the classroom. The fact that many of these decisions may be automatised is not the point. It would be unacceptable for any other professional group to stand by their actions when there is no obvious philosophy from which these arise. This is not a criticism of the teachers in the study, but rather a comment on the failings of policy makers. There has never been a national policy on the use of computers in New Zealand schools. Consequently, many teachers appear unsure about the precise role of the computer within the curriculum. Moreover, it would seem that professional development initiatives within the region have been unsuccessful in helping teachers develop a clear philosophy for computer use which is based on an explicit educational theory.

Collis (1994) argues that professional development on computers in education throughout Australia, Europe and North America has taken place removed from theory and research. Furthermore, it has evolved apart from expertise and knowledge on mainstream teacher education itself. The field has been hamstrung by the historical accident that many providers of professional development have not had the formal academic and theoretical background required of teacher educators (Collis, 1994). In addition, problems of teacher education have been confounded by the involvement of many people outside of the field of education. This is a highly contentious argument, but it is not a stance without supporting evidence. For example, despite the majority of teachers in this study participating in professional development on the use of computers, few could state explicit cognitive benefits from using educational software in schools. The only teachers in this study to raise the development of

thinking skills were those who were studying formalised theory. It is unfortunate that the 'reflective practitioner' model of teacher education contains a degree of anti-intellectualism that belittles the role of theory (Eraut, 1994). There is support in this study for the view that the path to enlightenment and empowerment is through teachers increasing knowledge and understanding of educational theory.

8.2.8 Changes to Teachers' Beliefs

A key difference between this research and earlier studies is that teachers reported few changes to their teaching practice as a result of using computers in the classroom. The computer did not appear to drive teachers practice in bold new directions. There are several possible explanations for this difference. Firstly, teachers may not have been able to accurately recall the changes that took place. Secondly, teachers may not have been consciously aware of their prior beliefs and, therefore, were unable to reflect on any subsequent changes to their practice as a result of introducing the computer. Some support for this position comes from the teachers inability to articulate their philosophies about learning and computers. Thirdly, proficient computer-using teachers may already value a learner-centred philosophy and their inclination to integrate the computer into the classroom is influenced by this belief. The social nature of educational computing is undoubtedly in accord with a learner-centred philosophy, and may explain why teachers reported that collaborative interactions 'at' and 'in relation to' the hardware were the main benefits of classroom computer use.

If this explanation has any validity there are some significant implications. The claims of prior research that computers have resulted in deep changes to teachers practice must be questioned, especially when such conclusions are largely based on survey techniques. This interpretation highlights the inadequacies of prior research and emphasises the importance of further teacher education. The premise suggests that teacher education initiatives might be better directed at raising the consciousness of teachers about their own beliefs and challenging their existing views in an attempt to promote a commitment to a more learner-centred philosophy. Miller and Olson (1995) argue, that it is teachers' existing beliefs and practices that are influential in the way computers are used in school. It is naive to think that teachers will suddenly embrace a learner-centred philosophy because they have learnt the mechanics of how to use a new machine in the classroom. Similarly, that teachers will adopt learner-centred approaches as a result of much practice experimenting with computers for learning. There are sound reasons to assume that computers are used by proficient teachers in innovative ways because they already harbour such a philosophy.

8.2.9 Overcoming the Resistance to Change

The converse of this interpretation is that teachers traditional philosophies of learning appear resistant to the impact of the computer when change might be desirable. In this regard, it is important that professional development avoids reinforcing the belief that the computer is simply a 'tool' as this may be counter productive. The computer is not like other learning aids in the classroom and the metaphor does not do the unique features of the hardware and software justice. Furthermore, such a metaphor gives teachers an excuse for why the computer should not have a more prominent role in the classroom. The computer is no ordinary innovation and it is a concern to think that there were participants in this study who perceive professional development has given control of the computer back to many teachers with detrimental effects. When computers were first introduced to education the students were often considered to have more knowledge than the teachers. It may be a case that less proficient computer-using teachers have now acquired sufficient knowledge to use the software in ways that have minimal impact on the conditions for learning in their classroom. The challenge for professional development is to address teachers resistance to change by revealing out-dated modes of teaching and using contemporary educational theory (and research) to link the latest computer innovations to new models of learning.

8.3 THE STUDENTS

In previous research the students have been a neglected variable. There has been a tendency to equate the proficient practice of teachers with better learning outcomes. This study makes no strong claims to studying learning outcomes, but it does demonstrate that students have an important influence on how the computer is used in the classroom. The student is a key partner in shaping the development of a computer learning culture. Their experiences and perceptions cannot be overlooked in the analysis of proficient computer-using teachers. In the following section a cross case comparison is offered on the competencies and perceptions of students involved in the study.

8.3.1 Comparison of Students' Competency

There were few obvious differences in the competency of students within the two case studies. Perhaps the most significant difference was that in one classroom boys appeared to be more technically competent than the girls, whereas in the other there was little apparent difference by gender. In both classrooms the students designated as computer 'consultants' or 'monitors' were generally more competent than other users. A related point is that these students gained a high level of status from this role. There were times when the more competent students did not always share their knowledge with others. Often, when asked for help, the consultant or monitor would take control of the keyboard and solve the problem

without leaving the student who requested assistance the knowledge of how to do it for themselves. This problem occurred in both cases and gives weight to Shrock and Steep's (1991) conclusion that student experts do not necessarily facilitate more proficient use of the computer in the classroom.

The issue of what constitutes student proficiency with computers is quite contentious. Over the years there have been attempts to define the knowledge and skills that students should develop from classroom computer use. The various definitions have given rise to different concepts of computer literacy. This concept is subject to much debate and has frequently been criticised for being too narrow. It is common for many definitions to focus on the technical skills only of using the hardware and software. This research can be criticised for defining competency in this manner. What is required according to Beynon (1993) is a new paradigm of 'technological literacy' where students are able to critically 'read' the role of technology in society. The focus of investigation, from this perspective, would be not only on students' ability to use the computer, but also on their knowledge of how it pervades their lives and who in society benefits from the technology. There was no attempt in this thesis to gather data on such a conceptualisation of literacy.

8.3.2 Comparison of Students' Perceptions

The major difference between the two case studies was in students' perceptions towards outcome expectancy. The boys in one classroom were far more positive towards the computer than the rest of the students. In particular, these boys appeared to perceive distinct vocational benefits from learning how to use the computer. It would be easy to explain the different perceptions in terms of the gender of the two teachers. However, Rocheleau (1995) shows that background socio-economic variables, besides gender, are key indicators of students' capabilities and perceptions. A high percentage of these boys had access to a home computer and other contextual variables may be involved. That there were few differences between students' perceptions in Anne's classroom could indicate the moderating influence of the teacher. Alternatively, it may simply be that these students have less prior computer experience and have not been exposed to the same expectations as those in higher socio-economic communities. The different perceptions of the students begs the question, however, of what will happen to their views about the computer as they progress through school? At present there is little comparative data and at best this study only establishes a bench mark for further research.

8.4 OTHER FACTORS

The study shows that there are a number of other factors which influence the development of a computer learning culture. Computers, teachers and students are part of a wider social

system that impacts on what happens in the classroom. There are agencies and intere groups at different levels of the New Zealand education system that effect the practice proficient computer-using teachers. This section discusses issues regarding school, region and national support for computer use. It also considers how time to use the computer is major variable in teachers proficient practice.

8.4.1 Lack of School Support

It was significant that several teachers involved in the study identified school-wide suppo as being critical in establishing the conditions for their proficient teaching practice. Th support of colleagues and the commitment of both the principal and BOT were undeniab important; a conclusion consistent with Hadley and Sheingold's (1993) research and that b Zammit (1992) on factors that hinder the use of computers in schools. Lack of support wa found by Zammit to be a major variable which discouraged teachers from using computer Ryba, Anderson and Brown (1992) have shown how the commitment of a whole school t computers can support teachers efforts in the classroom. According to the participants in th study, the type of commitment needs to include further consideration of space and buildin requirements related to computer use, the provision of adequate hardware and software ar the allocation of resources to help teacher coordinators spend more time supporting oth teachers. The development of an up-to-date policy on computers within the school and th support for further teacher education must also be given high priority.

8.4.2 Lack of Regional Support

A major factor perceived to inhibit computer use was the extent of regional support. Despi the study taking place in a district with a tradition of computer use, there was dissatisfactio with the opportunities for teachers to exchange ideas with one another. This shows that th role of 'informal' knowledge networks should not be underestimated, and there is a stron case for setting up a more formal and regular method of contact between computer-usin teachers. There has not been such a group in the region for a number of years. It may b worthwhile re-establishing a forum like that previously through the New Zealand Compute in Education Society. Alternatively, an electronic listserv may now be a viable and potentiall useful medium in getting teachers to share information. The research in this area, howeve shows that without a specific aim and central moderator the results may be discouraging (se for example, Grint, 1992). Although teachers welcomed further local professiona development initiatives, there was a strong perception that a second tier of teacher educatio was necessary to build on levels of existing expertise. The message here is that future teach education initiatives within the region need to support both novice and proficient compute using teachers.

8.4.3 Lack of National Support

The lack of support at a national level for the use of computers was a frequent concern raised by the participating teachers. Many teachers were looking to policy makers for some reassurance about their existing teaching practice and were wanting more explicit guidelines on the role of computers within the curriculum. A few teachers expressed the 'hope' that the new Technology Curriculum would address some of these concerns. The problem is that most teachers were generally equating the terms 'technology' and 'information technology' directly with the computer. This is a common misconception and one that needs to be corrected on a national basis. The most damming criticism, not surprisingly, of central government was the lack of financial support for schools to purchase new hardware and software. Clearly, one teacher was angry that their role was reduced to collecting supermarket vouchers to get more computers. There are obvious dangers for schools that are reliant on groups with commercial interests and there is some evidence that teachers were finding it difficult to make sense of the information being bombarded to them from the various interested parties. If schools are going to receive a major injection of funds for additional computer equipment then, hopefully, they will also obtain from central government sound advice on how to spend this money.

8.4.4 Lack of Time

A variable often ignored in one dimensional models of educational computing is time. Clearly 'time' has a direct bearing on the type of computer learning culture that develops from interactions between the different elements within an educational system. At each phase of the research time, or lack of it, was identified as a critical factor in determining the type of computer use. The teachers involved in the study spent considerable time planning and preparing for computer activities in their classroom. Even so, few teachers perceived they were able to give the commitment to the area that it really deserved. A lasting impression from the case studies was the lack of time available for using the computer in the regular programme. The problem is, arguably, being confounded by the range of new hardware developments and educational software being offered to schools. The point is that there are potentially unrealistic expectations of what can be done with computers in the regular classroom. It may be that current expectations and educational theory about the use of computers and proficient teaching is impossible. If we add together all that is expected of a proficient computer-using teacher and note the current conditions in schools, the sum of the activities to be undertaken might be making greater demands than any individual could possibly fulfil.

8.5 FURTHER LIMITATIONS

With the benefit of hindsight it is important to acknowledge that the research comprised a number of further limitations. If teachers beliefs are automatised then it is problematic to claim with confidence that the study captures such understandings. There is also a question whether the beliefs of teachers are accessible through just one interview. A related issue is that it was difficult to get some teachers to converse about their deeply held beliefs. This problem may have been compounded by the researcher's gender. Even if data represents a trustworthy account of beliefs there may be a mismatch between these and teachers actual practice. In other words, data may not convey an accurate description of what happens in the classroom. As a purposive sample there is also the possibility that teachers were eager to present themselves in the best light. This may have been particularly so during the case study phase of the research. The study of computer use in the regular classroom is not an easy task and there were problems in eliciting students' perceptions. At times the researcher was conscious of rephrasing questions to make these more explicit. Accordingly, there is doubt over the validity of perceptions data, especially given the time frame of the study and the age of the students. The discussion shows that comparison of data with previous research in other contexts is fraught with problems. There are subjective meanings assigned to the computer and it is difficult to compare the findings and interpretations of this study with similar research. Lastly, the field of educational computing is particularly dynamic and the research may now be out-of-date such that replication of the study might be meaningless.

8.6 SUMMARY

The main elements that contribute to the development of a computer learning culture have been discussed in relation to the results. The computer is demonstrated to be a multi-purpose technology that is difficult to generalise as having universal effects on teaching and learning. A detailed analysis was provided of the experiences, perceptions and beliefs of teachers 'nominated', 'perceived' and 'judged' to be proficient at using computers in the classroom. These teachers were shown to have considerable teaching experience, and it was proposed that in the past decade there have been two distinct waves of computer implementation within schools. A paradoxical orientation towards a student-centred approach was claimed to reveal itself from the teachers beliefs, and a strong argument put forward for computer-using teachers to have a more explicit grounding in educational theory. The competencies and perceptions of students involved in the research were compared along with other factors perceived to influence computer use at different levels of the school system. Finally, further limitations were outlined with the research and the overall interpretation of the results.

The final chapter evaluates the research in realising its objective and considers the overall implications of the study for practice, theory and research.

CHAPTER NINE

Conclusion

"The future, and in particular the future of education, will be what we make it" (Nickerson, 1988, p.29).

9.0 INTRODUCTION

This final chapter evaluates the research in achieving its objective and realising the specific research aims. The research is claimed to be generally successful in what it was designed to achieve. Implications of the study are considered for practice, theory and research. It is concluded that proficient computer-using teachers require a unique blend of expertise in teaching pedagogy and domain specific knowledge about the computer itself. The study shows that educational theory can help teachers acquire this knowledge as well as the 'conceptual language' for making critical reflections on their computer practice. The lesson, in turn, for educational theory is to avoid generalisations about the potential of the computer as it is a multi-dimensional machine. Data demonstrate the need to unify theories of learning with theories on teaching in a perspective responsive to teachers voice. The message for research is that much can be gained from studying computer-using teachers, particularly when questions elicit deeply held beliefs and are framed in regular settings of the classroom. Finally, the thesis illustrates that further debate is required on the purpose of education in the 21st century, so teachers can evaluate the benefits of this technology against the competing rationales for using computers in schools.

9.1 THE OBJECTIVE EVALUATED

The research was designed with the objective of investigating how teachers use computers to create conditions for better learning in the classroom. It sought to document the background characteristics and experiences of teachers who were considered proficient at using computers for learning purposes. A central aim of the research was to gather information on the specific computer applications being used by teachers. The study wanted to describe the changes proficient computer-using teachers perceived to have occurred to their practice as a result of computer use. In addition, it attempted to elicit the participants' beliefs about the processes of teaching and learning and how computers support these processes. It was hoped that the research would identify factors that proficient computer-using teachers perceive inhibit and/or enhance the use of computers in schools. The intention was also to document the role teachers adopt in the classroom during computer-related activities. A

peripheral aim of the study was to gather data on the competence and perceptions of students in the classrooms of proficient computer-using teachers.

The research was notable for the willingness of teachers to participate in the study. This willingness was reflected in a high response rate during each phase of the sample selection process. Consequently, there is every indication that the study was successful in identifying a purposive sample of proficient computer-using teachers. The questionnaire was generally effective in gathering data on teachers background characteristics and experiences and the range of computer applications being used in the classroom. It also gathered some useful preliminary information on teachers' perceptions towards computer use in education. The interview provided contextual data on ways teachers were using educational software for learning, but was less successful in gaining an insight on how computers were perceived to have changed classroom practice. A mixture of teachers' opinions, perceptions and beliefs were obtained on teaching and learning and the role of the computer within these processes. It is not possible to claim with confidence that the study was effectual in eliciting the deeply rooted beliefs of teachers. This phase did, however, gather numerous perceptions on the factors that inhibit and enhance the use of computers in schools. The case studies built upon these data and were particularly fruitful in getting the proficient computer-using teachers to converse on aspects of their classroom practice. Some data was obtained on students' competencies and perceptions, but there are still doubts about the trustworthiness of this information. In sum, the research was moderately successful in achieving its initial objective.

9.2 IMPLICATIONS FOR PRACTICE

The proficient computer-using teachers in this study perceive that the computer is best utilised as a writing machine. A distinctive feature of the study was the extensive use of the word processor in schools. That word processing is so prevalent in the participants' classrooms suggests that this application should be the priority for teacher education initiatives with novice computer-using teachers. It would seem sensible to provide information and resources in the area perceived to have most educational value. In other words, teachers should experiment and learn how to use the word processor well, before being encouraged to use a range of other software applications in the classroom. By way of analogy, it would be inadvisable for teachers (and students) to learn the piano, flute, violin and glockenspiel all at the same time. It is important that as teachers learn how to use the word processor their practice is linked to writing theory. As Graves (1984) states:

> *"I think marvellous things can be done with the computer as a word processor -- if it's in the hands of someone who really knows writing" (p.21).*

The point that Graves overlooks here is that the computer must also be used by someone with knowledge of the word processor itself. You cannot expect teachers to use the computer as a writing machine unless they have a sound conceptualisation of the educational possibilities with the hardware and software. There are now some exciting possibilities with desktop publishing software and programs that scaffold the writing process through metacognitive prompts and speech synthesis. Clearly, there is still plenty for teachers to learn in terms of using the word processor in the classroom.

At the same time we must encourage proficient computer-using teachers to explore other ways that educational software can contribute to learning. In particular, there are new opportunities with multimedia and computer mediated communications that these teachers should evaluate. The study shows, however, that as new developments with the hardware and software become available there are new problems in integrating the computer into the curriculum. Rather than waste considerable time on such problems, only to eventually become frustrated, these developments should be studied in the classroom whilst teachers gain a grounding in contemporary educational theory. This theory should help teachers acquire the knowledge that although the instruments change, the music often remains the same. In other words, teachers need a theoretical framework to recognise that new computer technology does not automatically equate to better learning. It is essential that teachers are empowered through educational theory with the conceptual language to critically reflect on their practice. A group of reflective theoretical practitioners who are proficient at using computers will help prevent the technology, and other than teaching and learning rationales driving, the future direction of education.

9.3 IMPLICATIONS FOR THEORY

The study demonstrates that it is a common mistake for theory to overly generalise the potential contribution of the computer in creating conditions for better classroom learning. The computer cannot be labelled as a single use machine and future theory needs to be refined to match the diversity of educational software used in schools. It would seem that the study of educational computing would benefit from a greater degree of specialisation with a higher profile being given to the sub-categories of computer use. It is problematic to think that there is one theory that explains how the computer supports the processes of teaching and learning. The continued development of the inclusive learning perspective will go some way towards accommodating a multi-dimensional concept of educational computing. This perspective must, however, give increased attention to theories of teaching and seek to develop a closer link to practice. If theory is not receptive to practice, and is unrealistic about the conditions of the classroom, then it may be counter productive. Those who develop the theory have as much responsibility as teachers who teach with the computer, to bridge the considerable gap that remains between theory and practice.

9.4 IMPLICATIONS FOR RESEARCH

This research offers a snap shot only of teachers' practice with computers in a highly specific context. It does, nevertheless, have several implications for future research. Firstly, it reveals that decontextualised studies of computer-using teachers offer little insight into the rich diversity of classroom practice. The computer is a highly subjective experience and teachers' beliefs have a central place in shaping the nature of computer use. Secondly, we can no longer conceive of the teacher as a constant or stable variable in the computer learning environment. Even teachers within a purposive sample have diverse practices and beliefs about computers. Thirdly, the challenge for research is to document these beliefs in valid contexts that investiagte the software that is actually used in the classroom, and at the same time to develop methodologies that allow teachers to refine their understandings into sound educational philosophies. These are not incompatible goals when research is perceived by the participants to be relevant to the improvement of practice. Finally, the study of proficient computer-using teachers (and the students in their classrooms) is clearly a fruitful area of inquiry when research is guided by, and analysed with, theory that transcends the educational computing literature and that on proficient teaching *per se.*

9.5 FINAL REMARKS

The computer is a complex educational phenomenon and caution is required in generalising the findings and implications of this study for practice, theory and research to other contexts. For this reason, the thesis does not offer any definitive answers in relation to classroom computer use. This would be contrary to the spirit of the research which sought to understand only existing practice. Furthermore, a list of recommendations would be incongruous with the multi-furious nature of the field. The computer must, nonetheless, be used according to sound principles of teaching and learning. We still need to develop many of these principles and debate what constitutes proficient teaching practice with computers. This debate should be mindful of how the computer displaces other potential learning opportunities and involve a reconsideration of the purpose of education in the 21st century. The computer is not an end in itself and the competing rationales, and potential benefits of using computers in schools, can only be assessed when we know what education is for and what type of society we want to create. A final word then on the importance of a clear philosophy and educational theory in relation to the computer learning environment:

> *If you don't know where you're going, then how will you get there? (Courtenay, 1994, p.23).*

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APPENDICES

APPENDIX A

MEMBERS OF THE RESEARCH ADVISORY COMMITTEE

RESEARCH ADVISORY COMMITTEE

Chairperson

Mr Barry Jackson, Senior Lecturer, Department of Information Systems, Massey University, Palmerston North.

Qualifications

BSc (Hons) *Lond.*, MSc *Brun.*, Dip SocSc, MIDPM

Background

Has previously taught at the Palmerston North College of Education. Is a graduate of an advanced course on 'Computers and the Learning Process' and teaches university courses in the area of human computer interaction. Recent sabbatical at the Open University (UK) -- Computer Assisted Learning Unit. Has a particular interest in multimedia and computer mediated communication (CMC) being used for learning and is currently pursing research in these areas.

Member

Dr Janet Burns, Senior Lecturer, Department of Educational Psychology, Massey University, Palmerston North.

Qualifications

BSc, MSc (Hons), DipEd Stud, PhD

Background

An experienced researcher and university academic. Has major responsibility for teaching a graduate course on research methods in education. Also teaches an advanced course on technology education. Current research involves an investigation of the effectiveness of tertiary level bridging courses in science and technology education. Was once employed in the Research and Statistics Division of the Ministry of Education. During this time was the New Zealand National Coordinator of the IEA International Study on Computers in Education.

Member

Mr David Giles, Lecturer, Department of Professional Studies, Palmerston North College of Education, Palmerston North.

Qualifications

BEd, Dip Tchg (Completing MEd)

Background

Has previously taught at both the primary and secondary level and currently teaches courses to pre-service teachers on aspects of educational theory. Was until recently Head of Department in Maths at Freyberg High School. During this time he was closely involved in the 'Freyberg Integrated Studies Project'. This project made extensive use of computers across the curriculum. Has completed graduate courses on 'Computers and the Learning Process' and 'Computers Across the Curriculum' and is completing a Masters Degree in Education.

Member

Mrs Anne Lawrence, Special Needs Teacher, Awatapu College, Palmerston North.

Qualifications

BSc, Dip Ed, Dip Tchg

Background

Has completed a 300 level Bachelor of Education course on 'Computers in Education'. More recently has been employed as a tutor in this course. Currently uses computers on a regular basis with students with special learning needs. Has assisted with pre and inservice courses on the use of computers in education and has an active interest on the use of educational software for learning.

APPENDIX B

PHASE ONE OF THE RESEARCH

18th June 1993

«Name»
«Institution»
«address»
«location»

Dear «Name»

I am writing to seek your assistance with a study I am doing on computer use in Palmerston North primary and intermediate schools. As part of my thesis, toward a Masters of Education, I am wanting to study teachers in your school, who are, in your opinion proficient in the use of computers in their classroom.

This study of proficient computer-using teachers aims to collect information on the types of arrangements and conditions where computers are actually used to enhance the teaching and learning of children. This information may potentially help teachers, principals and Boards of Trustees to make informed decisions about the use of computer technology in their schools.

To assist in identifying teachers for participation in this study, I would be grateful if you would complete and return by the **30th June** the attached form. The information that you provide will be treated as confidential. This information will be used as a basis for the selection of teachers to participate in the study.

If you have any questions concerning the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

Thank you for your cooperation. I value your assistance and will undertake to keep you and the participating teachers informed of the results. A summary of the results will be sent to you at the end of the study.

Mark Brown

Please return by the **30th June 1993.**

MASSEY UNIVERSITY
Department of Education

Study Of Computer-Using Teachers

The aim of this study is to examine ways in which teachers use computer technologies to enhance teaching and learning in their classrooms.

To assist in identifying teachers for participation in this study I would be grateful if you would nominate one or more primary or intermediate teachers within your school, who in your opinion are proficient in the use of computers in their classroom.

This information will be used as a basis for the selection of teachers to participate in the study. Your response will be treated as confidential. The teachers you nominate will be invited to participate in the sudy but no teacher will be involved without their prior permission.

==========

SECTION ONE

If you are unaware of any proficient computer-using teachers, or do not wish to nominate any specific teachers, please complete (tick) this section and return in the reply paid envelope on or before **30th June** 1993.

☐ I am unaware of any proficient computer-using teachers.

☐ I do not wish to nominate any proficient computer-using teachers for the following reasons:

==========

SECTION TWO

If you are able to nominate one or more proficient computer-using teacher please complete this section and return in the reply paid envelope on or before **30th June** 1993.

I consider the following teachers proficient in the use of computers in their classroom:

TEACHER'S NAME	SCHOOL	POSITION	LEVEL

(Use the reverse side of this form if you require more space)

COMMENTS:

Thank you

Mark Brown

Please return by the **30th June** in the reply paid envelope to Mark Brown, Massey University, Dept of Education, Private Bag, Palmerston North.

5th July 1993

«name»
«school»
«address»
«location»

Dear «name»

I wrote to you a few weeks ago seeking your assistance with a study I am doing on computer use in Palmerston North primary and intermediate schools. This study is part of my thesis toward a Masters of Education. I am wanting to study teachers in your school, who are, in your opinion proficient in the use of computers in their classroom.

To assist in identifying teachers for participation in this study, I would be grateful if you would complete and return by the **14th July** the attached form. The information that you provide will be treated as confidential and the names of any nominated proficient computer-using teachers will remain anonymous. This information will be used as a basis for the selection of teachers to participate in the study.

The nominated teachers who agree to participate in this study will be sent a questionnaire relating to the use of computers in their classroom. A small number of the proficient computer-using teachers will, at a later date, be interviewed to collect more detailed information.

I would value your assistance with this study. I hope that as a result of the study I will be able to provide schools with some potentially useful information on how teachers can make the most effective use of information technology in their classroom. I undertake to send you and your school a summary of the results at the end of the study.

If you have any questions concerning the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

Thank you for cooperation

Mark Brown

«name»
«institution»
«address»
«location»

Dear «name»

I am writing to thank you for your assistance with the study I am doing on computer use in Palmerston North primary and intermediate schools. While you were unable to provide the names of any teachers, who are in your opinion, proficient in the use of computers in your school, I am grateful for the consideration you gave to my request. It is usually difficult to identify teachers who are considered proficient in their classroom. For this reason, I value the fact that you took the time to return the nomination form.

The next stage of the study is to contact the nominated proficient computer-using teachers. These teachers will be sent a questionnaire relating to the use of computers in their classroom. A small number of the proficient computer-using teachers, who agree to complete this questionnaire, will then be interviewed in order to collect more detailed information.

I hope that as a result of the study I will be able to provide schools with some potentially useful information on how teachers can make the most effective use of information technology in their classroom. I will send you and your school a summary of the results at the end of the study. If I can help in the future on any matter related to the use of computers in your school please do not hesitate to contact me.

Yours Sincerely

Mark Brown

«name»
«institution»
«address»
«location»

Dear «name»

I am writing to thank you for your assistance with the study I am doing on computer use in Palmerston North primary and intermediate schools. I am grateful for your cooperation. It is usually difficult to identify teachers who are considered proficient in their classroom. I value the information that you provided and I will treat it as confidential.

The next stage of the study is to contact the nominated proficient computer-using teachers. These teachers will be sent a questionnaire relating to the use of computers in their classroom. A small number of the proficient computer-using teachers, who agree to complete this questionnaire, will then be interviewed in order to collect more detailed information.

I hope that as a result of the study I will be able to provide schools with some potentially useful information on how teachers can make the most effective use of information technology in their classroom. I will send you and your school a summary of the results at the end of the study. If I can help in the future on any matter related to the use of computers in your school please do not hesitate to contact me.

Yours Sincerely

Mark Brown

«name»
«school»
«address»
«location»

22 July 1993

Dear «name»

I am writing to seek your assistance with a study I am doing on computer use in Palmerston North primary and intermediate schools. As part of my thesis, toward a Masters of Education, I am wanting to study teachers who are proficient in using computers in their classroom.

You have been recommended «dear» as a teacher who would be suitable to participate in this study. I would value your participation as someone who has been noted for their proficiency in using a computer in the classroom. My study relies on a small number of computer-using teachers so I would very much appreciate your assistance.

The study aims to collect information on the types of arrangements and conditions where computers are being used to enhance the teaching and learning of children. This information has the potential to help teacher educators and other teachers to better understand how to use computers in the classroom.

I would be grateful, therefore, if you would take time to complete the enclosed questionnaire. This questionnaire will involve about 15 minutes of your time. It is designed to collect a range of information about your experience and use of computers with your class. The information that you provide will be treated as confidential. While I will know who has completed each questionnaire, I guarantee that neither you nor your school will be identified in any report of the study.

I hope that you will complete the questionnaire as carefully and accurately as you can. The quality of the study depends on the accuracy and the completeness of the information that you provide. This is the first study of its kind in New Zealand and I would like the results to be as valuable as possible.

There is a chance that after you complete the questionnaire I may wish to interview you to gather further information. I will only need to interview a few teachers, but I would appreciate if you would indicate in the appropriate section of the questionnaire if you are prepared to be involved in any further study. Your response does not commit you, however, to any further study. Please return the questionnaire in the stamped addressed envelope by the **13th August** 1993.

If you have any questions concerning the questionnaire or purpose of the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

Thank you for your cooperation. I value your assistance and I will undertake to keep you up-to-date and informed of the results. A summary of the results will be sent to you at the end of the study.

Mark Brown

MASSEY UNIVERSITY
Department of Education

Proficient Computer-Using Teachers

Purpose

This questionnaire has been designed to gather information from teachers who have been recommended as proficient in the use of computers in their classroom. The data gathered may provide some potentially useful information to other teachers who may wish to make more effective use of computers in their classroom.

Instructions

Please read each question carefully and where appropriate tick the box, circle the response, or write an answer in the space provided. This questionnaire should take about 15 minutes to complete.

THE INFORMATION THAT YOU PROVIDE WILL BE TREATED AS CONFIDENTIAL

1.0 Background Information

1.1 Name of School: _____

1.2 Teaching Position *(AP, Scale A):* _____

1.3 Teaching Level *(Y2, F1):* _____

1.4 Number of Years Teaching in Present School: _____

1.5 Number of Years Teaching in All Schools: _____

1.6 Gender *(M/F):* _____

1.7 Qualifications *(BEd, etc.):* _____

1.8 Age Group *(Please ✓ the appropriate box):*

☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60+

1.9 Ethnic Group *(Please ✓ the appropriate box):*

☐ European ☐ Maori ☐ Polynesian ☐ Other (specify). . . . .

2.0 Computer Experience

2.1 In what year did you first use a computer with a class of children? 19_____

2.2 Do you own a computer or have access to one at home? Yes ☐ No ☐

2.3 If yes, what do you mainly use this computer for? _____

_____

_____

2.4 Have you ever been a member of a computer organisation or club? Yes ☐ No ☐

2.5 If yes, what organisation or club? _____

_____

2.6 Do you have any special responsibility for the use of computers in your school? Yes ☐ No ☐

2.7 If yes, what is the nature of your responsibility? _____

_____

_____

_____

2.8 Have you ever completed a formal course or tertiary qualification on the use of computers in education? Yes ☐ No ☐

2.9 If yes, briefly describe each course or qualification? _____

_____

_____

2.10 Have you attended in the last two years any type of inservice course on the use of computers in education? Yes ☐ No ☐

2.11 If yes, briefly describe each inservice course? _____

_____

_____

_____

_____

2.12 Have you received any other training related to computer use? Yes ☐ No ☐

2.13 If yes, what was the nature of this training? _____

_____

_____

2.14 Have you ever been involved in the training of other teachers on the use of computers in education? Yes ☐ No ☐

2.15 If yes, briefly describe the nature of your involvement? _____

_____

_____

_____

2.16 Do you, or does your school, receive any journals and/or magazines on the use of computers in education? Yes ☐ No ☐

2.17 If yes, what are the names of these journals and/or magazines? _____

_____

_____

2.18 Have you ever attended a conference and/or given a formal presentation on the use of computers in education? Yes ☐ No ☐

2.19 If yes, what was the nature of the conference and/or formal presentation? _____

_____

_____

3.0 Computer Use

3.1 Do children have full-time access to a computer in your classroom? Yes ☐ No ☐

3.2 If yes, how many computers are available for children to use in your classroom? _____

3.3 Do children have regular access to a computer lab in your school? Yes ☐ No ☐

3.4 If yes, how many computers are available for children to use in this lab? _____

3.5 How often do children in your class use a computer? *(✓ the appropriate answer)*

☐ Never ☐ Some Days ☐ Most Days ☐ Every Day

3.6 How many hours were computers used by children in your class last week? _____

(eg: 2 hours of the school day x 5 days of the school week = 10 hours).

3.7 What is the most common way children in your class work when using a computer? *(✓ the appropriate answer)*

☐ Individually ☐ Pairs ☐ Small Groups ☐ Other (specify) .....

3.8 Do you have a method to manage the time children spend working with the computer? Yes ☐ No ☐

3.9 If yes, briefly explain how this method works? _____

_____

_____

_____

3.10 Which of the following types of software have been used (or are definitely planned for use) by your class this year?

(Circle the most appropriate answer for each type of software).

	Frequency			
Drill and Practice Programs	Never	Some Weeks	Most Weeks	Every Week
Tutorial Programs	Never	Some Weeks	Most Weeks	Every Week
Word Processing/Publishing Programs	Never	Some Weeks	Most Weeks	Every Week
Painting and Drawing Programs	Never	Some Weeks	Most Weeks	Every Week
Music Composition Programs	Never	Some Weeks	Most Weeks	Every Week
Interactive Fiction/Adventure Programs	Never	Some Weeks	Most Weeks	Every Week
Logo Programming	Never	Some Weeks	Most Weeks	Every Week
Simulation Programs	Never	Some Weeks	Most Weeks	Every Week
Educational Games	Never	Some Weeks	Most Weeks	Every Week
Database Programs	Never	Some Weeks	Most Weeks	Every Week
Spreadsheet Programs	Never	Some Weeks	Most Weeks	Every Week
Graphing/Statistical Programs	Never	Some Weeks	Most Weeks	Every Week
Data Logging Programs and Devices	Never	Some Weeks	Most Weeks	Every Week
Lego/Logo Robotics	Never	Some Weeks	Most Weeks	Every Week
CD-ROM Programs	Never	Some Weeks	Most Weeks	Every Week
Multimedia Authoring Programs	Never	Some Weeks	Most Weeks	Every Week
Electronic Communication Programs	Never	Some Weeks	Most Weeks	Every Week
Other [specify]	Never	Some Weeks	Most Weeks	Every Week

3.11 What do you consider to be the <u>main</u> benefit of children in your class using a computer?

_____

_____

_____

3.12 List, in order, the actual names of the three most frequently used pieces of software with your class? *(For example; Playroom, Fulltext, Explore a Story, etc.):*

1: _____

2: _____

3: _____

3.13 List, in order, the three main areas of the curriculum where computers are used with your class? *(For example; Language, Maths, Process Writing, etc.):*

1: _____

2: _____

3: _____

3.14 Rank the eight following types of software in order of their educational value. That is, place **1** beside the software you consider to have most educational valuable, **2** beside the next most valuable and so forth.

(Please do not use the same number more than once).

Educational Value

☐	DATABASE PROGRAMS	DRILL & PRACTICE PROGRAMS	☐
☐	TUTORIAL PROGRAMS	INTERACTIVE FICTION	☐
☐	EDUCATIONAL GAMES	WORD PROCESSING	☐
☐	LOGO PROGRAMMING	SPREADSHEET PROGRAMS	☐

3.15 Rank the six following reasons for children using computers in New Zealand schools in order of their educational importance. That is, place **1** beside the reason you consider most important, **2** beside the next most important, and so forth.

(Please do not use the same number more than once).

Educational Importance

☐	To develop children's experience and computer awareness.	To develop children's thinking and problem solving skills.	☐
☐	To give children more responsibility and control over their own learning.	To develop skills useful for future education and employment.	☐
☐	To support the individualised and personal instruction of children.	To develop social skills for collaboration and working with others.	☐

3.16 What do you enjoy most about using a computer in your classroom? _____

_____

_____

_____

_____

_____

4.0 Your Opinion

(Circle the most appropriate answer for each statement).

4.1 I feel confident about using computers with my pupils.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.2 I find computers reduce the social interaction between children in my class.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.3 I am unsure of how to best use the computer with my class.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.4 I find computers useful in only a few areas of the school curriculum.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.5 I believe computers allow more individualised instruction of children in my class.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.6 I find computers allow me in my teaching to link different subjects of the curriculum.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.7 I believe my way of teaching is positively affected when using a computer with my class.

Strongly Agree Agree Not Sure Disagree Strongly Disagree

4.8 Are you be prepared to be interviewed if any further information is required? Yes No

---

5.0 Additional Comments

Do you have any other comments you wish to make about the use of computers in education?

_____

_____

_____

_____

_____

_____

_____

_____

_____

When you have completed the questionnaire please put it into the stamped addressed envelope and return by the **13th Aug** 1993 to: Mark Brown, Department of Education Massey University, Palmerston North.

THANK YOU VERY MUCH FOR YOUR COOPERATION

«name»
«school»
«address»
«location»

23 Aug 1993

Dear «name»

I wrote to you a few weeks ago seeking your assistance with a study I am doing on computer use in Palmerston North primary and intermediate schools. This study is part of my thesis toward a Masters of Education. The thesis is focusing on teachers who are proficient in the use of computers in their classroom.

You were recommended as a teacher who would be suitable to participate in this study. I would value your participation as my study is highly dependant upon a small number of proficient computer-using teachers.

The study aims to collect information on the types of arrangements and conditions where computers are being used to enhance the teaching and learning of children. This information has the potential to help other teachers and teacher educators to better understand how to use computers in the classroom.

I would be grateful, therefore, if you would find time to complete the enclosed questionnaire. This questionnaire will involve about 15 minutes of your time. It is designed to collect a range of information about your experience and use of computers with your class. The information that you provide will be treated as <u>confidential.</u> While I will know who has completed each questionnaire, I guarantee that neither you nor your school will be identified in any report of the study.

There is a chance that after you complete the questionnaire I may wish to interview you to gather further information. For this reason, it would help if you would indicate in the appropriate section of the questionnaire if you are prepared to be involved in any further study. Your response does not commit you, however, to any further study.

I appreciate that this is a busy time of year. It would, however, greatly enhance the quality of my study if you would return the questionnaire in the stamped addressed envelope by Friday the **3rd September,** 1993. If you have any questions concerning the questionnaire or purpose of the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

Thank you for your cooperation. I value your assistance and I will undertake to keep you up-to-date and informed of the results. A summary of the results will be sent to you at the end of the study.

Mark Brown

«name»
«school»
«address»
«location»

17 Sept 1993

Dear «name»

I wrote to you at the end of the second term seeking your assistance with a study I am doing on computer use in Palmerston North primary and intermediate schools. This study is part of my thesis toward a Masters of Education. The thesis is focusing on teachers who are proficient in the use of computers in their classroom.

I am mindful that when I first wrote it was a very busy time of the year. You may not have had time to complete the questionnaire. I would, however, still value your participation in the study. For this reason, I have included with this letter another copy of the questionnaire. This questionnaire will involve about 15 minutes of your time. It is designed to collect a range of information about your experience and use of computers with your class. The information that you provide will be treated as confidential. While I will know who has completed each questionnaire, I guarantee that neither you nor your school will be identified in any report of the study.

The study aims to collect information on the types of arrangements and conditions where computers are being used to enhance the teaching and learning of children. This information has the potential to help other teachers and teacher educators to better understand how to use computers in the classroom.

There is a chance that after you complete the questionnaire I may wish to interview you to gather further information. It would help if you would indicate in the appropriate section of the questionnaire if you are prepared to be involved in any further study. Your response does not commit you, however, to any further study.

You will greatly enhance the quality of my study if you would return the questionnaire in the stamped addressed envelope by Thursday the **30th September,** 1993. If you have any questions concerning the questionnaire or purpose of the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

Thank you for your cooperation. I value your assistance and I will undertake to keep you up-to-date and informed of the results. A summary of the results will be sent to you at the end of the study.

Mark Brown

«name»
«school»
«address»
«location»

Dear «name»

I am writing to thank you for your assistance with the study I am doing on computer use in Palmerston North primary and intermediate schools. I am grateful for your cooperation «name» in returning the questionniare and I particularly value the information that you provided. I will treat this information as confidential and I guarantee that neither you nor your school will be identified in any report of the study.

In the next stage of the study I will follow-up on a few of the questionniare responses in order to gather further information. Thank you for indicating on the questionniare if you were prepared to be involved in any further study. This was very helpful and I will contact the teachers I would like to study further at the beginning of term three. The intention is to interview a handful of teachers so as to collect more detailed and precise information.

I hope that as a result of the study I will be able to provide schools with some potentially useful information on how teachers can make the most effective use of computers and associated information technologies in their classroom. I thank you once again for your cooperation and I will send you a summary of the results at the end of the study. If I can help in the future on any matter related to the use of computers in your school please do not hesitate to contact me.

Have a nice break!

Yours

Mark Brown

APPENDIX C

PHASE TWO OF THE RESEARCH

MASSEY UNIVERSITY

Department of Education

Learning and Computers:
A Study of Proficient Computer-Using Teachers

MEd Thesis

By Mark E Brown

Advisory Committee Meeting

(6:30pm 22nd Aug, 1993)

AGENDA

1. Introduction
2. Appointment of a Chairperson
2. Background Information
3. Selection Criteria
4. Preliminary Analysis of Questionnaire Results
5. Selection of *'Perceived Proficient Computer-Using Teachers'*
6. Looking Ahead
7. AOB

MASSEY UNIVERSITY
Department of Education

Learning and Computers:
A Study of Proficient Computer-Using Teachers

MEd Thesis

By Mark E Brown

Background Information

I first started the research in June when I invited 'Principals', 'BOT Reps' and 'Experts' in the Computers in Education field to nominate teachers (within a 10km radius Palmerston North City) who they considered to be proficient at using computers in their classroom. After sending out a follow up letter I achieved the following response rates:

BOT Rep	29/34	85%
Principals	27/34	80%
Experts	7/8	87%

All those who returned the nomination forms, regardless of whether they nominated any proficient computer-using teachers, were sent a letter of thanks. The people who had not responded were contacted by telephone to ascertain whether they had received the nomination form, whether they intended to reply and whether they knew of any proficient computer-using teachers.

In total, 39 teachers were nominated as proficient at using computers in their classroom. Three of these teachers worked in schools outside the area selected for study. The remaining 36 proficient computer-using teachers (in 16 different schools) were sent a letter explaining the purpose of the study. Included with this letter was a questionnaire for the teachers to complete.

This questionnaire addressed the following research questions:

i) What are the characteristics of proficient computer-using teachers in terms of their educational experience and background?

ii) How do proficient computer-using teachers use computers to support student learning?

After sending out a follow up letter and another copy of the questionnaire, I achieved the following response rate:

Proficient Computer-Using Teachers

Returned Questionnaires	31/36	86%

All those who completed and returned the questionnaire were sent a letter of thanks. At the beginning of the third term the remaining teachers were sent another letter and questionnaire. A third letter and questionnaire was sent out mainly because the other material would have come at the end of the second term (a very busy time). In following up by telephone, of the 5 teachers who had not completed the questionnaire, three indicated they would do so in the next week and two indicated that they did not want to participate in the study.

The next stage is to select the teachers for follow up interviews. The teachers who are selected for interview will be *perceived as proficient computer-using teachers*. Your role as an Advisory Committee member is to assist with this selection process. I will need to convince you which teachers should be invited to participate in the next stage of the study. I have included with this background information a copy of the criteria that will used to guide the selection process and a preliminary analysis of the questionnaire results. The raw data will be available for you to examine during the meeting. The questionnaire information is confidential and I ask that you treat it in this light.

Finally, I value your assistance with this study and I look forward to working with you as we select the teachers most suitable for further study.

MASSEY UNIVERSITY
Department of Education

Learning and Computers: A Study of Proficient Computer-Using Teachers

By Mark E Brown

Criteria for the Selection of Perceived Proficient Computer-Using Teachers

The perceived proficient computer-using teachers who will be selected for further study will need to satisfy the following criteria:

1. Full-time employment in a Palmerston North primary or intermediate school.

2. Full-time access to a computer and students within the normal classroom.

3. At least three years teaching experience in the classroom.

4. At least three years teaching experience with computers in the classroom.

5. A qualification related to educational computing or some type of professional development on the use of computers in education.

6. Uses a computer with students in the classroom most days of the week.

7. Uses more than one computer application most weeks of the year in the classroom.

8. Values and Uses 'tool' applications of the computer.

9. Recognises the importance and opportunities computers provide for the development of thinking and social skills in the classroom, and the chance to give children more control over their own learning.

10. Feels confident about using computers in the classroom, is sure how to best use them, and believes that their teaching has been positively affected as result of computer use.

<<name>>
<<address>>
<<location>>

23 Sept 1993

Dear <<name>>

I writing to express my appreciation for your time and effort the other night in helping me to select the computer-using teachers for further study. I value your membership on my thesis Advisory Committee and I am grateful for your on-going support during the selection process. I apologise for underestimating the time I thought it would take to select a smaller group of teachers for further study. I was delighted, however, with the way the Committee considered the merits of each individual computer-using teacher. Your thorough analysis of the questionnaire responses helped to identify thirteen teachers for the next phase of the study. I am committed to making the study as valuable as possible. I hope that I can collect important information on the characteristics and conditions where computers are being used to enhance the teaching and learning of children.

I enclose, for your information, a summary of the questionnaire responses for the thirteen teachers selected for further study. I will contact you again, for your further assistance, when I have completed the next phase of the study.

Regards

Mark E Brown

«name»
«school»
«address»
«location»

23rd Sept 1993

Dear «name»

I am writing to you to seek your further assistance with the study I am doing on computer use in Palmerston North primary and intermediate schools. While I realise that you indicated you were unavailable for further information, I would be grateful if you would reconsider your availabilty. I am committed to making this study as valuable as possible, but its quality depends upon more detailed and precise information. I would appreciate it, therefore, if you were willing to participate in a follow-up interview. This interview would involve about 1 hour of your time and would be conducted at a time and place of your convenience.

I will telephone you in the next few days to see if you are still prepared to participate in the study. If you are willing to continue to be involved I will want to arrange a suitable time and place to conduct the interview.

I must point out, once again, that all the information you provide is treated as confidential. I guarantee that neither you nor your school will be identified in any report of the study. Furthermore, you are free to withdraw from the study at anytime.

If you have any questions concerning this stage of the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

As already indicated I will keep you up-to-date and informed of the results and send you a summary of these at the end of the study.

Regards

Mark E Brown

«name»
«school»
«address»
«location»

23rd Sept 1993

Dear «name»

I am writing to you to seek your further assistance with the study I am doing on computer use in Palmerston North primary and intermediate schools. You may recall that as part of my thesis, toward a Masters of Education, I am studying teachers who are proficient in using computers in their classroom.

I hope that this study will collect important information on the types of arrangements and conditions where computers are being used to enhance the teaching and learning of children. This information has the potential to help other teachers and teacher educators to better understand how to use computers in the classroom.

The questionnaire responses have already provided me with some interesting information. It is important, however, for the quality of the study to gather some more detailed and precise information. When you completed the questionnaire you indicated that you would be prepared to be involved in some further study. For this reason, I would be grateful if you would be willing to participate in a follow-up interview. This interview will involve about 1 hour of your time and would be conducted at a time and place of your convenience.

I am mindful that this request is yet another demand on your time. However, I am committed to making this study as valuable as possible. The study would not be as worthwhile without your participation. I will telephone you in the next few days to see if you are still prepared to participate in the study. If you are willing to continue to be involved I will want to arrange a suitable time and place to conduct the interview.

I must point out, once again, that all the information you provide is treated as confidential. I guarantee that neither you nor your school will be identified in any report of the study. Furthermore, you are free to withdraw from the study at anytime.

If you have any questions concerning this stage of the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Education, telephone 356 9099, extension 8425.

Thank you for your cooperation. I value your ongoing support. As already indicated I will keep you up-to-date and informed of the results and send you a summary of these at the end of the study.

Regards

Mark E Brown

MASSEY UNIVERSITY
Department of Education

Learning and Computers: A Study of Proficient Computer-Using Teachers

By Mark E Brown

INTERVIEW SCHEDULE FOR: PERCEIVED PROFICIENT COMPUTER-USING TEACHERS

Code: _____

Date: _____

Time: _____

Consent: _____

Tape No: _____

Introduction:

The purpose of my research is to understand how teachers use computers in the normal classroom. Most schools in New Zealand now have computers but there is very little information on the ways that teachers use these computers. I hope that through your participation this research will contribute to our understanding of how computers can be used to support the teaching and learning of children. For this reason, I'm interested to hear anything that you think is important when using computers in the classroom. I'd like you to know that I'm not here to judge how you're using computers in the classroom. I'd value your views as a teacher about the role of computers in education.

Consent Form

The research that I'm completing is toward a Masters degree in Education. I'd like to take a minute to explain how the information will be used and give you some assurances about the confidentiality of the information (discuss and complete the consent form).

Interview

I'd like to start the interview by giving you the chance to elaborate on some of the answers that you have already provided in the questionnaire. I have the questionnaire that you returned with me (hand completed questionnaire to participant). Please feel free to discuss any matter that you think is important in relation to using computers in the classroom (wait for response). Are there any questions that you think I should have asked but didn't in the questionnaire (wait for response).

THEMES AND RELATED QUESTIONS

The following themes and related questions act as only a guide.
The aim is to give the locus of control to the interviewees!

Theme 1.0 ***How 'perceived proficient' computer-using teachers use computers to support learning in their classroom.***

1.1 Where is the computer located in your classroom? _____

1.2 What type of computer do you have in your classroom? _____

1.3 It would help if you could clarify the number of hours per week that the computer is used in your classroom? _____

1.4 Can you tell me a little bit more about how you use [_____] (specific software) in your classroom?

_____

_____

1.5 Can you tell me a little bit more about how you use [_____] (specific software) in your classroom?

_____

_____

1.6 What computer uses have you found to be most successful in your classroom?

_____

_____

1.7 What would you consider to be your main goal when using computers in the classroom?

_____

_____

.8 Is there anything else that you would like to say in relation to the questionnaire that you completed?

_____

_____

heme 2.0 The changes 'perceived proficient' computer-using teachers believe they have made to their practice as a result of using computers in the classroom.

1 In what ways do you believe your teaching practice changed since you have used computers in the classroom? Possible areas to explore:

Teaching Methods	Classroom Atmosphere
Quality of Work	Teachers Role
Classroom Interaction	Preparation and Planning
Teaching Satisfaction	Classroom Organisation
Student Motivation	Social Relationships

_____

_____

_____

2 What would you say then has been the most significant change as a result of using a computer as part of your teaching?

_____

_____

heme 3.0 The beliefs 'perceived proficient' computer-using teacher's have about the teaching and learning process.

.1 How would you describe your particular style or approach to teaching?

_____

_____

_____

.2 What ideas about teaching and learning do you think have most influenced your educational philosophy?

_____

_____

.3 Is there thing that best describes your view of how children learn?

_____

_____

_____

Theme 4.0 ***The beliefs 'perceived proficient' computer-using teacher's have about how computers support the teaching and learning process.***

4.1 How would you respond to a teacher who feels that using computers in the classroom is a waste of time?

_____

_____

4.2 What would you say to a sceptical teacher are the specific benefits when children use computers in the classroom?

_____

_____

4.3 Does your school have a written policy about the use of computers in the classroom? _____

4.4 Do you think the benefits of computer use are reflected in this policy?

_____

_____

Theme 5.0 ***Factors 'perceived proficient' computer-using teachers believe enhance and/or inhibit the use of computers in their classroom?***

5.1 What do you think are the main ingredients if teachers are to successfully use computers in the classroom?

_____

_____

5.2 What are some of the obstacles or problems that you believe need to be overcome to make effective use of computers in the classroom?

_____

_____

5.3 Do you have any other comments you would like to make about the use of computers in education?

_____

_____

CODE _____

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FACULTY OF EDUCATION

Mark Brown
Lecturer

DEPARTMENT OF
EDUCATION

Learning and Computers:
A Study of Proficient Computer-Using Teachers

By Mark E Brown

INTERVIEW CONSENT FORM

I am satisfied that I have been fully informed of the nature and purpose of the study. I therefore agree to participate in an interview and have the interview recorded on the condition that:

- all the information I provide remains anonymous
- no information which may identify me or my school is published or referred to in any presentations or reports that are prepared from the study.
- all the information I provide is completely confidential to the researcher, with the possible exception being if, in the professional judgement of the researcher, sharing of such information with a supervising researcher is necessary to maintain the integrity of the study.
- I can refuse to answer any particular questions.
- I can ask further questions about the study at any time during my participation
- I understand that I am free to withdraw from the study at any time.
- I will be given access to the findings and sent a summary of these when the study is completed.

_____ _____

PARTICIPANT'S SIGNATURE DATE

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New Zealand
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Facsimile 0-6-350 5635
Email M.E.Brown@masse

FACULTY OF EDUCATIC

Mark Brown
Lecturer

DEPARTMENT OF
EDUCATION

«name»
«school»
«address»
«location»

Dear «name»

I am writing to thank you for your time and for the valuable information you gave me during our recent interview. I enjoyed our discussion about the different uses of computers in education and the ways that you use computers in your classroom. I am very grateful for your participation as I believe you have provided me with some useful information on the types of arrangements and conditions necessary if computers are to enhance the teaching and learning of children.

I would like to assure you again that all the information you have provided will be treated as confidential. I guarantee that neither you nor your school will be identified in any report of the study. I will send you, as soon as I can, a copy of the interview transcript. I would like you to check the accuracy of this transcript.

I expect that it will take me a while to analyse and write up the results of the study. However, I will send you, as promised, a summary of the results when I have completed the study. If you have any questions concerning the study please do not hesitate to contact me.

Thank you once again for your cooperation.

Regards

Mark E Brown

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FACULTY OF EDUCATION

Mark Brown
Lecturer

DEPARTMENT OF
EDUCATIONAL PSYCHOLOGY

«name»
«school»
«address»
«location»

18 March 1994

Dear «name»

I am writing to let you know that I am still analysing the results of the interview we had last year on the use of computers in your classroom. The information that you provided during our discussion was very helpful and has given me a better picture of how computers are being used in your school. I hope to complete the data analysis phase of the study in the near future. I will contact you again at this point in order to give you the opportunity to clarify any of my interpretations.

Once again, I would like to thank you for your participation. I value the information that you have already provided and sincerely appreciate your on-going cooperation. If you have any questions concerning the study please do not hesitate to contact me.

Best Wishes

Mark E Brown

APPENDIX D

PHASE THREE OF THE RESEARCH

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FACULTY OF EDUCATION

Mark Brown
Lecturer

DEPARTMENT OF
EDUCATIONAL PSYCHOLOGY

<<name>>
<<institution>>
<<address>>
<<location>>

11th October, 1994

Hello <<name>>

I am writing to you to seek your further assistance with my research on proficient computer-using teachers in Palmerston North primary schools. Last year, you will recall, as an Advisory Committee member, you helped in the selection of computer-using teachers for further study. I have now completed this study and I am at the point where I require your assistance to select the teachers for the final 'case study' phase of the research.

This will involve a meeting where I summarise the results of the research to-date, and then using specific criteria, we select teachers whom we consider to be most proficient at using computers in their classroom. I have included with this letter a copy of the criteria along with summarised results of interviews with the teachers perceived to be proficient at using computers. The interview summaries are confidential and I ask that you treat them as such. I have included the summaries with this letter simply to give you the opportunity to become familiar with the information. I will provide a detailed presentation of the results when the Advisory Committee meets. It is at this point that you will need to take a much closer look at these summaries.

I am mindful that this is a busy time of the year, but I would appreciate if we could meet some time within the next two weeks. I will contact you within the next few days to arrange a time of mutual convenience.

Finally, I value your assistance with this study and I look forward to working with you as we select the teachers most suitable for the case study phase of the research.

Thank you for your cooperation

Mark E Brown

MASSEY UNIVERSITY
Department of Educational Psychology

Learning and Computers: A Study of Proficient Computer-Using Teachers

By Mark E Brown

CRITERIA FOR THE SELECTION OF PROFICIENT COMPUTER-USING TEACHERS

The proficient computer-using teachers chosen for the final part of the study wil be selected on the basis of the following criteria:

1. A clear and well articulated philosophy of education which is tested against their personal practice.

2. A sound knowledge of teaching and learning processes and factors that have an influence on these processes.

3. A sound knowledge of the different ways that computers can be used within and across the curriculum to support teaching and learning processes.

4. A learner-centred approach to teaching where students are encouraged to set their own goals, to challenge and solve problems and to have lots of fun.

5. A highly reflective approach to their teaching practice with a passionate and intrinsic commitment toward becoming a better classroom and computer-using teacher.

6. A clear and well informed aim related to the use of computers in the classroom and a high level of confidence in their own ability to successfully achieve such aims.

7. A high level of analysis when discussing their classroom practice and the problems experienced as students learn with computers.

8. A sound understanding of classroom organisation and management techniques and evidence of these techniques being used in the classroom.

These criteria are based upon both theory and research on proficient an exemplary teaching practice (see for example; Berliner, 1986; Olson, 1992 Sheingold and Hartley, 1993; Ramsay and Oliver, 1993, etc).

MASSEY UNIVERSITY
Faculty of Education

Learning and Computers:
A Study of Proficient Computer-Using Teachers

MEd Thesis

By Mark E Brown

Advisory Committee Meeting

(4:00pm 3rd Nov, 1994)

AGENDA

1. Welcome
2. Background Information
3. Selection Criteria
4. Interview Summaries
5. Selection of Proficient Computer-Using Teachers
6. AOB

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FACULTY OF EDUCATION

Mark Brown
Lecturer

DEPARTMENT OF
EDUCATIONAL PSYCHOLC

«name»
«school»
«address»
«location»

4th Nov 1994

Dear «name»

I am writing to seek your further assistance with the study I am doing on computer use in Palmerston North primary and intermediate schools. You will recall that as part of my thesis toward a Master of Education degree I have been studying teachers who are proficient at using computers in their classroom.

The study has already collected important information on the types of arrangements and conditions where computers are being used to enhance the teaching and learning of children. I hope that this information will eventually help other teachers and teacher educators to better understand how to use computers in the classroom.

The interviews responses were particularly useful in this regard. It is important, however, that the study gather even more detailed and precise information. When we last met you indicated that you would be prepared to be involved further in the study. I would now be grateful if you would be willing to participate in the final phase of the research. This phase will involve a case study where I will observe your use of computers in the classroom over the period of one week. I am interested to study how a proficient computer-using teacher actually uses a computer in the classroom.

I am mindful that this request is yet another demand on your time. However, I am committed to making this study as valuable as possible and do not anticipate that my observations in your classroom would involve much inconvenience. I will telephone you in the next day or so to see if you are still prepared to participate in the study. If you are still willing to be involved then I will want to conduct the case study before the end of the month.

I reiterate that all the information you provide is treated as confidential. I guarantee that neither you nor your school will be identified in any report of the study. Furthermore, you are free to withdraw from the study at anytime.

If you have any questions concerning this phase of the study please do not hesitate to contact me. I can be contacted at Massey University, Department of Educational Psychology, telephone 356 9099, extension 8425.

Thank you for your cooperation.

Regards

Mark E Brown

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FACULTY OF EDUCATION

Mark Brown
Lecturer

DEPARTMENT OF
EDUCATIONAL PSYCHOLOGY

«name»
«school»
«address»
«location»

6th Nov 1994

Dear «name1»

I am writing to seek your permission to conduct a case study of <<name1>> use of computers in your school. As you may be aware <<name1>> has been participating with me in a study on proficient computer-using teachers in Palmerston North primary and intermediate schools. <<Name1>> has indicated a willingness for me to now observe how computers are being used within (her/his) classroom and I would like your approval for such a study to take place.

This is the final phase of the study which has already collected important information on the types of arrangements and conditions where computers are being used to enhance the teaching and learning of children. I hope that a case study of <<name1> will provide even more information that will eventually help other teachers and teacher educators to better understand how to use computers in the classroom.

The case study will involve observations of <<name1>> practice over the period of one week and will be designed to minimise any disruption to the normal classroom programme. I am interested in studying how the computer is used the regular classroom. For this reason, I do not want any special attention and will try and be as unobtrusive as possible. I do not anticipate any inconvenience to you or the school.

I must stress that all information gathered is treated as confidential. I guarantee that neither <<name>> nor your school will be identified in any report of the study. The research is towards a Master of Education degree and is being supervised by Dr Ken Ryba and Dr Janet Burns. If you have any concerns about the research then either of my colleagues would be happy to discuss these with you. I will telephone you in the next day or so to see if you are happy for <<name1>> to participate in the study.

Regards

Mark E Brown

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FACULTY OF EDUCATION

Mark Brown - Lecturer
(Information and Communication Technology)

DEPARTMENT OF
EDUCATIONAL PSYCHOLOGY

Learning and Computers:
A Study of Proficient Computer-Using Teachers

By Mark E Brown

CASE STUDY CONSENT FORM

I am satisfied that I have been fully informed of the nature and purpose of the study. I agree to participate in a case study of my teaching practice with computers over the period of one week on the conditions that:

- all the information I provide remains anonymous
- no information which may identify me or my school is published or referred to in any presentations or reports that are prepared from the study.
- all the information I provide is completely confidential to the researcher, with the possible exception being if, in the professional judgement of the researcher, sharing of such information with a supervising researcher is necessary to maintain the integrity of the study.
- I can refuse to answer any particular questions.
- I can ask further questions about the study at any time during my participation
- I understand that I am free to withdraw from the study at any time.
- I will be given access to the findings and sent a summary of these when the study is completed.

_____ _____

PARTICIPANT'S SIGNATURE DATE

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FACULTY OF EDUCATI(

Mark Brown - Lecturer
(Information and Communication Te

DEPARTMENT OF
EDUCATIONAL PSYCHO

«name»
«school»
«address»
«location»

Dear «name»

I am writing to sincerely thank you for the opportunity you gave me to spend time in your classroom. I thoroughly enjoyed the experience and believe you provided valuable information on how computers are being used to enhance learning. I am most grateful for the willingness you showed to participate in the research and trust it did not inconvenience you too much. Without your involvement the research would not have been possible.

It will take me a few months to fully document and analyse the results. I will contact you again, however, early next year when I would like your guidance on the final presentation of the case study material. In particular, I am keen to accurately capture your 'voice' on the use of computers in education and would like to collaborate with you on this task. This will involve reading what I have written and making changes to better match your views.

In the meantime I wish you all the best for Xmas and thank you again for your on-going cooperation.

Best wishes

Mark E Brown

MASSEY UNIVERSITY
Faculty of Education

MICROETHNOGRAPHIC CASE STUDY PROTOCOL

1. Research Objective:

Investigate how primary school teachers use computers to create conditions for better learning in the classroom.

2. Research Plan:

i) Pilot research techniques

ii) Arrange access to classroom

iii) Conduct pre-observation interview

iv) Establish routine for teacher diary

v) Commence participant-observation (days 1-5)

vi) Record noteworthy observations in research diary

vii) Converse with teacher and students about their computer practice

viii) Source data on classroom documentation

ix) Collect data on students' computer competence and perceptions

x) Conduct post-observation interview

3. Research Questions:

i) What is the physical arrangement of a 'proficient' computer-using teacher's classroom?

ii) What specific computer applications do 'proficient' computer-using teachers use to support student learning in their classroom?

iii) How do 'proficient' computer-using teachers use different computer applications to support learning in their classroom?

iv) What beliefs do 'proficient' computer-using teachers have about the teaching and learning process?

v) What beliefs do 'proficient' computer-using teachers have about how computers support the teaching and learning process?

vi) What role do 'proficient' computer-using teachers adopt during computer-related activities in their classroom?

vii) How competent are students at using computers in the classrooms of 'proficient' computer-using teachers?

viii) What perceptions of how computers support their learning do students' have within the classrooms of 'proficient' computer-using teachers?

4. Research Techniques:

i) Participant Observation

ii) Self-Reflection Record

iii) Research Diary

iv) Teacher Diary

v) Teacher Interview Schedules

vi) Computer Competency Schedule

vii) Computer Perceptions Questionnaire

viii) Student Interview Schedule

ix) Classroom Documentation Schedule

Day: _____

MASSEY UNIVERSITY
Faculty Of Education

RESEARCH DIARY

Daily Observations of Computer Use

1. What is notable about the teacher today?

Day: _____

MASSEY UNIVERSITY
Faculty Of Education

RESEARCH DIARY

Daily Observations of Computer Use

1. What is notable about the students today?

Day: _____

MASSEY UNIVERSITY
Faculty Of Education

RESEARCH DIARY

Daily Observations of Computer Use

1. What is notable about the computer today?

Day: _____

MASSEY UNIVERSITY
Faculty Of Education

RESEARCH DIARY

Daily Observations of Computer Use

1. What else have I noticed today?

Day: _____

MASSEY UNIVERSITY
Faculty Of Education

TEACHER DIARY

Daily Computer Use

1. What was the purpose of using the computer in the classroom today?

_____
_____
_____
_____
_____
_____

2. What were the main learning outcomes from computer related activities in the classroom today?

_____
_____
_____
_____
_____
_____

3. Were there any problems resulting from computer related activities in the classroom today?

_____
_____
_____
_____
_____
_____

4. Do you have any other reflections on the use of computers in the classroom today?

_____
_____
_____
_____
_____
_____

MASSEY UNIVERSITY
Faculty of Education

Learning and Computers:
A Study of Proficient Computer-Using Teachers

CASE STUDY PRE-OBSERVATION INTERVIEW SCHEDULE

Date: _____

Time: _____

Consent: _____

Tape No: _____

Introduction:

What I would like to do in this interview is give you the opportunity to tell me a little more about the ways you use computers in the classroom. I'll ask some specific questions but I don't want you to feel constrained by these questions. Please feel free to offer any additional information or comments that you like.

Questions:

1. How many years have computers been used for instruction in the school?

2. How many children are in the classroom?

3. What is the ratio of boys and girls?

4. What is the ratio of computers per child in the classroom?

5. What type of computer do you have in the classroom?

6. Where is the computer located in the classroom?

7. What type of software do you have available in the classroom?

8. How many children use the computer each day in the classroom?

9. How do you generally use the computer in the classroom?

10. How many children have access to a home computer?

11. How many hours do you personally use the school computer each week?

12. What is the extent of your personal (home) use of a computer?

13. Do you see yourself as successful in using the computer in your classroom?

14. Has the presence of computers in the classroom had any influence on the teaching methods that you use?

15. Do computer-related activities require any more planning and organisation than traditiona classroom activities?

16. How do you stay informed about computers in education?

17. How many other teachers use computers at the school?

18. How many other teachers in the school do you consider to be proficient?

19. Does the school have a policy related to computers? (Can I have a copy?)

20. Do you have any other comments you would like to make about using computers in you classroom?

MASSEY UNIVERSITY
Faculty of Education

Learning and Computers:
A Study of Proficient Computer-Using Teachers

CASE STUDY POST-OBSERVATION INTERVIEW SCHEDULE

Date: _____

Time: _____

Consent: _____

Tape No: _____

Introduction:

What I would like to do in this interview is give you the opportunity to reflect on computer use over the course of the past week. I'll ask some specific questions, but I'd rather hear your views on how the computer was being used in the classroom. Please feel free to offer any information or comments that you like. Let's start by talking about the entries in your diary.

Questions:

1. Can you talk me through the entires in the diary?
2. Do you want to add anything to the diary?
3. Was this a typical week using the computer in the classroom?
4. How would you describe your particular style or approach to teaching?
5. What theories or ideas about teaching have most influenced your style or approach?
6. Has the availability of a computer in your classroom made possible any new teaching and learning strategies?
7. What do you think are the main learning benefits for students when they work with computers.
8. What do you think are the main benefits of children using a word processor to support their writing?
9. What is the most lasting impression that you have of the computer use in the classroom over the course of the week?
10. Do you have any other comments you would like to make about using computers in your classroom?

MASSEY UNIVERSITY
Faculty of Education

COMPUTER COMPETENCY SCHEDULE

i) Are you a boy or girl?

☐ Boy ☐ Girl

ii) What is your age?

☐ 7 years old ☐ 8 years old ☐ 9 years old ☐ 10 years old ☐ 11 years old

iii) What can you do with the computer?

Statement	Yes	Not Sure	No
I can turn on and off the computer			
I can use a word processor			
I can change the font/style of text			
I can move the cursor and correct errors			
I can delete and replace words			
I can delete large sections of work			
I can move (cut & paste) a piece of text			
I can copy (copy & paste) a piece of text			
I can centre and adjust the margins of text			
I can use a spell checker			
I can add a picture or graphic to my text			
I can use help to find out something new			
I can print my work out			
I can save a document to a disk			
I can get a document from a disk			
I can copy work onto another disk			
I can format a blank disk			
I can change paper in the printer			

iv) Do you have anything else to tell me about what you can do on the computer?

MASSEY UNIVERSITY
Faculty of Education

MICROCOMPUTER PERCEPTIONS INVENTORY

Please read the following questions and ✓ the appropriate box.

i) Are you a boy or girl? ☐ Boy ☐ Girl

ii) What is your age?

☐ 7 years old ☐ 8 years old ☐ 9 years old ☐ 10 years old ☐ 11 years old

The following statements relate to using the computer in the classroom. Please circle the most appropriate answer for each statement.

1. I know how to use the computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

2. I am always finding better ways to use the computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

3. I feel comfortable when I use a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

4. I like to use the computer in the classroom.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

5. I know how to use a computer as well as most children.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

6. I find it difficult to use a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

7. Even when I try hard I do not use the computer as well as others do.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

8. Whenever I can I try and avoid using a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

9. I am not very good at using a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

10. I generally use the computer poorly.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

11. Most good jobs require some computer skills.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

12. Learning how to use the computer helps me with my school work.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

13. My success in school work is related to how well I can use a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

14. If I got better in using the computer it would help me do better in school.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

15. Learning how to use a computer can help me learn.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

16. It is not worth my time to use a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

17. It is not really necessary to use a computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

18. Success at school has nothing to do with being able to use the computer.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

19. I will probably never use a computer once I leave school.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

20. Learning how to use a computer will not help my future.

Strongly Disagree Disagree Not Sure Agree Strongly Agree

(Adapted from Riggs & Enochs', 1993)

MASSEY UNIVERSITY
Faculty of Education

Learning and Computers:
A Study of Proficient Computer-Using Teachers

CASE STUDY STUDENT INTERVIEW SCHEDULE

Introduction:

What I would like to do in this interview is give you the opportunity to tell me a little more about the ways you use computers in the classroom. I'll ask some specific questions but feel free to tell me anything you like about computers.

Questions:

1. Do you like using computers in the classroom?

2. What you do like most about computers?

3. What do you like least about computers?

4. Do you think the computer helps you to learn better?

5. In what ways does the computer help you learn?

6. What do you learn most about when using a computer?

7. Do you notice any difference between the boys and girls when using a computer?

8. Do you think you will need to use a computer in the future?

9. Do you have a computer at home that you can use?

10. Is there anything else you would like to tell me about using computers?

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CASE STUDY DOCUMENTATION SCHEDULE

ypes of information to be collected during the case study:

1. School Computer Policy
2. Teacher's Daily Work Plan
3. Teacher's Long-Term Plan
4. Software Available Within School
5. Software Available Within Classroom
6. Wall Charts and Classroom Displays
7. Student Work Samples
8. Computer Files and Documents