# Information and Communication Technology in Secondary Schools:

## A study of factors relating to the integration of ICT into the curriculum areas of English, mathematics, social studies and science

by

Jacquelin Ann Halliday

neé Cornwall

A thesis submitted in partial fulfillment
of the requirements for the
Degree of Master of Education,
Massey University,
Palmerston North,
New Zealand.
2000

## ABSTRACT

New Zealand schools have been using ICT, especially computers, for more than two decades yet there is a lack of research in the secondary school area, of how and if, these technologies are being integrated into the curriculum. It has been well documented that the main use of ICT in secondary schools is for studying *how* the computer works, rather than using it to enhance student learning. The main question this study investigates is: to what extent are secondary schools integrating ICT into the core curriculum areas of English, mathematics, social studies and science? Areas such as teacher attitudes, professional development, access, policies, success factors and barriers were investigated. Student perceptions on the use of ICT were also sought. The findings from this study have the potential to assist school managers and teachers to understand how ICT can be successfully integrated into the curriculum.

A multi-dimensional research approach was used employing both quantitative and qualitative methods of data collection. A survey was conducted of 18 urban secondary schools. Data were collected from Heads of Departments of the target curriculum areas, and from one teacher in each department whom the HOD perceived to be an ICT–using teacher. From these data one school, perceived to be a successful ICT–using school, was selected according to set criteria, to be the subject of a case study. Interviews were conducted with the principal, the HOD ICT, the Librarian, a software consultant, as well as the HOD and a teacher from each curriculum area. Students from two year levels were also interviewed. This approach enabled an overview of ICT use in a range of secondary schools to be sought, followed by an in depth study of strategies used in one school.

Data were analysed according to a theoretical framework adapted to reflect the hierarchical situation in a secondary school. The macro, mesa and micro environments were analysed to understand the interrelationships that occur between these levels. Results from the study confirm a generally low level of ICT use in these curriculum areas and highlights a number of issues which impact at each level of a secondary school, with ramifications for the use of ICT

in teaching and learning programmes. These issues include: school systems - policies and procedures, professional development, pedagogical knowledge of teachers, the role of the teacher, and access to, and location of, ICT equipment, especially computers. There is a complex interaction between all of these issues which need to be understood, for the meaningful integration of ICT into the curriculum to occur.

**ACKNOWLEDGEMENTS**

This thesis could not have been completed without the support and assistance of many people. First and foremost I would like to sincerely thank the secondary schools, the Principals, HODs and teachers who took the time from their busy schedules to complete the questionnaires. I am most grateful to the Principal and staff of Seaview High who went out of their way to make me welcome, and share their views and professional knowledge with me.

I would like to thank my supervisors, Mark Brown and Linda Selby, for their encouragement, professional guidance and expertise in the field of ICT in education. I would also like to thank my colleagues at the School of Education, UNITEC, for their enduring support and patience. In particular, I must thank the Head of School, Professor Carol Cardno for giving me the time and space to complete this thesis. Thanks also go to Dr Janet Clinton and Dr Jens Hansen for assistance with research methodology, questionnaire design, data presentation and proofreading. To Deepa Marat, Research Assistant, who spent considerable time inputting data, a big thank you.

Special thanks must go to my friend and colleague Sandra Cubitt who provided much moral support and encouragement, albeit from a distance. I would also like to thank Ann Northover, for proofreading, and my son-in-law Shane Smales, for assistance with questionnaire design and statistics.

Finally I would like to acknowledge the role of my family, my husband Ian, daughters Jennifer and Ngaire, and son-in-law Shane, without whose emotional support, encouragement, understanding and patience, this thesis would not have been completed.

# DEDICATION

This thesis is dedicated to my mother,

Marjorie Constance Cornwall

1920 – 1983

who never had the opportunities

of the next generation.

## 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.

Signed JAHalliday

# TABLE OF CONTENTS

## CHAPTER FOUR – RESULTS PHASE ONE



## CHAPTER FIVE – RESULTS PHASE TWO

## LIST OF TABLES

### CHAPTER THREE



### CHAPTER FOUR

**CHAPTER FIVE**

## LIST OF FIGURES

### CHAPTER TWO



### CHAPTER THREE



### CHAPTER FOUR

## APPENDICES

# CHAPTER ONE – INTRODUCTION

## INTRODUCTION

The impetus for this thesis came from an article on the place of computers in the secondary English classroom (Ham, 1989). It contained a rationale for the use of a word processor in English and argued that they need to be more widely accessible in the secondary classroom. Ham also pointed out that there were many students now entering secondary schools with much experience already in the use of computers and word processors from their primary and intermediate schooling. He stated that students were already entering secondary schools with knowledge and skills of how to use these technologies in their own learning and of the wider significance of the role of computers in society. Ham asked if secondary schools and teachers were ready for these students. The article was written a decade ago and the question arose, what has happened in the area of information and communication technologies, especially in New Zealand secondary schools in the intervening ten years? Are these information literate students from primary schools being challenged when they reach secondary school? Are their skills and knowledge put to good use and built upon? Do secondary teachers know what skills and knowledge students come to them with? Are there more word processors available in the secondary English classroom? Have they been integrated into secondary English teaching and learning programmes? Research questions developed from these initial questions and concerns.

## BACKGROUND

Over the last twenty years the use of ICT in both primary and secondary schools has increased considerably. It is generally known that, for a number of reasons, primary schools have been able to integrate the use of these technologies into their teaching and learning programmes. Historically, primary schools, being smaller than secondary schools, and with a correspondingly smaller budget have not been able to purchase large quantities of computers and site them in one classroom. Therefore they have purchased modest numbers of computers and placed them in individual classrooms (Pelgrum & Plomp, 1993). These computers have often been 'given' to an enthusiastic, visionary teacher and therefore it has been possible to include it in everyday teaching and learning programmes. Sometimes one computer has been shared among a group of classes. In this way the skill and knowledge of the individual teachers has been shared and increased.

The timetable and structure of the school day in primary schools, where students have one teacher for all curriculum areas, has meant that an integrated approach to the curriculum is possible, and indeed, more likely. Teachers have one class of students for the whole day and have the potential to be more flexible in their planning and classroom management strategies, to ensure all students have equal access to the computer. The smaller size of primary schools has made it possible for whole school professional development initiatives to take place, and hence some schools have built up a reputation for being visionary and innovative in their use of ICT (Coogan, 1999).

In secondary schools the situation is quite different. The curriculum is more compartmentalised with teachers specialising in one curriculum area, making it difficult for any degree of integration to occur. Primary teachers have an overall view, and understanding, of all curriculum areas and can see where links can be made, whereas a secondary teacher with expertise in one area, does not have this overall perspective.

Timetable constraints, and the pressure of teaching a content-based syllabus leading to external examinations, mean that secondary teachers sometimes perceive that they have little time for the use of new technologies and innovative teaching practice. Secondary teachers usually teach five or six different classes for periods of up to one hour at a time. This often means teaching and learning activities are broken down into a series of small discreet tasks and makes it difficult for sustained, long term, collaborative, investigative work. Learning activities are more likely to be teacher centred, whole class oriented, with an emphasis on the transmission of content (Becker, 1991; Chamberlain & Kennedy, 1991; Pelgrum and Plomp, 1993).

Computers in secondary schools have traditionally been located in special rooms called 'laboratories' and used mainly for studying how they work, how to use common applications such as a word processor, or for learning keyboarding skills (Becker, 1991; Chamberlain & Kennedy, 1991; Nightingale & Chamberlain 1991; Pelgrum & Plomp, 1993). Consequently students who did not study the subjects of Computer Studies and Typing (now in New Zealand called Text and Information Management (TIM)), rarely had access to computers for use in other curriculum areas. With the emphasis on teaching students *how to use* a computer, there was an underlying assumption that students entered secondary school with no prior knowledge. Teachers also had difficulty gaining access to these scarce resources as computer rooms were timetabled first, for Computer Studies and TIM, and teachers of other curriculum areas could book in, if there was time available. Consequently secondary teachers have not had easy access to computers and they certainly have not had one in their classroom.

Although there is little evidence documenting the aforementioned problems, the scenario for secondary teachers who endeavoured to use computers in their teaching and learning programmes was quite different to that of a primary teacher. Secondary teachers, when they were able to book time in the computer room, had to walk their class there, often over a great distance given the geography of some secondary schools, to the computer room, and get them settled before they could proceed with the whole-class lesson. Ten or fifteen minutes of a one hour period had already elapsed. Computers in these rooms were often networked. Usually it was stable, but sometimes it crashed, or the printer wouldn't work. Thus secondary teachers were confronted with a situation of thirty students and thirty computers, in a foreign environment divorced from their usual teaching space and often no technical support on hand. Faced with this scenario it is not surprising that secondary teachers have found it difficult to include ICT into their programmes.

There is a perception that the use of computers in secondary schools has been dominated by the Computer Studies HOD or teacher. Because this teacher had the technical knowledge they often had a major influence about the types of computers and software purchased, where they were sited and how they should be used. Thus, decisions were often made from a technocentric, rather than a curriculum viewpoint, hence the domination of learning 'about' computers rather than learning 'with' computers (Becker, 1991; Nightingale & Chamberlain 1991; Chamberlain & Kennedy, 1991; Pelgrum and Plomp, 1993). When computer studies teachers endeavoured to assist colleagues from other curriculum areas, there was, again, a technocentric view, rather than an emphasis on *how* the computer could assist and enhance student learning. Thus professional development, when it did occur, was often skills based rather than pedagogically set in a curriculum context (O'Donnell, 1996).

The introduction of the internet meant a change in focus for the computer. No longer was it just a productivity tool to help students process information but suddenly new horizons were possible in the type and amount of information, and the learning activities, that were available to teachers and students (Lai, 1996; Tiffin & Rajasingham, 1995). Viewing it as an information source allowed the computer and, with it, internet access, to become part of the function of the library, especially in secondary schools. This has enabled ready access to students and teachers because the library was already an integral part of their teaching and learning strategies. The environment was familiar but *how* are teachers using the internet to enhance student learning? Are they just using it to retrieve information or are they aware of the possibilities of extending the boundaries of the classroom?

Very little research has been undertaken to highlight the difficulties of the curriculum classroom teacher in secondary schools in attempting to integrate ICT. Their voices have largely gone unheard and even unasked! This research will give those teachers a voice and enable policy makers and school administrators to take into account their views when making crucial decisions about the purchase and location of ICT and the professional development needs of their staff. This research is also an attempt to give the students a voice. What are their experiences in secondary schools? What skills and knowledge do they bring with them from primary and intermediate school and are these skill being utilised?

## STATEMENT OF PURPOSE

This thesis investigates the use of ICT by English, mathematics, social studies and science teachers in a secondary school setting. It describes a systematic sample selection process that documents the use of ICT by Heads of Departments and teachers in the curriculum areas of English, mathematics, social studies and science. The research adopts a multi-dimensional paradigm with both quantitative and qualitative techniques. The two phases of the research were conducted over a twelve month period. The purpose is to gain an overview of ICT use in a selection of secondary schools, and then to focus on one school, perceived to be a successful 'ICT-using' school to undertake an in depth case study in order to gain an understanding of the issues involved.

This study resulted from the researcher's teaching background in both primary and secondary schools, followed by a number of years in the tertiary sector involved in the professional development of teachers in ICT and a keen interest in the research literature. The researcher's studies and work with individual teachers have lead to an awareness of the complexity of issues surrounding the integration of ICT into the secondary school curriculum. Because of the disparate nature of the secondary school curriculum and teachers who teach in each area, the situation is not widely debated. It is hoped that this research will highlight the situation of the curriculum teacher and his or her students, and add to the discussion.

## ORGANISATION OF THE THESIS

The thesis is organised into a series of chapters. Chapter One introduces the significance of the topic, provides a statement of purpose and gives background information. Chapter Two presents a literature review which outlines policy directions for the use of information and communication technologies (ICT) in the New Zealand context as well as giving a definition of the term 'ICT'. Where ICT fits in the New Zealand curriculum is discussed along with the concept of 'integration'. A theoretical framework, relevant to a secondary school is presented. Themes that emerge from an examination of New Zealand and international studies on the use of ICT in secondary schools are discussed. The chapter concludes with a statement of the research problem and an outline of the significance of the study. Chapter Three presents the research question and outlines the overall methodological approach and research design. It provides a detailed account of the method and procedures used throughout the data collection period. Chapters Four and Five present the results for each phase of the study. Chapter Six discusses the main findings in relation to a number of emerging themes: (a) school systems – policies and procedures (b) professional development; (c) pedagogical knowledge; (d) the role of the teacher, and, (e) access and location. Each theme is discussed within the theoretical framework outlined in Chapter Two. Limitations of the study are also discussed. Chapter Seven concludes with a summary of cogent points including the implications of the study for policy makers, schools, teachers and other researchers. Recommendations are made to each of these groups.

# CHAPTER TWO - LITERATURE REVIEW

## INTRODUCTION

This chapter outlines the parameters of the thesis beginning with an outline of policy directions for the use of information and communication technologies (ICT) in New Zealand schools and gives a definition of the term "ICT". This is followed by a discussion of how ICT can be integrated into the New Zealand curriculum with reference to contemporary learning theories and pedagogical strategies. Frameworks for the use of computers in education are examined briefly. The concept of 'integrating ICT into the curriculum' is discussed, and a theoretical framework, adapted to the learning environment of a secondary school is presented. Themes that emerge from the literature follow an examination of studies on the use of ICT in New Zealand and international schools. The chapter concludes with a statement of the research problem and an outline of the significance of the study.

## POLICY DIRECTIONS IN NEW ZEALAND

In 1982 the then, New Zealand Department of Education, commissioned a study, *Report of the Consultative Committee on Computers in Schools: Computers in Schools* (Department of Education, 1982) from which it set up the Computers in Education Development Unit (CEDU). This recognised the place and importance that computers were beginning to play in New Zealand schools and signaled the impact that they could have on student learning. The role of the CEDU was to develop resources for teachers in specific curriculum areas and advise on the use of various software packages. Among the publications that CEDU sent to all schools was one entitled *Computers in Secondary English* (CEDU, 1989). This booklet contained much practical advice for the secondary school English Head of Department and teacher. Topics ranged from writing with a word processor to using databases in English. It examined issues such as the role of the teacher, the importance of copyright, as well as looking at computers in the library. Advice was given on how to run professional development days and who to go to for support. Sound pedagogical advice was given with the inclusion of the saying "the curriculum horse must pull the technology cart" and "computer software should only be used to enhance your planned English language programme" (p.26). Student centred learning, cooperative learning and having computers in the classroom were also emphasised.

A year later, in 1990, further support was available for secondary English teachers when the New Zealand Association for the Teaching of English (NZATE) published its Green Paper No 4, *Introducing Computers to English* (Sheppard, 1990). This also gave practical advice to teachers by addressing fundamental issues of why computers should be used in English, what they can be used for and how to get started.

In 1986, CEDU managed 19 Exploratory Studies in Educational Computing which were evaluated by the New Zealand Council for Educational Research (Podmore & Craig, 1989). One of the studies was at the preschool level, with four dealing with children with special needs. All the remainder were located in primary schools but only "some involved secondary school children" (Podmore & Craig, 1989. p. vii).

The Computers in Education Development Unit was disbanded in October 1989 along with the Department of Education as a result of major educational administrative reforms, Tomorrow's Schools (Minister of Education, 1989). These reforms emphasised school self-management (Caldwell & Spinks, 1988) and new administrative bodies for schools, Boards of Trustees, were elected from parents and members of the community. The Department of Education was replaced by a Ministry of Education.

Throughout the 1980s 'computers' were the focus of technology use in schools as were the studies that accompanied them. In 1990 the term 'Information

Technology' entered the lexicon with the Report of the Consultative Committee on Information Technology, commonly known as the *Sallis Report* (Department of Education, 1990). This change in terminology recognised that computers were not the only tools that could be used for gathering, storing, and presenting information and it acknowledged telecommunications technologies such as the telephone and facsimile machine which could be used without the use of a computer. The *Sallis Report* set out two policy goals for the integration of Information Technology (IT) into the curriculum and three major recommendations for government policy action to achieve these goals.

Goal One stated:

> *that all students will have the opportunity to increase the efficiency and the effectiveness of their learning at all levels and all subjects through the use of information technology.* (p. 3)

Goal two referred to students leaving school with "the necessary skills to take their place in an information society". The first and third recommendations were strongly worded statements about providing professional development for teachers, support and advice for boards of trustees, and it emphasised the importance of IT in learning being reflected in national curriculum objectives:

> *Recommendation 1: that the Government make a commitment to a major upgrading of the levels of teacher professional development and support and advice for school communities and Boards of Trustees in the use of information technology across the curriculum.* (p. 4)
>
> *Recommendation 3: that the National Curriculum Objectives assert the importance of appropriate applications if information technology in learning.* (p. 4)

These recommendations for Government Policy in this area were significant in that the International Educational Achievement (IEA) study on the use computers in education conducted a year earlier, in 1989 (Pelgrum & Plomp, 1993), showed that New Zealand was one of the few countries among those with similar education systems, that did not have a clearly formulated national policy on the use of IT in education. However, there was a change of government before the report's recommendations could be fully implemented. The incoming government did not proceed with a national policy but did continue with nation-wide professional development programmes for teachers (Gilmore, 1995). These began in 1991 and continued until 1996. The professional development contracts were based on a tendering system. Most were awarded to the Education Advisory Services attached to Colleges of Education. Some contracts were placed with private providers (Stanley, 1995).

However, policy statements by the Ministry of Education were not very precise, leaving schools to interpret the Government's intention. For example, in 1994 a major Government policy document on a new education system was published by the Ministry of Education, *Education for the 21$^{st}$ Century* (Ministry of Education, 1994a). It contained national education aims for the 21$^{st}$ century and the only goal that made reference to technology was a vague economic one directly related to qualifications: "qualifications achieved will enable all to participate successfully in the changing technological and economic environment" (p.30). There was no reference to the use of information technology in teaching and learning.

This lack of policy direction in the area of information technology in education was consistent with the Government's philosophy of the self-managing school mentioned earlier. The importance of IT in learning was acknowledged in two Government Green Papers issued in 1997. The *Tertiary Education Review* Green Paper (Ministry of Education. September 1997) identified the development of IT as one of three powerful trends shaping the tertiary sector and the *Teacher Education* Green Paper (Ministry of Education, October, 1997) recognised the direct implications for teaching methods in schools:

> *Advances in information and communications technologies will continue to affect the nature of learning and the organisation of schooling, requiring teachers to adapt their approaches accordingly.*
> (Teacher Education Green Paper, p.5. cited in Butler, 1997, p.7.)

Because of this deliberate 'hands off' approach by the Government, industry groups, such as the Telecom Education Foundation (TEF) and the Information

Technology Advisory Group (ITAG), which reported directly to the then Minister for Information Technology, recognised the importance of IT in schools by commissioning a discussion document (Butler & Zwimpfer, 1997) and conducting a number of surveys (TEF, 1996; Harris, 1997; ITAG, 1999; Sullivan, Allan, & Paul, 1998).

The discussion document, *Impact 2001: Learning with IT, the Issues* (Butler & Zwimpfer, 1997) was prepared by the industry group New Zealand Futures Trust for ITAG and the Information Technology Association of New Zealand. It contained a foreword, not by the Minister of Education, but by the Minister for Information Technology and was available on the website of the Ministry of Commerce. While a number of educators from the tertiary sector were acknowledged as providing assistance, there was no one mentioned from the Ministry of Education, or the school sector. The Report identified fifteen key issues and explored these in depth. Despite this lack of consultation with teachers, these key issues provided useful guidelines for teachers, principals and school administrators. They included issues as diverse as pedagogical strategies, teacher training, equity of access, school IT infrastructure and the provision of resources, to intellectual property law and linking business to education. One of the key issues identified the role of Government in providing leadership for schools, and education in general, in the form of policy guidelines. The Report cited a number of countries similar to New Zealand, who have developed national strategies, and called for policies to be developed that "ensure all children have the opportunity to take advantage of contemporary information technology at all stages of schooling" (Butler & Zwimpfer, 1997. p.36).

In October 1998, the New Zealand Government heeded these calls and a national strategy, *Interactive Education: An Information and Communication Strategy for Schools* (Ministry of Education, 1998) was announced. This document officially used the term Information and Communication Technology (ICT). The addition of the term 'communication' was intended to recognise the increasing use and importance of communications technologies for accessing information from sources such as the internet. The strategy contains four objectives:

- *improve students learning outcomes through the use of ICT in teaching and learning*
- *increase the effectiveness and efficiency of teachers and schools by helping them to use ICT to:*
  - *(i) enhance delivery of the curriculum , and*
  - *(ii) reduce time spent on administration*
- *improve the quality of teaching in and leadership of school by helping teachers and principals to identify their ICT needs and to develop the skills necessary to meet these needs*
- *increase opportunities for schools, businesses, and government to work together in developing an information technology-literate workforce that will help New Zealand to maintain its competitive advantage.*

Inherent in these objectives are a number of reasons, or rationales, (Brown, 1997) for the use of ICT in education. Brown summarises these rationales as: (a) vocational; (b) economic; (c) commercial; (d) marketing; (e) cost effectiveness; (f) social; (g) transformation; and (h) pedagogical. The pedagogical rationale is evident in the first and second objective and the economic one is obvious in the last. A cost-effectiveness rationale is also contained in the second objective where it was envisaged that less time would be spent on administration.

The strategy focuses on two areas, (1) infrastructure which relates to schools' access to ICT, and, (2) improving school capability with the provision of professional development for principals and teachers. A number of new initiatives were announced. These included an online resource centre for teachers and administrators, a computer recycling scheme, and the establishment of ICT lead professional development schools. Throughout 1999 national *Principals First* workshops, were held for all principals in the country. At these workshops ICT planning guides were issued. Existing professional development initiatives continued.

In 1997, a year prior to the national ICT strategy, a contestable funding pool for information technology professional development (ITPD) was set up by the government. This programme was to run for three years only but was extended and has almost become another strand of the ICT strategy. As it predates the government's ICT strategy, it continues to use the term IT.

Because of the wide range of ICT tools the computer provides, from word processing and databases, to browsers for surfing the world wide web, from simulations and computer aided instruction (CAI), to email and internet chat, it is still regarded as the main information and communication technology tool that is used in teaching and learning. The computer is also the most expensive piece of technology and its scarcity and accessibility is of major concern to teachers and students and will be discussed in more detail later. Hence the juxtaposition of the two terms 'computer' and 'ICT' throughout this thesis.

## DEFINITION OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

There has been much debate about the precise meaning of the term information and communication technology. Much of it has focused on the electronic nature of the relevant technologies. The New Zealand national strategy document *Interactive Education* defines ICT as:

> ***Information technology (IT)*** *is the term used to describe the items of equipment (hardware) and computer programs (software) that allow us to access, retrieve, store, organise, manipulate, and present information by electronic means. Personal computers, scanners, and digital cameras fit into the hardware category; database storage programs and multimedia programs all fit into the software category.*
> ***Communication technology (CT)*** *is the term used to describe telecommunications equipment through which information can be sought and accessed, for example, phones, faxes, modems, and computers.*
> (Ministry of Education, 1998. p.5)

This definition is very technocentric as it focuses on pieces of hardware and software through which humans can communicate information, whereas Brown (Brown, 1995b) takes a different perspective and looks at definitions of each of the individual words and synthesizes them into an educationally meaningful term. Brown first examines a contemporary view of technology which is not based on electronic machines or gadgets. Rather it has a process focus, whereby humans identify problems and seek solutions to solve them. It could be an artifact, environment or a system. A distinction is made between knowledge, information and data. Data, the structural basis for information, only becomes information when meaning or interpretation is given. Information becomes knowledge when it is used to construct new understandings. Communication is the social activity by which humans exchange information which can lead to the construction of new knowledge. With this analysis Brown offers a definition of the term information and communication technology:

> *The design (and evaluation) of an artifact, environment or system as a solution to a human problem with either the structure or function of information and/or communication.*
>
> (Brown, 1995. p.9)

The significance of this definition, Brown maintains, is that it offers the concept of ICT as something designed for a particular purpose to meet a specific human problem, the solution to which can take many forms and may not necessarily always involve an electronic machine. It is recognised that ICT is more than just computers, but for pragmatic reasons ICT and computers are seen as one and the same in this thesis. With this definition in mind, the focus must now turn to the role of ICT in the curriculum.

## INTEGRATING ICT INTO THE CURRICULUM

### The New Zealand curriculum

The New Zealand Curriculum Framework (Ministry of Education, 1993) contains seven learning areas and alongside this are identified Eight Essential Skills. Within these documents is the expectation that teachers will integrate the use of ICT into their teaching and learning programmes. An achievement objective, for example, in the Written Language strand Levels 5 and 6 (approximately Years 9 - 11) of the English Curriculum states that, in processing information students should use "appropriate technologies to retrieve, select, and interpret, information from a variety of sources, and present accurate and coherent, information for a range of purposes, analysing the processes used" (Ministry of Education, 1994b p. 36). Under a section entitled *Resources* in the

Mathematics Curriculum an explicit statement is included regarding the use of computers and other electronic devices:

> *This curriculum statement assumes that both calculators and computers will be available and used in the teaching and learning of mathematics at all levels.........graphics calculators and computers are learning tools which students can use to discover and reinforce new ideas.........computer software such as graphing packages and spreadsheets, are tools which enable students to concentrate on mathematical ideas rather than on routine mechanical manipulation, which often intrudes on the real point of particular learning situations.*
> ( Ministry of Education, 1992. p. 14)

The Inquiry Process is highlighted in the Social Studies Curriculum where, for example, students at Level 1 and 2 are expected to "use questions, collect and record information, sort information, make a generalisation based on findings and communicate findings" (Ministry of Education, 1997b. frontispiece). Achievement objectives for higher levels develop from these skills but they fail to state explicitly that various technologies, such as databases, can be used to facilitate these process. Information Technology is a strand in the Technology Curriculum and information processing skills feature strongly in the eight essential skill areas in the New Zealand Curriculum Framework.

Computer Studies as a subject has been taught at Year 12 and in some cases in Year 13. It fits loosely in the Technology Curriculum. More recently a new curriculum area called Text and Information Management (TIM) has been introduced at secondary school level. It replaces what used to be called Typing. In TIM classes students study keyboarding skills, word processing, databases and spreadsheets. There is a widely held view that this emphasis on teaching skills has hindered the progress of integration into other curriculum areas in secondary schools. Scarce resources, such as computers, have been concentrated in these areas causing a lack of access for teachers and students of curriculum areas such as English, mathematics, social studies and science.

A report by the Education Review Office in 1997 on the use of information technology in schools acknowledged the lack of specific direction:

> *New Zealand Curriculum Framework does not **explicitly** require schools to use information technology, it **implicitly** requires such equipment to be made available to students on the same basis as books and other classroom materials.*
>
> ( Education Review Office, 1997. p.13)

What these curriculum documents, and those mentioned previously, indicate is that, apart from the information technology strand in the Technology Curriculum document, New Zealand educators see ICT not as a separate subject to be studied, but to be used for a pedagogical rationale (Brown, 1997), as a means of enhancing student learning. This means that the place of ICT in New Zealand education differs significantly from that in the United Kingdom (UK), for instance.

Whereas in the New Zealand Technology Curriculum ICT is one strand of seven technological areas, in the UK, Information Technology is included, along with Design Technology, in the Technology subject of the National Curriculum (Department for Education, 1995). Contained within it are statutory orders stating requirements at Key Stages 3 and 4 (years 7 – 11) for students' IT capability. One of the statements says that students will be able to use "IT tools and information sources, such as computer systems and software packages, to support learning in a variety of contexts". (Crawford, 1997. p. 6). Students are assessed in these areas using level descriptors. However, unlike the New Zealand Curriculum documents mentioned above, there is only one reference to the use of IT in the statutory orders for other National Curriculum subjects;

> *Pupils should be given the opportunities, where appropriate, to develop and apply their IT capability in their study of [the relevant NC subject].*
>
> (Crawford, 1997. p. 7.)

Principals and teachers in the UK have to make a decision about how they are going to cover these requirements. Crawford outlines three approaches:

- the subject IT approach, where IT is taught as a separate subject;
- the cross curricular approach, similar to New Zealand where students learn about IT by using it to enhance learning in other curriculum areas;

- the hybrid IT approach which is, Crawford maintains, the most popular approach where IT is taught as a subject and is also used in other curriculum areas where appropriate.

Crawford cites Office for Standards in Education (OFSTED) figures collected in 1993/1994 to show that the cross curricular delivery of IT only works where subject teachers are also confident in IT. However, where an IT programme is more rigorous there are often insufficient opportunities for students to apply their skills and knowledge in authentic contexts. They conclude that the delivery of the IT goals are most successful when there is some timetabled teaching of IT combined with "well supported opportunities to apply skill in other subjects" (OFSTED, 1995, cited in Crawford, 1997. p. 16).

## The use of ICT in schools

Since the introduction of technology, in particular computers, into schools, there has been a debate about the most effective ways to use them to enhance student learning. Various models have been proposed to conceptualise the link between the types of uses and student learning. Many of the early models have focused more on the technology, the hardware and software, rather than the learning process or the learning environment.

### *Theories of learning*

In discussing these various models of computer use it is helpful to bear in mind two major perspectives on the learning process. These are the behaviourist perspective and the cognitive/constructivist perspective.

Behaviourist models of learning are based on the work of Skinner (Pressley & McCormick, 1995) and stem from a premise that learning involves a change in behaviour, and that the instructional process guides learners towards educational goals or outcomes. Negative and positive reinforcement are used to bring about and maintain desired behaviour and learning. Programmed instruction strategies have their origins in behaviourist models of learning.

Constructivist models of learning recognise the importance of cognitive processes, and that each learner must construct their own understandings of the world around them. Constructivism has a basis in Piaget's theories of cognitive development. Cognitive theories often use concepts similar to those of information systems, and emphasise the acquisition, processing, storage, and retrieval of information. The implications for learning of metacognitive activities, the ability of students to be aware of their own learning and to engage in effective strategies, are demonstrated in the encouragement of reflective learners. The socio-cultural views of Vygotsky (Pressley & McCormick, 1995) are also acknowledged in a constructivist view of learning. This recognises the social nature of learning as well as the importance of language and cultural background that students bring to a learning situation.

*Frameworks for computer use in education*

An early model described four educational paradigms which outline the educational implications of computer aided learning (Kemmis, Atkin & Wright, 1977, cited in Rushby, 1979). The *instructional paradigm* was based on the behaviourist principles of BF Skinner (Pressley & McCormick, 1995) whereby learning is seen a discreet steps which are both observable and measurable. These are controlled by a system of stimulus by the computer software and response on the part of the learner. This is often referred to as programmed instruction. Computer simulations and interactive fiction programs came under the *revelatory paradigm* where students learn by discovery. The subject matter is progressively revealed as students progress through the program. The *conjectural paradigm* is one where students create their own knowledge by model building in situations where they can test hypotheses. There is an emphasis on student exploration and knowledge is created through this exploration. The fourth paradigm proposed is the *emancipatory paradigm* whereby the computer is used as a tool to complete another learning task, i.e. it used as a means to an end. Here the advantage of the computer's speed of processing, storage and retrieval capacity frees the student from menial tasks enabling them to concentrate on higher order cognitive skills such as analysis and synthesis.

Taylor (1980) developed a model of computer use whereby he identified three modes of computer use in education. The computer can be a *tutor* when a student uses programmed instruction software that is designed to teach the content of a specific curriculum area. This uses behaviourist techniques (Pressley & McCormick, 1995) where the students are rewarded for producing correct responses. This is similar to the *instructional paradigm* proposed by Kemmis, et al. (1977, cited in Rushby, 1979). Taylor proposes a mode where students can give the computer instructions to follow , for example the programming language *Logo*. Students here are in control; they can experiment with, and test, their own ideas. In this mode the computer is a *tutee*. In the third mode the computer is used as a *tool* to enable students to complete a curriculum related task. Programs used here are often generic in that they are content free and can be used at any level, for example, a word processor, database, spreadsheet or multimedia authoring package. These last two modes encourage students to engage in higher order cognitive and metacognitive skills where they are able to plan, predict, analyse, evaluate and reflect on their own solution to a problem. Metacognitive skills are those where students understand their own learning patterns and can employ effective learning strategies.

The importance of collaborative learning has been highlighted with a framework that emphasises the social interactions that students have with the computer (Crook, 1996). Four types of interactions are described: (a) interactions *with* computers; (b) interactions *in relation to* computers; (c) interactions *at* the computer; and, (d) interactions *around and through* computers. Interactions *with* the computer refers to a situation where the student is working individually with the computer taking the tutor role in actively teaching the student new skills or content knowledge. This scenario involves programmed instruction producing face-to-face social interaction with the computer whereas interactions *in relation to* the computer are where the computer becomes part of the wider social space of the learning environment. The computer is not the centre of the learning activity but contributes nonetheless to the learning that takes place. It also recognises the part that the teacher plays in managing the learning process and the social nature of the learning environment in the presence of technology. Interactions *at* the computer involve students working in small groups to complete a learning task. Here they may work at the computer while discussing various ideas and possibilities for completing their task. The primary interaction here is not specifically with the computer but with their peers, collaborating in their learning. When this collaboration moves outside the classroom and students are collaborating with other members of the community in a different time and space then the interactions can be categorised as learning *around and through* the computer.

Another perspective for analysing computer use in education is the distinction between learning *with* information and communication technology, learning *in* information and communication technology, and learning *about* information and communication technology (Brown, 1995). Learning *with* information and communication technology encompasses all the modes of Taylor's (1980) model where technologies are used as part of the learning process to help students to support and extend their cognitive processes. This dimension gives teachers the opportunity to integrate the use of ICT into their classroom programmes. These technologies can be used at any level of education and across all learning areas. Learning *in* information and communication technology aims for students to become more capable and knowledgeable in this area by helping them solve problems. These problems can be related to the use of different symbol systems and how these are mediated by humans in getting particular messages across. Learning *about* information and communication technology involves an understanding of the relationship between these technologies and society.

These frameworks are useful for teachers to conceptualise their use of ICT. However, in doing so, they must always keep in mind that the goal of integration is the improvement of student learning.

## Integration and pedagogy

Since the introduction of computers into schools there has been a debate about the most effective ways to use them to enhance student learning. Do teachers assimilate them into their current style of teaching or do they integrate them into the curriculum in a way that changes the way that they teach? What are the key factors that determine the approach that an individual teacher takes?

It has been claimed that the most beneficial aspect of computer use is related to the integration of computers into existing curriculum areas (Collis, 1988) and that it offers new opportunities for learning (Salomon, 1991). Using computers in this way is the most complex in education and it requires a change in the role of teachers and adaptations of existing curricula (Walker, 1986, cited in Pelgrum & Plomp, 1993). Papert demonstrated, with the programming language *Logo*, that computers need not be restricted to use as a machine to teach children a pre-defined curriculum (Papert, 1980). Rather, they had enormous potential to transform the way teachers teach and students learn. They could become "interactive learning extensions of the children themselves" (Morton, 1996. p.416). A decade later Papert (1993) offers a very critical view as to why this change in educational practice had not happened. He argues that schools have not essentially changed from a late 19th century – early 20th century model. When computers were first introduced they were used by a small group of enthusiastic, visionary teachers who saw the computer as an instrument of change. However, when the numbers of computers grew it became more convenient for school administrators to put them into a room "misleadingly called a 'computer lab'" (Papert, 1993. p. 39) with a specialised computer teacher in charge. In this situation children could study the computer for a specified time period a week to learn how it worked. From this a computer curriculum grew. Thus the capability for a revolution in learning in the classroom was removed. He comments:

> *Instead of cutting across and so challenging the very idea of subject boundaries, the computer now defined a new subject; instead of changing the emphasis from impersonal curriculum to excited, live exploration by students, the computer was now used to reinforce School's ways. What*

> *had started as a subversive instrument of change was neutralized by the system and converted into a an instrument of consolidation.*
>
> (Papert, 1993. p. 39).

Eight major trends have been identified that have happened in schools where computers have been integrated into the curriculum (Collins, 1991). These indicate a move to a more constructivist form of learning. These trends show a shift from whole class to small group instruction with an emphasis on cooperation rather than competition. Lecture situations where the teacher is the font of all knowledge are replaced with coaching and facilitation. Teachers move from working with able students to working with those less able and assessments previously based on test performance show a shift to that based on process and products. Rather than all students learning the same things they now learn different things. There is also a change from primacy of verbal thinking to integration of visual and verbal thinking. All this leads to more engaged students but the integration of ICT into the curriculum often depends on individual teachers.

Morrison (1989) identified two models of computer use; one restricted and supplementary, with computers an add-on, controlled by the teacher, with limited time and used for selected purposes. The other can be described as elaborated and integrative where computers are integrated into the classroom programme, are readily accessible, a high level of student control and leads to a change in the role of the teachers. Morrison argues that for 'ideological, financial and practical' reasons the former model generally operates in secondary schools. A set of classroom conditions were identified for the most effective integration of computers and which lead to a change in teaching style. These involve careful, knowledgeable planning on the part of the teacher and more control by the student. The use of ICT is merely a microcosm of education per se. Sound educational practice is still sound whether ICT is used or not.

The four related dimensions identified by Knupfer (1995) that occur when introducing an educational innovation such as working toward successful ICT integration can be developed further. First is a level of *assimilation*, where there is an understanding by staff of the process of educational change. Here the technologies are used on an ad hoc basis according to opportunities that may arise. The second level involves a more *planned* approach to using ICT. The technologies are planned for and used within existing teaching strategies while at the third level teachers have a more in-depth understanding of potential that ICT had to enhance student learning. Teachers are beginning to re-think the way that they teach and adapting strategies accordingly. The final level, where ICT is fully *integrated*, is the acceptance by a large and diverse school community where the technologies are readily available for teacher and student use, and where appropriate pedagogical strategies are utilised. Although there is a danger of adopting an overly deterministic understanding of the phases of technology integration, these stages serve as a useful guide for schools, but are not the only consideration.

Tobin (1988, cited in Pelgrum & Plomp, 1993) predicted that teacher attitude and behaviour would determine the impact of the computer on teaching and learning in the classroom. This is evident in a survey of 608 teachers across in the USA by Hadley and Sheingold (1993) where motivation and commitment to teaching with computers was found to be a key factor in the achievements relating to the use of computers in their classrooms. The teachers believed in the educational value of student use of technology mainly from what they had seen happening in their classrooms. By integrating the use of computers into their classroom programmes they also believed that their teaching practice had been transformed (Hadley & Sheingold, 1993). For example, their classrooms were more student centred and students were more actively involved in doing projects and creating products. Their role as a teacher changed in that they were helping students to do more thinking and interpreting, allowing students to work more independently and as a consequence, giving them more individual attention. These teachers believed they taught differently and more effectively as a result of integrating computers. Other factors identified were the support and collegiality available in schools, appropriate, regular access to technology, and time for teachers. However Hadley and Sheingold did not distinguish between grade levels when reporting these findings so it is not possible to identify whether they relate to primary or secondary level teachers.

As demonstrated by the teachers in Hadley & Sheingold's study and the work of other researchers (Ryba & Anderson, 1993) the role of the teacher has been identified as a key factor in the successful integration of ICT. Teachers need to move from a position of being an information provider to one of a planner, facilitator, guide, participant and model. The teacher becomes a learning partner and collaborator in the learning process (Knupfer, 1995). The skill of the teacher is in setting challenging, authentic learning tasks according to what achievement objectives or learning outcomes they want the students to achieve.

There is a possibility that ICT, when used only in the 'tool' mode in existing programmes, does not lead to a change in teaching style. This use of ICT is used to *support* the existing system rather than *challenge* it. Because the use of these technologies in teaching and learning programmes can be quite flexible, they can be made to fit the existing practice and where this cannot occur they will not be used (Collins, 1991). The concept of 'computer as tool' relegates computers to the level of 'supplies' such as pencils and paper (Morton, 1996). Thus decisions can be made by administrators and teachers that computers are just expensive tools among many others therefore they can be rejected.

In recent years there has been a move, mostly in the primary school sector, for the use of ICT to provide a foundation for these new pedagogical approaches. Some schools have identified a need for students to become more information-literate, and have instigated programmes such as "KIC start" (kids in charge of learning; Gray, 1999). They are based on a constructivist view of education and encourage students to develop their own questions and use ICT as one way of accessing the world outside the classroom and school to find answers to these questions. Students are then able to choose the technology to suit their own learning goal. These programmes are developed from inquiry learning models generated by Gawith (1991) and others. There is also an emphasis on Bloom's Taxonomy (Pressley & McCormick, 1995) where the use of ICT can assist students at the analysis, synthesis and evaluation stages. Teachers can be quite specific about the link between student attainment of higher cognitive skills and the use of technology. The practicalities of introducing a change in pedagogical style is not so easy at secondary school level where particular difficulties have been identified when attempting to integrate ICT into secondary school programmes. Whereas in primary schools thematic and problem solving approaches are common the structure of the secondary curriculum is not conducive to this type of learning. The compartmentalisation of the curriculum and the timetable make a cross curricular approach difficult without a great deal of cooperation and goodwill between departments (Brown, 1995b). This is not to say it is impossible (Halliday & Cubitt, 1996).

An understanding of the dynamics of implementing change and innovation in a school is necessary for the use of ICT to achieve full integration and hence a pedagogical shift. Key themes have been identified which lead to successful school change (Fullan, 1991). These themes are equally applicable to implementing an ICT integrated curriculum. Whole school development is essential with all staff participating in establishing a vision for the school. Without ownership of the vision, change will not occur. Planning for the school's vision needs to be flexible and ongoing to adapt to unexpected developments and opportunities. Leaders in the field must be supported in their initiatives and empowered to assist other teachers. The development of a collaborative learning culture is an important part of any change. This breaks down the isolation of teachers and makes them feel supported in any new ventures. Just as the social aspect of learning is important for students, so too, is it for teachers. In this way successes can be shared with colleagues. Staff development is essential, as is monitoring of the situation in order that improvements can be made along the way. Restructuring involves organisational aspects such as allocating time; for planning, for the development of mentors and coaches and for team teaching (Fullan, 1991).

### Towards a Theoretical Framework

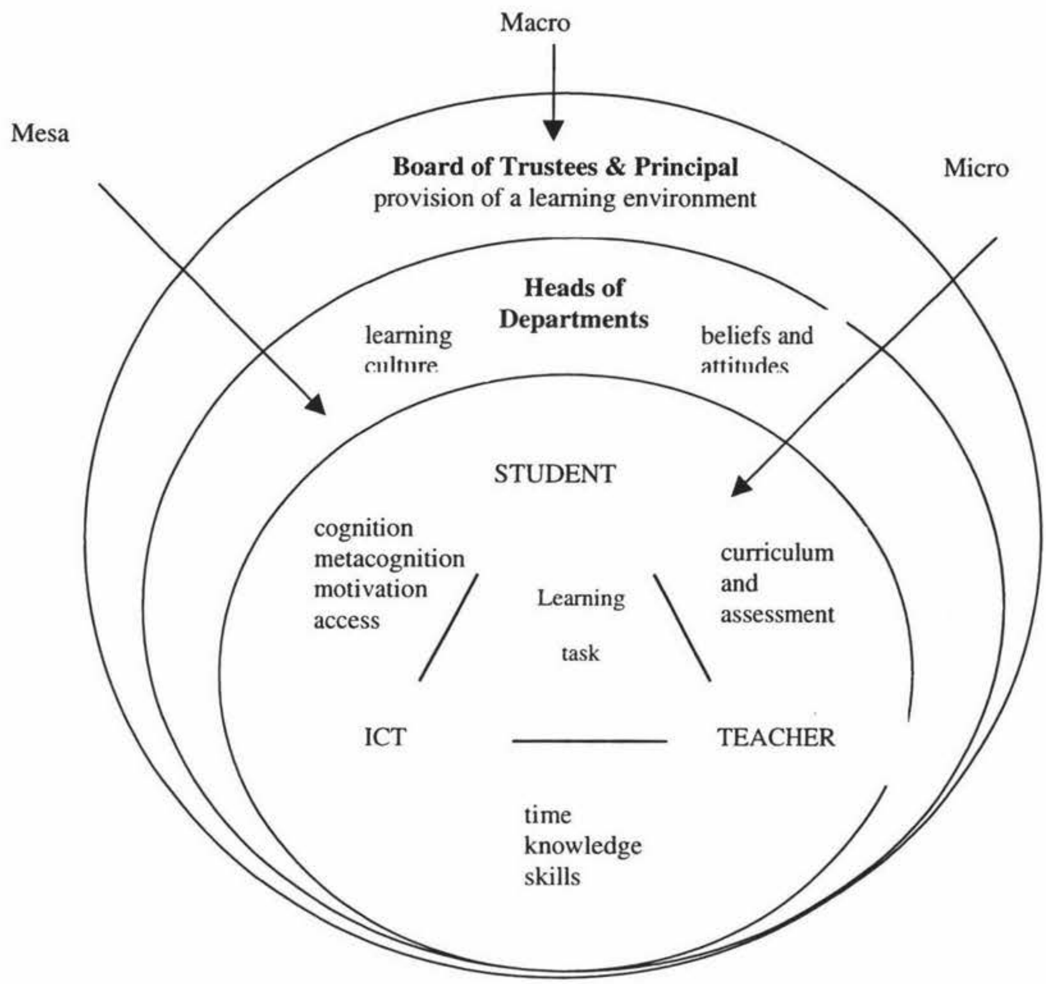
A theoretical framework which impacts on the use of ICT in schools has been developed by Pelgrum and Plomp (1988) which incorporates concepts derived from system theory, curriculum theory and theories of educational change. It states that an educational system – which is most likely to be hierarchical – is composed of a number of systems interacting with one another and sometimes with other systems. Pelgrum and Plomp identified three system levels – macro (e.g. government, support institutes, Ministry of Education), mesa (the school level), and micro (student level). This model shows how agencies and people interact with one another within a level to influence or make decisions regarding such aspects as the curriculum and resources. The different educational system levels also interact in order to effect educational change. Influences such as policies, objectives, resources, are all brought to bear on this process.

Brown (1995a) developed the model further and proposed an ecological model of a computer learning environment. He maintains that the strength of this model is that all the different element and systems must always be considered in relation to one another. None can be treated in isolation. Brown's model includes the various roles of teacher, student and computer and shows how they combine and interact to form a computer learning culture, first identified by Papert (Papert, 1980). The role of the teacher is shown to be crucial and highlights the numerous and varied roles that teachers assume when using computers and other ICT tools in their classroom programmes. Teachers can be, at one time or another, manager, planner, facilitator, model, guide and/or participant (Ryba & Anderson, 1993). These roles influence the way teachers interact with students and develop the learning culture. The importance of the student is included in the model with a representation of the essential learning processes identified by Short and Weissberg-Benchell (1989, cited in Brown 1995) and the various roles of the computer are shown using Taylor's (1980) tutor, tutee, tool model.

The model in Figure 2.1 has been adapted from Brown (1995) to show the complex relationships between the macro, mesa and micro levels in a secondary school which interact and impact on each other to produce an environment where information and communication technologies can be integrated into the curriculum. Here the macro level is the Board of Trustees and the principal who provide the vision and learning environment in a secondary school (Fullan, 1991). The mesa level includes the middle managers such as heads of the various curriculum areas including the Head of Computer Studies or ICT. The beliefs and attitudes of these teachers are crucial to what occurs at the micro, the classroom level. Within the classroom interaction between teacher, students and ICT equipment occurs. This interaction is influenced by issues such as curriculum and assessment, and the individual knowledge and skills of both the students and the teacher. Knowledge includes technical knowledge and knowledge of the learning process. Through the use of ICT students are encouraged to develop metacognitive skills, an explicit awareness of their own learning process. Access to equipment and time for planning is also crucial at this micro level. All of these factors impact upon the development of an ICT learning culture within the secondary school.

*Figure 2.1*

**Ecology of the ICT-using Learning Environment in a Secondary School.**



## ICT IN NEW ZEALAND SECONDARY SCHOOLS

Although the variables impacting on the computer learning environment are now well known, it is timely to examine the data from studies on New Zealand secondary schools and, in the following section, those conducted internationally.

Apart from the IEA study (Chamberlain & Kennedy, 1991; Nightingale & Chamberlain, 1991; Pelgrum & Plomp, 1993) most studies on the use of ICT in New Zealand secondary schools have been small scale case studies where innovative ICT projects have been implemented, largely dependent on individual, enthusiastic teachers (Boyd, 1997). Some involved the implementation of computer networks to attempt to give access to more teachers and students (Neilson, 1991; Porteous, 1992). In one case, where laptops were introduced for Year 9, the use of these computers, in relation to their effects on learning and motivation, were studied (Parr & Bairstow, 1992). Short descriptive articles have also contributed to the overall picture of what is happening in New Zealand secondary schools (Butterworth, 1998; Hill, 1998). Other studies have collected quantitative data on the numbers of computers in schools, primary and secondary and reported on such aspects as the national computer-student ratio (Owens, 1996; Sullivan et al., 1998; Telecom Education Foundation, 1996) or were an outline of the ICT developments in New Zealand (Harris, 1997). All of these reports showed an increase in the numbers of computers available in schools and the conclusion was drawn that this indicated an increase in usage by students. However, there has been little in-depth investigation into student use of computers.

In 1989, New Zealand was part of a major international study by the International Association for the Evaluation of Educational Achievement (IEA) on the use of computers in education (Pelgrum & Plomp, 1993). The main study, a survey collecting quantitative data, was followed up in each country with a more qualitative, in-depth case study. Three populations were studied, elementary students, and, in New Zealand, Year 9 and Year 13 students. In the survey, data relating to the latter two target groups were collected separately so the secondary school as a whole, and the culture and processes that comprise a secondary school, could not be taken into account. Three groups of people responded to the questionnaires – the principal, a technically informed person and a teacher for each of mathematics, science and mother tongue. The inclusion of subject teachers yielded valuable data which schools could use to build on in their efforts to integrate the computer into the wider curriculum areas. The nature of the survey gave a representative overview of what was happening in New Zealand secondary schools in 1989.

In New Zealand 128 schools containing lower secondary students and 139 with upper secondary students, participated in the study (Nightingale & Chamberlain, 1991). This first survey examined the use of computers for teaching and learning. All secondary schools had computers which were being used for educational purposes, but in 3% of schools they were not being used by the junior levels, Year 9 and 10. Data showed that although computers were being used in a wide range of curriculum areas such as languages, science, English, music, technical subjects, social studies and mathematics, the integration into existing curricula was still at an initial stage. Very few schools had written policies for the use of computers in teaching and learning. Computers were introduced to ensure that students had experience with them and to keep the curriculum and teaching methods up to date. Their implementation however was characterised by an unplanned approach with little or no guidance in the form of a national strategy. Computer purchases of hardware and software were piecemeal and lead to problems with incompatibility. Teachers identified insufficient computers, difficulty gaining access, a lack of suitable software and a lack of training as problems they were experiencing. Professional development for teachers was identified as an urgent priority.

There was a large discrepancy between primary and secondary schools in New Zealand as to where computers were located. Thirty six percent of primary schools, and only 8% of secondary schools, had computers located in classrooms. In secondary schools computers were more likely (74%) to be in computer laboratories. Only 4% were in other teaching rooms such as science labs or reading rooms. This has implications for a teacher's ability to integrate the computer into the day-to-day teaching and learning programme. Although over

90% of principals reported that Year 9 and Year 13 students were using computer applications as tools there was no indication of how many students were involved in these activities. A different picture emerges when this percentage is compared with the reported use in one class by the English (38%; 14%) mathematics (34%; 42%) and science (15%; 39%) teachers at Year 9 and 13. Teachers who reported not having used a computer in their Year 9 and Year 13 classes were English (50%, 66%) mathematics (50% 30%) and science (55%, 45%). Other major ways in which principals reported computers were used at Year 9 and Year 13 respectively, were; CAI (81%, 74%); introductory courses about computers, (89%, 84%); courses in a programming language, (66%, 86%). Unfortunately New Zealand did not participate in the 1992 IEA survey using the same instrumentation. This would have given important comparative data about the changes that had taken place in New Zealand schools in the three years since the first study.

A follow up case study was done in each country and in New Zealand two secondary schools were studied (Chamberlain & Kennedy, 1991). The practice of Computer Integrated Teaching and Learning (CITL) at Year 9 and 10 was examined. This was described as a "phenomenon to be scrutinized" (p. 3) but the term was not specifically defined. The two schools, one large urban and one small non-urban, were chosen from the earlier research, using set criteria, and were deemed to be successfully integrating computers for teaching and learning in a range of curriculum areas such as English, mathematics, social studies, science, music, technical drawing, computer studies and general studies, all at Year 9 and 10. This was a comprehensive case study methodologically, with questionnaires completed by the principal, the computer co-ordinator as well as a computer-using and non-computer-using teacher covering the areas of English, mathematics and social studies. Science was included in the small non-urban school and one wonders why not in the large urban school. These questionnaires were largely the same as those used in Phase One of the international study. A questionnaire was also administered to students at the lower secondary level and who were in the class of a participating teacher. Structured interviews were conducted with principals, teachers and students and in addition, observations were made in classes of computer-using teacher participants. Whereas the Phase

One study gave an overview of the situation in New Zealand secondary schools, this case study gave more specific detailed information which had not been collected before.

The findings were similar to the earlier study. Teachers of curriculum areas other than computer studies expressed frustration at not being able to access computers in computer rooms on a regular basis, or at a time that fitted in with a prepared lesson. This was a major concern. At school A, although computers were being used in curriculum areas of English (Year 9 only), mathematics (Year 10 only), Year 9 and 10 French, and Year 10 for typing and technical drawing, these students still received most of their instruction about computers in the context of a computer studies course. A computer studies course was compulsory at Year 9 and an option at Year 10.

Year 10 students in School B received their computer instruction as a module within a 'general studies' course while Year 9 students had no formal computer lessons. However computers were used in a range of curriculum areas including English, mathematics, social studies, science, French music and 'commercial studies'. Activities in both schools reflected the types of software available in 1991 with curriculum-specific educational games, instructional programmes, simulations and problem solving software.

Teachers reported problems obtaining and using suitable software, and having sufficient software for teaching and learning. If they did have it, it was not adaptable enough for their classes or it was too difficult and complicated to use. They reported lack of time to learn how to use it. This was compounded with poorly designed manuals. In general there was a lack of information and guidance about the quality of educational software. Technical issues, with many system crashes, and a lack of access were other major concerns, making it difficult to successfully achieve computer integrated teaching and learning.

The report recommended that school-based training programmes be developed to introduce teachers to the types of software available in their area and a central body be set up to provide advice and information on educational software.

Formal policies were needed to address issues of equity, use in teaching and learning, and professional development. Although this study was carried out a year after the main study many of the same issues were still evident as teachers were faced with the dilemma of trying to integrate the computer in their teaching and learning programmes with insufficient support and coping with restricted access. The location of computers in secondary schools was also becoming a major issue for curriculum teachers as evidenced by Ham's article two years earlier.

Ham (1989) discussed the use of computers, particularly the word processor, in secondary schools and lamented that while primary schools were situating computers in classrooms where the learning happens, secondary schools, in contrast, isolated them from normal classroom routine by locating them in separate rooms in order to study them. He pointed out that increasing numbers of Year 9 students, used to using computers in English, will be attending secondary schools and will expect access. Their parents will also expect access for them.

The Freyberg High School Integrated Studies Project was an attempt to provide a model of an integrated curriculum in a secondary school with sufficient access to information technology, for learning goals to be achieved. This began in 1986, (Ayres & Nolan, 1987) with a programme of integrated studies for Year 12. A similar programme was also introduced at Years 9 and 10. The aim was to investigate the impact that computers had on the curriculum, types of learning activities, learning environments, planning, resources and the use of computers as tools for learning. This project involved integrating the curriculum areas of English, mathematics, social studies and science as well as integrating the use of computers into this innovative holistic programme. The project received special funding from the then New Zealand Department of Education, IBM and Massey University. Thus the programme was able to provide extra technology to students in the form of computers.

The results from a longitudinal study (Nolan & McKinnon, 1998) of this project showed that students took computer use in their work for granted and came to regard the computer as a means to an end. They even expressed dismay and resentment when they had to return to regular classes and realised they would not have the special increased access to computers that they enjoyed as part of the project. The students regarded computers as a tool for learning just as they would a calculator, pen or notebook. It was just part of their day-to-day working environment. This demonstrates that when students have ready access to ICT tools, and they have the skills and knowledge to use them, then they are capable of making informed and appropriate choices as to which technology to use for the task at hand.

The programme employed sound pedagogical strategies but because it was designed and implemented with influence and support from the macro environment, it is outside the usual curriculum activities and therefore not typical of the experience for most students at Freyberg, nor those in other New Zealand secondary schools. The ethics of this programme can be questioned in regard to the negative effect on students when they had to return to regular classes in Year 11 and did not have this intense exposure to ICT. Year 11 is an important year in New Zealand education for secondary school students as this is the year they sit their first national examinations, School Certificate. What effect did this lack of access to technology have on these students, their motivation and inability to build on the successful learning strategies that they employed the year before? The constraints that a national examination has on the secondary school programme is evidenced here, with tight syllabi and timelines to get through, perhaps causing teachers to resort to traditional teaching strategies of a mainly information transfer approach.

In contrast to the Freyberg Project a completely different programme was introduced at Rutherford High School (Parr, 1994). This was a computer assisted learning (CAL) program, called *Successmaker*, which was based on the behaviourist principles of programmed instruction. A form of drill and practice software, it takes a tutor role (Taylor, 1980) and is used for individualised learning. It delivers specific curriculum content sequentially and at different levels, these being determined by the software makers. Consequently there is little control by the teacher or student, with no link to the New Zealand curriculum. It was used also at Year 9 and 10 and covered basic literacy and numeracy skills. Being a CAL program it employed quite different pedagogical strategies than that of the Freyburg project, but was also employed outside the normal curriculum programme. Gains in test scores were shown to be made for 'learning support' students, thus, like Freyburg, was used for a selected group of students.

In a more recent study, Palmerston North Girls' High School implemented a Learning Enhancement with Information Technology project (Boyd, 1997) during 1995 and 1996. This involved integrating the use of computers in the classroom by all students studying Year 12 & 13 accounting and economics, or Year 13 mathematics with statistics. This programme was introduced as a result of decision making at the school, or mesa, level. Realising the innovative nature of the programme, a researcher was invited to study the effects. It showed that teachers' and students' perceptions of computers changed over time, from viewing them as the focus of a lesson to that of a tool that was part of general classroom practice.

Like the Freyberg Integrated Studies Project students became more independent in their use of computers and teachers were more selective in their use and changed the way the computer was integrated into their lessons. Teachers reported increased motivation in students as well as the development of skills such as computer literacy, presentation skills, group work, peer tutoring, self-teaching and problem solving skills. Student learning was enhanced in a variety of ways; co-operative learning opportunities helped the development of practical and conceptual information technology skills, and the use of word processors improved the quality of internally assessed projects. Teachers called for more curriculum resources and advice as to how to integrate specific software into lesson plans. An important aspect of integrating ICT into the secondary school curriculum, especially at the senior level is the effect on student examination performance. This study showed there were no significant positive or negative effects on student performance in end-of-year Bursary examinations, but a recommendation was made for more research into the implications of the use of new technologies for the current examination system and curricula, and for all assessment.

As mentioned earlier, a number of annual surveys were undertaken by industry groups such as the Telecom Education Foundation and the Information Technology Advisory Group (Harris, 1997; ITAG, 1999; Sullivan et al., 1998; TEF, 1996). These surveys concentrated mainly on the numbers of computers and other equipment in schools and did not look at *how*, or even *if*, this equipment was being used in classrooms. Included in the numbers were computers used for administrative purposes in schools. This was, and remains, a major flaw with their approach to documenting the situation. Another flaw in their methodology was that substantial prizes were given to schools who responded. These results need to be viewed with caution as they may show more ICT activity than is really the case and the authors comment that schools with active ICT programmes may have responded disproportionately to the survey. However they have provided interesting data for example in 1998, 94% of secondary schools had access to the internet which included administration computers, and 60% had access in at least one classroom (ITAG, 1999).

These New Zealand studies have largely documented the impact of specific innovations in individual schools and particular curriculum areas at the micro or mesa levels, often involving technology-rich environments that are not typical of most secondary schools. They give us compelling stories and useful insights with detailed and encouraging examples of the New Zealand situation, but, because of their particular research designs the results cannot be generalized to the wider secondary school population. The most comprehensive study was undertaken a decade ago and other, more recent surveys are quantitative, concentrating on facts and figures rather than investigating the pedagogical rationale of using ICT in secondary schools.

## ICT IN SECONDARY SCHOOLS OVERSEAS

The following section examines international literature on the integration of ICT into the secondary school curriculum. These studies follow a similar pattern to those found in New Zealand, small scale case studies which follow teaching practices in a number of schools and classrooms often in technology-rich environments not typical of the average school. Exceptions are the IEA study, the New Zealand results of which were reported in the previous section, and a survey of 608 teachers from 576 schools throughout the USA by Hadley and Sheingold (1993), also reported in an earlier section. This survey sacrificed depth of information for breadth in order to discover the views of many technology-using teachers.

A review of international literature of computers in the secondary school curriculum brought together a number of findings(Morrison, 1989). The review drew extensively from experimental and survey research. A number of the studies looked at the learning implications of using tutor and drill and practice software. They showed that access and the provision of computers was an issue throughout the 1980s as well as where they were located. Teachers in Hurd's study (cited in Morrison) believed that concentrations of computers in laboratories depressed the level of use, while mobile computers for classrooms were an important stimulus to use. Supportive school policies were viewed as important and teachers views on learning processes and their teaching style affected the way they used computers. Morrison reports that there are few formal studies of how secondary teachers actually use the software available. In 1989 he recommended that further research be done on areas such as: desirable levels of provision in relation to particular curriculum applications, policy and practice in promoting general computer awareness across the curriculum, and between-schools comparisons of their uses of the resources. The pedagogical issue of student autonomy was discussed with the aspect of who controls the knowledge, teacher or student, highlighted. Chatterton (1988, cited in Morrison) found that there was a major shift in classroom organisation and student/teacher roles when control of the knowledge base was transferred to the students. This is similar to the findings of other studies (Hadley & Sheingold, 1993; Nolan & McKinnon, 1998). The methodologies of some of the studies, quantitative and comparative, make it difficult to measure qualities such as teacher pedagogical knowledge and student transfer of knowledge. Studies involving qualitative research methods, case study and interpretive, which can reveal more in-depth information are more rare.

In the same year, 1989, the IEA survey, mentioned earlier, collected quantitative data to gain an international perspective on the use of computers in education (Pelgrum & Plomp, 1993). Data were collected from three populations of students, elementary, lower secondary and upper secondary school, in 21 countries. The survey looked at the reasons schools use computers, the availability of equipment, how schools and teachers were using computers, and teacher professional development. The survey methodology gives an overview rather than in-depth information. Follow up case studies in each country, using observations, interviews, and questionnaires, yielded a more qualitative perspective. The way the data was analysed gave important information on secondary school computer integration. An indicator of integration in this study was the link between how teachers used the computer, for example, whether they taught it as a topic or taught *with* it, and where computers were located. In lower and upper secondary schools there was an increased reporting of use on all integration indicators when computers were in the classroom.

The study showed that a social rationale was given as the main reason computers were introduced into schools; that of preparing students in computer literacy to be able to take part in society. Computers were used in a variety of curriculum areas with use in mathematics mainly for arithmetic in lower secondary, and algebra in upper secondary schools. In science the topics were from the physics curriculum such as electricity, time and movement and wave phenomena. Unsurprisingly, the word processor was most frequently used in English for writing activities. Pelgrum and Schipper (1992, cited by Pelgrum & Plomp, 1993) found that the extent to which schools integrate computers tends to increase slowly as a function of years they had gained experience in using them.

Data from the USA in the same study (Becker, 1991) showed that less than 25% of the total student computer time in secondary schools was devoted to productive work in the major academic areas – English (7%), mathematics (8%), social studies (4%) and science (5%) and foreign languages. This included vocabulary drill and practice, educational games and other computer-assisted instruction, as well as graphing programs, writing and other analytic and expressive functions. One half of all student computer use was instruction in how to use applications, such as, word processor, database, spreadsheet, programming and keyboarding. While 49% of teachers reported *viewing* the use of computers as a tool for academic tasks, only 23% of English, 24% of mathematics, and 8% of science teachers reported students *using* computers in a substantial academic way. English teachers stood out as a group who were using computers, i.e. a word processor, as a tool for learning, whereas drill and practice programs were used mostly by mathematics, and science teachers. The study recognised that secondary schools would have difficulty keeping up with rapid changes in technology and would be challenged to provide sufficient access to computers for classroom teachers.

From data collected in 1989 and 1992 from the USA (Becker, 1998) it is difficult to get a reliable indication of exactly how often computers are used by students. However these student surveys do give an indication of the relatively infrequent use of computers in the major academic areas of the secondary school curriculum, excluding classes about computers. Becker re-analysed the data and estimated computer use of two hours per week per student, but when this was compared with data obtained from the students themselves, an amount of 40 minutes per week per student was reached. An indication of the difference in amount of use between primary and secondary schools was a decline of 10% in the estimated amount of time a student spent on mathematics learning between elementary and high school (from 18% to 8%). This suggests that computer applications are not being used for higher level problem solving activities in the secondary school. The main use in secondary schools was still computer application skills, with the exception being the use of the word processor. Teachers reported time was an issue, time to learn how to use computer applications and enough time on computers for students to complete tasks.

Schools did not have enough computers so access was always an issue for teachers. At the time this research by Becker was being conceptualised, he was believed to be about to embark on a further study.

In the United Kingdom, science and mathematics teachers investigated the impact that ICT would have on their respective curriculum areas (Harris, 1994; Higgo, 1994) and gave strategic guidance for other teachers. A study of secondary mathematics teachers in England and Wales investigated classroom use of databases, spreadsheets, logo and the programming language *Basic* (Andrews, 1997). The proportion of teachers incorporating this software successfully into their programmes was small, with 14% reporting frequent use of a database or a spreadsheet. A spreadsheet was perceived to be most useful for achieving curriculum goals. A correlation was found between teachers' competence with, and regular classroom use of, this software, however competence was not an indicator of regular classroom use.

A national Australian survey (Sherwood, 1993) of computer-using teachers in both primary and secondary schools examined how teachers had acquired the necessary skills and knowledge to use ICT in their curriculum areas. As the participants were 'computer-using' teachers only, the results do not reflect the situation among all Australian teachers. The data were not analysed according to year levels so it is not possible to isolate the results for secondary teachers. Many teachers felt that their pre-service and in-service training had not prepared them to effectively integrate computers into their teaching and learning programmes. Almost 80% indicated they were to some degree self-taught, with six out of ten having received instruction from colleagues. Teachers identified barriers such as : lack of sufficient equipment and financial support from central bureaucracy, lack of time to develop lessons, lack of effective training, inadequate pre-service, and inappropriate in-service, workshops. The training also did not prepare them to integrate ICT into their teaching, provide sufficient time to become comfortable with software, or offer support in the early implementation phase. In short, the training experience was not tailored to their needs. Many had subsequently undertaken professional development in their own time.

A two year study, investigating the interaction and relationship between literacy and technology in teaching and learning was conducted in three Australian states (Wild et al., 1998). Classroom-based sites were each treated as a holistic self-defining entity and studied using case study methodology. This meant that an in-depth study could be made of a range of critical practices in which literacies and technology interact. Sites included both primary and secondary classrooms with curriculum areas of English, technology, social studies, science, mathematics and the arts. Three broad patterns were identified. Firstly, the process of integrating ICT into classroom practices was a synthesis of very complex components, often depending on individual teachers' knowledge and skills, both of technology and pedagogy. Because of this dependence on the skill, knowledge and enthusiasm of individual teachers the successful integration of ICT in any given classroom was seen as being fragile. Continuity was the third pattern or trend identified. Coherent policies and curriculum planning are seen as vital for the continuity of student learning within a school.

Seven schools, including three secondary schools, in Victoria, Australia (Department of Education, 1998) were singled out in 1995 to become navigator schools. The objectives were to create exemplar schools as models of a new learning environment with access to technology in every classroom, to share what is learned in a collaborative way via professional development for teachers, and to research this environment. Extra funding, for resources and personnel, was received by these schools so while they have succeeded in providing a model for other schools, the achievements are not necessarily realistic for other schools without the corresponding resource input. Ongoing evaluation shows that initial planning is one of the crucial factors leading to successful integration. The expanding role of the library as a strategic centre to provide physical and electronic resources, is also identified as a key factor. The report indicates that a change in teaching practice has occurred in every classroom.

A similar programme for seven lighthouse schools was developed in Tasmania in 1997 (Connor, 1999). One school per district, with a spread of primary and secondary, was selected for extra resourcing. Initial establishment focused on provision of hardware and technical assistance rather than professional development for teachers. The goals do not mention anything about increasing student learning but talk about how ICT will 'look and operate' in a school, and 'maintaining credibility and enthusiasm for implementing technologies'. The web pages of the secondary schools list a series of activities that students have engaged in. Three schools mention curriculum integration and professional development for teachers.

These two Australian initiatives have succeeded in providing exemplar schools but an inequitable situation has developed between selected schools and others in each state. While they are sharing their knowledge with teachers in other schools, without a similar input of resources it is going to be very difficult to emulate their success. A two tiered education system could arise with inequitable educational achievements for students highlighting a danger for countries pursuing this approach.

International literature indicates widespread reported use of ICT in various curriculum areas in secondary schools, but when analysed more closely the frequency of use is relatively low unless students are in classes where computing skills are taught. School systems, policies and procedures, as well as teacher skill and knowledge, were important features of successful integration programmes.

## THEMES TO EMERGE

Themes that emerge from this research into the use of ICT in secondary schools can be categorised into five areas. These themes are important in determining the success or otherwise of the integration of ICT into teaching and learning programmes of curriculum areas other than computer studies classes. These areas are (a) policy guidelines, (b) effective professional development (c) the use of effective pedagogical strategies, (d) the role of the teacher, and (e) appropriate access to equipment.

### Policy guidelines

As early as 1991 the conclusion was reached in New Zealand that a national strategy with clear policy guidelines were necessary to assist schools in integrating ICT across the curriculum. This was not implemented in New Zealand until 1998. Previously, schools attempts at integration were characterised by ad hoc initiatives largely dependent on enthusiastic teachers in individual curriculum areas. It is hoped that the emphasis on planning in the New Zealand Government ICT Strategy will lead to a more cohesive approach across all curriculum areas. In schools where planned implementation of ICT into the curriculum has been successful, there has been clear policy direction from the government, the school governing body and the principal. It is important that the schools' vision and policies are decided collectively so that teachers own the strategy (Fullan, 1991). HODs and teachers are then clear about what the collective vision is and work collaboratively to achieve it.

### Professional development

Training for teachers in integration strategies has long been recognised (Pelgrum & Plomp, 1993) as an essential element in the successful integration of ICT into existing curriculum areas. All reports and investigations into the use of ICT have recommended professional development as a priority. Having the time to do this has also been recognised as an important ingredient in the whole equation. The innovation is such that it will take teachers many years to fully integrate it into their curriculum area. They need to get to know the technology, to find out what potential advantages there will be and then to explore ways of using it in their teaching and learning programmes. Secondary teachers who are successfully integrating computers into their existing subject areas had a greater knowledge of computers and a greater capability of using them as tools. O'Donnell (1996) identified curriculum context as 'the missing key' in ICT professional development for teachers arguing that there had been too much emphasis on skills rather than contextualising the training for teachers. Professional development programmes must include pedagogical strategies within a curriculum context.

Evidence suggests (Fullan, 1991; Hargreaves, 1994; McKenzie, 1998; O'Donnell, 1996) that ICT professional development should be whole school development that develops a collaborative culture of learning in teams in order to effect change. Reflective practice should be encouraged with collegial, emotional and pedagogical support available for teachers. ICT professional development should occur within a curriculum context and include assistance with planning. Ideally the programme will be carefully planned over a period of years and not just organised on an ad hoc basis year by year.

### Pedagogical strategies and the role of the teacher

These two issues have been included together because evidence suggests that as teachers begin to use ICT as part of their everyday teaching and learning programme a change occurs in their pedagogical style which includes a change in their role as a teacher.

Teachers have integrated ICT for a number of reasons. Some as result of their own enthusiasm, skill, pedagogical knowledge and belief that these technologies will enhance the learning of their students. Some have used them as part of a planned implementation strategy in their school. The literature reflects both of these situations. Studies have examined the practices of teachers who are already competent computer-using teachers as well as documenting the implementation of a planned programme of integration.

There is general agreement that teaching practices change over time as teachers become more confident and proficient at using and integrating ICT into their teaching and learning programmes. This process happens over a period of years, five to six years has been mentioned, rather than weeks and months. Classrooms change from being teacher centred to more student centred with a corresponding change in the role of the teacher to that of coach, facilitator and participant in the learning process. More collaborative work in small groups is done by students and the individual needs of students are met.

## Access to, and location of, ICT tools in secondary schools

The issue of where computers are located is a contentious one. Secondary schools have traditionally sited computers in computer 'laboratories' in order that a class of 30 students can study them. Secondary schools have put into practice Papert's (1993) argument; that 'school' as an entity has done this to avoid the teaching and learning changes that are possible with the use of computers. Computers have been put in isolated rooms, access restricted to students enrolled in computer awareness courses, for Year 9 and 10 students, or computer studies, for Year 12 and 13 students. A curriculum called 'computer studies' has been built around the computer, involving the study of the history of its development, how it works and how to make it work, that is, programming. This curriculum has been taught mainly to senior secondary students. Most use of computers that secondary students have had, have been from these dedicated computer use classes.

The location of computers has implications for the frequency of use of computers for curriculum teachers and their students. There is evidence of an extraordinarily low use of computers by secondary students in the target curriculum areas of English, mathematics, science and social studies when compared to students in primary schools. In secondary schools, computers are located away from classrooms where curriculum learning happens, whereas in primary schools there is a much higher proportion of computers located in classrooms. The literature shows that this lack of ready access can be a significant barrier for the secondary curriculum teacher. A decrease in the amount of use by students from primary to secondary school has been demonstrated. When used as an integration indicator, computers are used more by curriculum teachers when they are located in classrooms.

A link can be made between where computers are located and the teaching style employed by the teacher. If constructivist teaching strategies are used, such as inquiry learning, small group, collaborative, authentic activities, it has been argued (Becker, 1998) that resources, including information and communication technologies, need to be available in the same teaching and learning space.

Much of the literature concentrates on quantitative data about how many and what type of computers are in schools and does not give a clear indication of the views of the curriculum teacher in a secondary school. Questionnaires are often completed by principals or the computer coordinator, whose experience may not be the same as the curriculum teacher or the student. From survey data it is also difficult to gain an accurate account of how often students are actually using computers in curriculum classes. It is important to seek the views and experiences of the students themselves.

## STATEMENT OF THE PROBLEM

The literature review conducted in this chapter revealed a number of important gaps especially in the literature about New Zealand secondary schools.

Methodologies used have been largely quantitative surveys and questionnaires with very few in-depth qualitative studies. While surveys enable a wider group of teachers' views and practices to be canvassed it is at the expense of examining closely individual teaching practices and the culture of a school. Useful data has been collected about quantities of hardware and types of software available in schools and where they are located. Information is collated about the computer-student ratio which increases each year. However this data does not indicate how frequently computers are used, who uses them and the types of learning activities they are used for. Often surveys and questionnaires are completed by the principal, the person in charge of computers or an enthusiastic computer-using teacher. This may lead to an over reporting of the situation in a school as the views of the 'ordinary' classroom teacher are not sought. Very few studies have sought the views of students. Many questions are left unanswered.

Much research was done in the late 1980s and early 1990s and very few in-depth studies have been conducted since, especially in New Zealand. As early as 1989 Morrison (1989) listed a set of classroom policies and conditions where the effective use of computers would be found. He commented that the extent to which these conditions were met by secondary teachers in secondary classrooms was not known. From a review of the literature ten years later it is still not known.

Research in secondary schools has often involved isolated projects on single curriculum areas. Some articles have been short descriptions of particular initiatives in individual schools. Many of these projects have been as a result of individual enthusiastic teachers who have often written up their own projects.

Other studies have concentrated on specific, enriched programmes in a school at particular year levels, in particular curriculum areas. These programmes have not been implemented across the whole school so a holistic picture does not emerge. These special one off programmes sometimes receive extra funding for resources so are not typical of the average secondary school. There have been no investigations in New Zealand of the use of ICT in the major academic curriculum areas of English, mathematics, social studies and science across a range of secondary schools since the IEA study. Nor has there been an in-depth case study conducted in the naturalistic setting of a whole secondary school, to gain the views of classroom teachers and students.

## SIGNIFICANCE OF THE STUDY

The findings of this research will have the potential to assist Boards of Trustees, Principals, ICT managers, HODs and teachers in secondary schools to better understand the interacting variables that operate in a secondary school across the three levels, macro, mesa and micro, outlined earlier. This will enable them to effectively manage the process of integrating ICT into teaching and learning programmes in all curriculum areas.

Information from this study will be useful in a wider national and international context. It will inform the New Zealand Ministry of Education when reviewing the ICT national policy and provide specific issues to consider when addressing professional development in this area. Tertiary teacher educators and consultants will also be informed by the issues raised in this study. Internationally there are similar issues that can provide guidance for policy makers at government, district and school level.

## SUMMARY

The parameters of the thesis have been outlined beginning with a historical outline of policy directions for the use of ICT in New Zealand schools. The term "ICT" has been defined and discussed in the context of the New Zealand curriculum and contemporary learning theories. Frameworks for the use of computers in education were examined. A theoretical framework, adapted to the learning environment of a secondary school was presented. The research literature from New Zealand and international studies on the use of ICT in secondary schools was reviewed with findings described and methodologies critiqued. A number of methodological weaknesses were identified. Themes that emerged from this literature were described. The chapter concludes with a statement of the research problem and an outline of the significance of the study.

# CHAPTER THREE – METHOD

## INTRODUCTION

This chapter presents the research questions and outlines the overall methodological approach and research design. It shows how information gathering strategies are directly linked to specific research questions. The two phases of the research are described, together with an outline of sample selection processes in each phase of the study. Methods of data collection in each phase, as well techniques for analysing data are summarised. The justification for decisions made throughout the study are explained and attention is also given to ethical considerations. Finally the methodological limitations of the research are considered.

## RESEARCH QUESTIONS

### Main Question

To what extent are secondary schools integrating information and communication technology into the curriculum areas of English, social studies, mathematics and science?

### Related questions

1. *What attitudes do secondary teachers have towards the integration of ICT in their curriculum area?*

2. *How are secondary teachers integrating ICT into their teaching and learning programmes?*

3. *What type of access do English, social studies, mathematics and science teachers have to ICT?*

4. *What factors do teachers of English, social studies, mathematics and science, identify as leading to the successful integration of ICT into their curriculum area?*

5. *What factors do teachers of English, social studies, mathematics and science, identify as barriers to the successful integration of ICT into their curriculum area?*

6. *To what extent have formal professional development programmes played a part in the successful integration of ICT into the curriculum areas of English, social studies, mathematics and science.*

7. *What systems are in place to support teachers to integrate the use of ICT into the curriculum areas of English, social studies, mathematics and science?*

8. *What perceptions do students have of their experiences in using ICT in the curriculum areas of English, social studies, mathematics and science?*

## RESEARCH METHODOLOGY

Methodology can be distinguished from method by the theory of knowledge which guides the way in which the research is conducted and data is interpreted (Cohen & Manion, 1997). Methodologies can be classified as positivist, where the world is perceived as both real and capable of being simply defined, or postpositivist where the focus is on constructed rather than found worlds and there are many possible interpretations of data. Within the postpositivist perspective a number of paradigms can be identified and may be categorised as either interpretivist or critical. Underlying the critical paradigm is the challenge to existing power structures with the goal of emancipation. Such research is participatory and collaborative. Interpretivist research on the other hand is ambivalent to power relationships. It not only involves interpretation of the data but also analyses and debates the reasons for adopting a particular interpretation. Knowledge is seen as being personal, subjective and socially constructed (Cohen & Manion, 1997). Language therefore plays a crucial role in the interpretivist methodology as we seek to interpret our own and others actions and conceptualizations. This research is based within the interpretivist methodological paradigm as it seeks to explore the subjective realities of participant teachers and has the goal of revealing how teachers are integrating ICT into their classroom programmes. The researcher was independent of the schools and their ICT programmes and thus power relationships were never discussed or challenged. This clearly places the research outside the critical methodological paradigm.

## NATURE OF THE RESEARCH

Case study research is defined by its depth rather than its breadth (Cohen & Manion, 1997). Because a case study explores the ideas and actions of an individual it can capture the particularity and complexity of a single personality allowing us to understand someone's thoughts and behaviours within a real life context and timeframe (Anderson, 1998 ). Hence it provides an ideal method for Phase Two of this research which is situated in the context of the use information and communication technology in a New Zealand secondary school, a context in which the case study method has previously been used (Chamberlain & Kennedy, 1991).

The fact that case study research is not easily generalisable is not an issue in this instance, because the question to be answered concerns integration strategies in one secondary school, which is perceived to be a successful ICT-using school. The role of participant observer (Cohen & Manion, 1997) in a case study gives the opportunity to explore and gain insights into an individual's perceptions and actions, as well as making it possible to profile the culture within which these individuals work. The complex interaction between school management processes, and how these translate to what happens in the classroom can be explored using a case study.

This research may therefore be described as being mainly qualitative, reflective and reciprocal. Some quantitative data relating to length of time teaching, what, how often and where ICT was used, was collected in the first phase of the study. The study was mainly qualitative in that it exhibited the following characteristics (Cohen & Manion, 1997). Firstly the research occurred in a naturalistic setting. Questionnaires were sent to HODs and teachers who were currently teaching in the targeted curriculum areas. In the case study school interviews were carried out in the school, in classrooms, offices and meeting rooms during school hours. As the research involved the identification of classroom practices, social interactions and the cultural setting in which the teachers and students were working, it would have been self-defeating to have removed them from their school environment and collegial relationships. This would have severely compromised the ecological validity of the research. The researcher had to gain the trust of all concerned.

Secondly, the structure of the study was flexible and allowed for review and reformulation of data collection methods between phases one and two. This flexibility allowed the exploration of issues in Phase Two that arose from the results collected in the overview survey of Phase One. As data was collected and analysed simultaneously it was possible for the theory to emerge from the data rather than being superimposed on the data as would be the case with a quantitative study. It also allowed for data to be analysed in the light of previous findings and for data collection methods to be reviewed and revised. The research was concerned with the social and professional processes in implementing an ICT strategy, therefore the accounts of the principal, HODs, teachers and students were of prime importance.

The research was reflective in that while completing the questionnaires and participating in the interviews, principals, HODs, teachers and students had to reflect on their use of ICT in their schools, departments and classrooms. Interviews were particularly so, as questions were open ended, allowing for specific and close reflection related to classroom programmes and practices at each level.

The reciprocal nature of the research was demonstrated by the findings being mutually beneficial to researcher and participants, both personally and professionally. The schools in Phase One were able to view the findings and reflect on how their school, professional development and curriculum programmes fitted into the wider picture presented. The case study school received the results of a detailed and in-depth study of the use of ICT in their school. This would be very useful for evaluation of their ICT strategy and assist them in future planning.

## RESEARCH DESIGN

The research was designed to realise the specific aims of the study within a multi-dimensional framework, 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 about how secondary school teachers of English, mathematics, social studies and science were integrating ICT into their respective curriculum areas. Phase two was a case study of a school identified as a successful ICT-using school by an analysis of data collected in Phase One. The case study focused on school-wide, departmental and individual teacher strategies used to integrate ICT into the curriculum. Phase Two also provided an opportunity to follow up on issues that were raised in Phase One. Information was also collected from students during this phase.

## JUSTIFICATION FOR THE RESEARCH DESIGN

A multi-dimensional framework adopts a design that is most suitable in terms of the aims and objectives of the study. It is based on the selection of a method, or 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 practices of ICT in secondary schools. It was considered important to use both qualitative and quantitative research methods, within a multidimensional framework in order to gather information on the experiences of teachers within the culture of a secondary school. 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 systemic case study and ethnographic approach to research in this field. Morrison (1989) also called for research in a more naturalistic setting especially in regard to ICT use in secondary schools.

## RESEARCH DEFINITIONS

The use of terms such as *computers in education*, *information technology* (IT) and *information and communication technology* (ICT) have evolved in education along with the development of the technologies and were defined in the Literature Review.

At the time this study was conducted, in mid 1999, teachers were not yet familiar with the term ICT and still used IT. ICT had not entered the vernacular of teachers. Therefore the questionnaires referred to the use of IT in teaching and learning as it was considered that teachers would have a clearer understanding of this term. IT was also used in the case study school to avoid confusion. Henceforth in this research the term ICT is used regardless of which term was used in the HOD and teacher questionnaires, and case study interviews.

*Core curriculum:* (also referred to as the target curriculum areas) English, mathematics, social studies and science, were the 'academic' subjects of the core curriculum to be studied by all New Zealand students (Ministry of Education, 1984). 'Social studies' in this research is taken to include the subject 'social studies' taken by all Year 9 and 10 students, and the subjects of geography and history taken as an option at Years 11, 12 and 13. These come under the general term 'social science'. Geography and history were included in the term 'social studies' in order to discover what was occurring at senior levels. To include only

Years 9 and 10 social studies was seen as too restrictive and not giving an overall picture across the school in this area. Some secondary schools do teach social studies at Year 11. Music, art and physical education were also included in the core curriculum, but were not studied in this research In 1993 the Ministry of Education released the New Zealand Curriculum Framework (Ministry of Education, 1993) which introduced seven essential learning areas. These included the four target curriculum areas, including social sciences.

*Integration*: integration requires that teachers readily and flexibly incorporate ICT into their everyday teaching practice in relation to the subject matter they teach (Hadley & Sheingold, 1993). For the purposes of this research integration is taken to mean the appropriate use of ICT in the learning situation that teachers manage and plan for in their day-to-day teaching and learning programmes.

A *secondary school* is defined as a school offering classes from Year 9 to Year 13.

*Successful ICT using secondary school*: this was measured using four criteria;
(a) frequency of reported use of ICT tools, (b) ICT is mentioned in departmental scheme, (c) a high rating given to the importance of ICT in teaching and learning, and (d) a high rating for support of ICT in the school. The process is described in more detail later on in the chapter. These criteria were developed from that used by a case study of two New Zealand secondary schools by Chamberlain and Kennedy (1991) which were symptomatic of the time in which they were developed. They included the year that computers were introduced and the extent and nature of software available and were deemed not relevant in the current ICT environment.

## RESEARCH POPULATION

The target population for the research was 24 secondary schools in a large metropolitan area in New Zealand. A total of 96 Heads of Departments (HODs) from the curriculum areas of English, mathematics, social sciences and science, and 96 teachers in those curriculum areas were invited to participate. The HOD of Social Science was targeted here as this person usually has overarching responsibility for social studies as well. Of these 54 HODs and 36 teachers responded and became the research sample for Phase One. The following people from the case study school were interviewed and comprised the sample for Phase Two:

- the Heads of Departments from English, mathematics, social sciences and science
- one teacher each from English, mathematics, social studies and science,
- the Principal,
- the HOD ICT,
- the HOD Maori Studies,
- the HOD Sports Academy,
- the Librarian
- six students, two from Year 9 and four from Year 12.

## JUSTIFICATION FOR EXAMINING ICT IN ENGLISH, MATHEMATICS, SOCIAL STUDIES AND SCIENCE IN SECONDARY SCHOOLS

The curriculum areas of English, mathematics, social studies and science were chosen because they comprise the compulsory core academic curriculum that has been in use in New Zealand secondary schools since the Thomas Report of 1944 (Ministry of Education, 1984). Secondary schools have a high computer-student ratio (Sullivan et al., 1998) of 1:8 but there is little evidence of the extent to which they have been used in these curriculum areas. Anecdotal evidence suggests that these computers have been mainly used in the curriculum areas of computer studies and typing. Computers in secondary schools are often grouped in rooms of 25 – 30 computers to allow for individual student use by a whole class in these two areas. Timetable demands from computer studies and typing have made it difficult for teachers from other curriculum areas to gain access to these machines. Consequently there was much anecdotal evidence regarding the lack of use of ICT by curriculum areas such as English, mathematics, social studies and science. A systematic study of how secondary teachers in these curriculum areas are using ICT tools in their teaching and learning programmes would inform other secondary schools and teachers. Such a study would provide an opportunity for those in the study to engage in reflective thinking as their own use of ICT tools in their teaching and learning programmes.

## LINKING INFORMATION GATHERING STRATEGIES TO SPECIFIC RESEARCH QUESTIONS

The following is a brief description of information gathering strategies that were used to answer each of the eight related questions and ultimately the main research question.

### Main Question

*To what extent are secondary schools integrating information and communication technology into the curriculum areas of English, social studies, mathematics and science?*

Table 3.1 indicates the link between sub questions and information gathering strategies which will ultimately answer the main research question.

*Table 3.1*
**Information gathering strategies used to answer sub questions**

| Sub Question | Sample | Data collection | Strategy |
|---|---|---|---|
| **1. What attitudes do secondary teachers have towards the integration of ICT in their curriculum area?** | HODs and teachers | survey | indicate how important they felt that integrating ICT into their curriculum area is |
| | | | what they considered to be the main benefits for students in using ICT in learning |
| | | interview | - what their ideal situation with the use of ICT would be |
| | HOD of ICT | interview | - how teachers were responding to the use of ICT in their curriculum areas. |
| | Principal | interview | - teachers attitudes to the integration of ICT in the school |
| **2. How are secondary teachers integrating ICT into their teaching and learning programmes?** | HODs and teachers | survey | what ICT tools they were using, how often they used them and with what year levels. |
| | | | describe their most recent successful experience at integrating ICT into their classroom programme |
| | | interview | types of learning activities that ICT are mainly used for |
| | | | follow up questions from Phase 1 regarding use of multimedia and use by Year 12 students. |
| | | | how teachers were integrating ICT into the curriculum. |
| **3. What type of access do English, social studies, mathematics and science teachers have to computers?** | HODs | survey | where their teachers were able to access ICT. |
| | Teachers | survey | where their students mainly accessed ICT. |
| | HODs | interview | where their teachers were able to access ICT |
| | HODs and teachers | interview | follow-up question to Phase 1 in the case study interview about the amount of access to ICT in the library |
| **4. What factors do teachers of English, social studies, mathematics and science, identify as leading to the successful integration of ICT into their curriculum area?** | HODs and teachers | survey and interview | what factors they thought lead to the successful integration of ICT. |

| Sub Question | Sample | Data collection | Strategy |
|---|---|---|---|
| **5. What factors do teachers of the target curriculum areas identify as barriers to the successful integration of ICT into their curriculum area?** | HODs and teachers | survey and interview | what factors they thought were barriers to the successful integration of ICT. |
| **6. To what extent have formal professional development programmes played a part in the successful integration of ICT into the curriculum areas of English, social studies, mathematics and science.** | HODs | survey | if any of their staff were currently engaged in professional development in ICT, and if so how many teachers and what type of professional development. |
| | HODs and teachers | survey | if they were currently engaged in professional development in ICT. If so, they were asked to briefly describe it. |
| | | | if they had attended, in the last two years, any type of in-service course on the use of ICT in teaching and learning. If so, they were asked to briefly describe this |
| | | | where they had gained most of their knowledge about the use of ICT in teaching and learning |
| | HODs and teachers | interview | if they knew what ICT and information literacy skills the Year 9 students have when they enter their school |
| **7. What systems are in place to support teachers integrate the use of ICT into the curriculum areas of English, social studies, mathematics and science?** | HODs | survey | explain how they supported teachers in their curriculum area who wanted to integrate the use of ICT into their teaching and learning programmes. |
| | | | if the use of ICT is specifically mentioned in their departmental scheme |
| | HODs and teachers | survey | rate their school's support for the integration of ICT into curriculum areas. |
| | HODs | interview | how they encouraged reluctant teachers |
| | | | how they ensured equitable access to ICT for all students in their curriculum area. |
| | HODs and teachers | interview | if they had a systematic progression through year levels of activities that must be done to ensure all students have the opportunity to use ICT in their learning |
| | HOD ICT | interview | what types of learning activities students do in dedicated ICT classes and how these help teachers integrate ICT into their curriculum areas. |
| | | | what technical support there was in the school for teachers. |
| | | | how he ensured equity of access to ICT. |

| Sub question | Sample | Data collection | Strategy |
|---|---|---|---|
| **8. What perceptions do students have of their experiences in using ICT in the curriculum areas of English, social studies, mathematics and science?** | Year 9 students | interview | describe learning activities which involved the use of ICT, at their previous schools and their present school |
| | Year 12 students | | describe learning activities in the four target curriculum areas which involved the use of ICT |
| | Year 9 and 12 students | | which ICT they had used that year |
| | | | if they thought that using ICT helped in their learning. |

## PHASE ONE

The purpose of the initial phase was to gather baseline data, and gain an overview of what was happening in secondary schools in terms of ICT curriculum integration specifically in the areas of English, mathematics, social studies and science.

### Sample Selection

Twenty four secondary schools within a large New Zealand metropolitan area were chosen as a convenience sample (Cohen & Manion, 1997). Table 3.2 shows the different types of schools situated within the boundaries of this area.

*Table 3.2*

**Types of secondary schools in the sample area**

| State Co-ed | State Female | State Male | Integrated Co-ed | Integrated Female | Integrated Male |
|---|---|---|---|---|---|
| 11 | 2 | 2 | 1 | 5 | 3 |

## Procedure

The principals of each school were contacted by telephone to gain their support for the study. Where the Principal was not available a message was left with the Principal's secretary explaining the purpose of the study and seeking support. Two principals did not agree to participate at this stage. Those who agreed to take part consented to distributing a package of questions to the HODs of the target curriculum areas. This was deemed the most efficient way of distributing the questionnaires. The package sent to 22 schools contained:

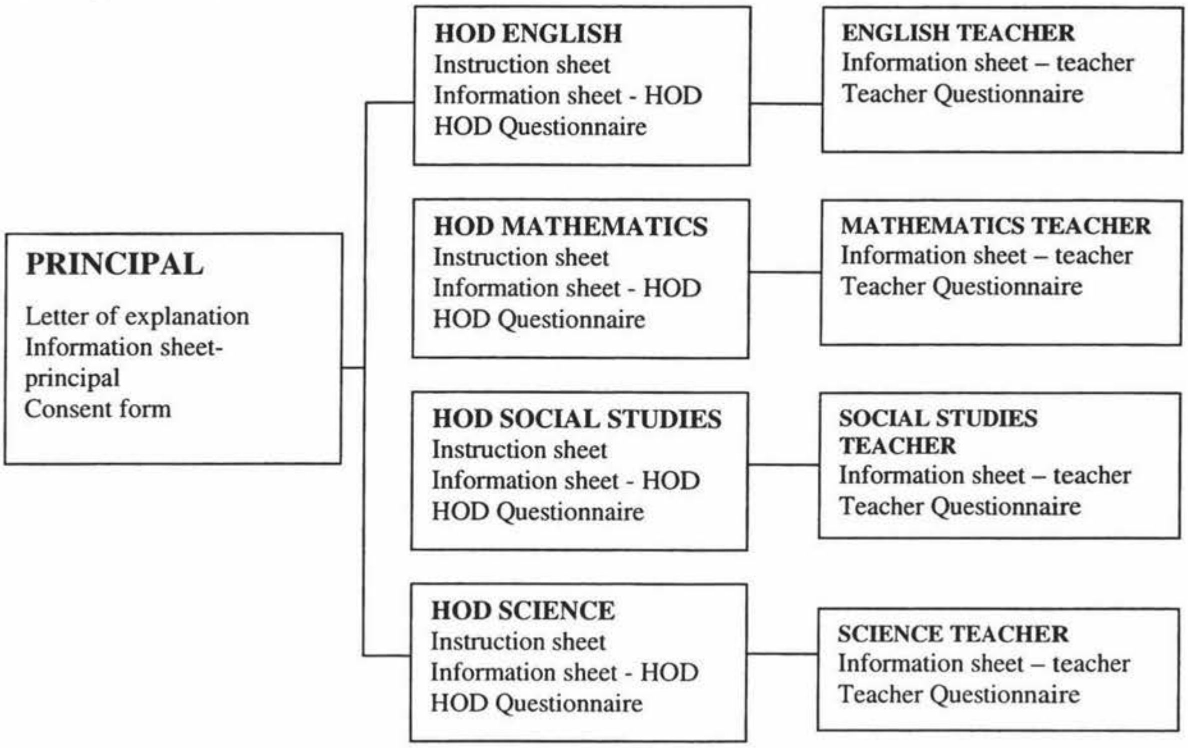
- a letter of explanation to the Principal,
- an *Information for Principals* sheet
- a consent form to sign and return,
- a stamped addressed envelope
- an instruction sheet for HODs
- an *Information about the Research for HODs* sheet
- 8 questionnaires and stamped addressed envelopes for the HODs of English, mathematics, social studies and science
- an *Information about the Research for Teachers* sheet
- 8 questionnaires and stamped addressed envelopes for one teacher in each of the target curriculum areas

Copies of these are available in Appendices 2 - 9.

The Principal was asked in the letter to send a copy of the school's ICT policy to the researcher. A large stamped addressed envelope was provided for this purpose. They were also asked to distribute the HOD and teacher questionnaires and information sheets to the HOD of English, mathematics, social studies and science. The HODs were asked to complete the relevant questionnaire and pass the teacher questionnaire on to a teacher in their curriculum areas whom they perceived to be a competent ICT using teacher. These teachers were asked to complete the questionnaire and return it in the stamped addressed envelope. In all cases a date for return, a fortnight's hence, was given. A total of 176 questionnaires were sent out, eight to each of 22 schools. There were separate questionnaires for HODs and teachers. Four questionnaires were for the HOD of

English, mathematics, social studies and science and four were for one teacher in each of these curriculum areas.

*Figure 3.1*
**Summary of information sent to schools**




By the return date, 25% of questionnaires had been returned. No return had been received from four schools. In this case it was assumed that the Principal was not in agreement and had failed to hand on the questionnaires. These schools were not contacted further. A reminder letter (Appendix 10) was sent directly to the HOD of each department in 16 schools where there had been a low response rate. A personal note to the HOD explaining how much their support would be appreciated, was hand written and signed on the bottom of each letter. Copies of the relevant information sheet and each questionnaire, plus a stamped addressed envelope, were included. This produced a total response rate of 51% from 17 schools. A total of 90 questionnaires were returned. Table 3.3 presents the percentage response rate for each group.

*Table 3.3*
**Percentage response rate for each group**

| | **English** % | **Maths** % | **Social Sciences** % | **Science** % | **Total** % |
|---|---|---|---|---|---|
| **HOD** | 68 (n=15) | 50 (n=11) | 54 (n=12) | 73 (n=16) | 61 (n=54) |
| **Teacher** | 45 (n=10) | 59 (n=13) | 32 (n=7) | 27 (n=6) | 41 (n=36) |
| **Total** | 57 (n=25) | 55 (n=24) | 43 (n=19) | 50 (n=22) | 51 (n=90) |

A letter was sent to 12 principals who had returned the *Permission to Participate* form thanking them for their school's support. Another letter was sent to the remaining five Principals thanking them for their support and requesting that they sign and return an enclosed *Permission to Participate* form. All five returned the form.

## Data Collection

Two questionnaires were designed, one for the HODs and one for teachers. They were designed to collect relevant contextual information on teachers use of ICT in their teaching and learning programmes. The questions were prepared with reference to previous surveys of teacher use of ICT in schools (Boyd, 1997; Chamberlain & Kennedy, 1991). The style of questionnaire and specific questions were informed by a review of the research methods literature on questionnaire construction (de Vaus, 1995; Cohen & Manion, 1997) The questionnaire for HODs contained the same questions as those in the teacher questionnaire, and in addition contained questions relating to their leadership role in the department. The questionnaires were designed with a mix of open and closed questions to collect written data on how ICT was being used in secondary schools.

### Pilot Questionnaire

A draft questionnaire for teachers and HODs was trialled at one school within the research population. Four HODs and four teachers from the target curriculum areas participated. The HODs and teachers completed the questionnaires individually in the presence of the researcher. This enabled immediate feedback as to the nature and appropriateness of the questions and whether they were clearly understood. The design of the questionnaires and the sequencing of the questions were also discussed. The researcher was able to gauge the time involved in completing the questionnaires. The pilot questionnaires, and further consultation with other researchers, assisted with refining the final questionnaire used in Phase One of the study (see Appendix 7 and 9).

### Description of Questionnaire

The questionnaires contained a brief introductory section at the beginning explaining the purpose of the research, a guide as to how long it would take to complete, who to return it to and a date to be returned by. Questions focussed on the following areas, background teaching information, confidence level in using ICT tools, use of such tools in the classroom, professional development. HODs were asked further questions relating to their leadership role. Questions were numbered sequentially and consisted of a mixture of likert-type scales, tick-the-box multi-choice, and short answers. Each questionnaire included the school code for administrative purposes. The questionnaire provided an efficient means to gather information from a number of secondary schools on how teachers in the target curriculum areas were using ICT.

## Data Analysis

Quantitative data received from the questionnaires were coded numerically and tabulated with the use of an Excel spreadsheet. A research assistant was employed to enter the data. The results were analysed using basic statistical calculations, such as frequencies and percentages. Results were first collated in order to identify a successful ICT-using school to study for Phase Two of the research. Following this they were analysed in relation to the research questions. Qualitative data from the questionnaires were thematically analysed in relation to the research questions. Data are presented in figure and table format according to the research questions.

# PHASE TWO

The purpose of this phase was to study one school in depth in order to gather more detailed information about the strategies used to integrate ICT into the curriculum areas of English, mathematics, social studies and science. It was decided that an in-depth study of a single school would be more useful to schools and teachers than just the overview data collected in Phase One. Issues raised in Phase One were followed up and investigated further.

## Justification for a case study

The nature of the questionnaire used in Phase One did not allow for follow up on critical issues. As such it was a rather crude instrument; however it did give general information from which one school who was using ICT successfully could be selected. The case study methodology gave the opportunity for a more detailed and in depth investigation to answer the research questions, especially those related to classroom strategies, school systems, culture and strategic planning. Differences between the curriculum areas were able to be studied and individual teachers were able to tell their stories about their use of ICT in their curriculum areas. Attitudes and experiences of both teachers and students and the impact of school culture on them could be explored further. Issues that arose from Phase One were also able to be investigated further.

### Selection of Case Study School

The case study school was selected on a number of criteria according to a preliminary analysis of data received in Phase One. One measure of success can be the extent to which computers are being used across the curriculum (Chamberlain & Kennedy, 1991). This was the first criterion used.

- The frequency of use of ICT tools in a school, over all year levels and curriculum areas;

Other criteria used were:

- The number of departments within a school who reported having ICT mentioned in their schemes of work;
- The number of respondents in a school who rated ICT as *very important* in teaching and learning;
- The number of respondents in a school who gave their school the highest ranking for support of ICT in the school.

The additional criteria were based on research from other studies such as Hadley and Sheingold (1993) although a gap at the secondary level meant that the selection process was always going to be highly problematical.

### Procedure

A frequency table was constructed showing each school's reported weekly and monthly use of ICT over all curriculum areas and levels. This included both the HOD and teacher who taught classes at each year level. Schools who did not report any weekly or monthly use were not included.

*Table 3.4*

**An aggregation of each school's reported weekly and monthly use of ICT**

| School code | HOD n= | Tchr n= | Weekly use of ICT | Monthly use of ICT | Total |
|---|---|---|---|---|---|
| 113 | 3 | 1 | 0 | 5 | 5 |
| 116 | 4 | 4 | 5 | 3 | 8 |
| 120 | 3 | 1 | 5 | 2 | 7 |
| 121 | 4 | 3 | 4 | 1 | 5 |
| 122 | 3 | 2 | 3 | 1 | 4 |
| 124 | 3 | 2 | 1 | 2 | 3 |
| 125 | 2 | 1 | 4 | 3 | 7 |
| 127 | 2 | 1 | 0 | 7 | 7 |
| 128 | 4 | 2 | 4 | 1 | 5 |
| 129 | 3 | 2 | 1 | 3 | 4 |
| **132** | 4 | 1 | 7 | 5 | **12** |
| 133 | 2 | 2 | 5 | 1 | 6 |
| 134 | 4 | 1 | 0 | 2 | 2 |

School 132 clearly stood out on this criteria.

Further analysis of these schools was done using the remaining three criteria; (a) the number of HODs who reported that ICT was mentioned in their departmental scheme, (b) the rating given to the importance of ICT in teaching and learning and (c) the number of respondents who gave their school the highest rating for support of ICT.

Table 3.5
**An aggregation of the schools responses on selection criteria for a successful ICT using school**

| School Code | Total no. of respondents from each school out of a possible 8 N= | Total for monthly and weekly use of ICT tools | No. of Depts reporting ICT included in scheme | No. of respondents who gave the highest rating to importance of ICT in teaching and learning | No. of respondents who gave highest rating for school support of ICT |
|---|---|---|---|---|---|
| 113 | 4 | 5 | 0 | | 0 |
| 116 | 8 | 8 | 4 | 2 | 2 |
| 120 | 4 | 7 | 3 | 3 | 0 |
| 121 | 7 | 5 | 4 | 4 | 2 |
| 122 | 5 | 4 | 3 | 1 | 1 |
| 124 | 5 | 3 | 3 | 2 | 0 |
| 125 | 3 | 7 | 0 | 1 | 0 |
| 127 | 3 | 7 | 0 | 0 | 0 |
| 128 | 6 | 5 | 4 | 2 | 3 |
| 129 | 5 | 4 | 1 | 2 | 0 |
| **132** | **5** | **12** | **3** | **3** | **5** |
| 133 | 4 | 6 | 2 | 1 | 0 |
| 134 | 5 | 2 | 2 | 2 | 0 |

Comparing these results school 132 had the highest frequency of reported use of ICT tools over all year levels, three out of four departments have ICT mentioned in their scheme, three out of four respondents strongly agreed with the statement about the importance of using ICT in their curriculum area and five out of five respondents gave their school the highest rating for the support of the integration of ICT into the curriculum. Accordingly school 132 was selected for an in-depth study. For the purposes of confidentiality (Tolich & Davidson, 1999) this school will be referred to in the research as 'Seaview High', even though permission was gained from the principal to use the school's real name. Before the researcher entered the school an article appeared in the local paper about Seaview High being chosen by this university for a study into the use of ICT.

## Consent for the Research

A letter was written to the Principal (Appendix 13) asking permission to conduct an in-depth investigation in his school. The letter explained the purpose of the research, how this school was selected and what the case study investigation would involve. The Principal was asked to discuss the proposed research with the Board of Trustees and staff. If they were agreeable to the research proceeding, it was suggested a meeting could be held with the researcher where any questions could be answered. At this meeting a suitable time could be negotiated for access to conduct the research. The Board of Trustees, Principal and staff gave consent for the research to be conducted at Seaview High. Other issues for which consent was gained were:

- using the school's real name in any subsequent publicity
- photocopying press clippings from the school scrapbook
- interviewing the software consultant regarding administrative software

After the initial meeting with the Principal, all meetings to arrange visits were held with the Deputy Principal.

## Outline of the Process

Interviews were conducted with (a) the Principal, (b) the HODs of English, mathematics, social studies and science, (c) a teacher in each of these areas, (d) the HOD of ICT, (e) the Librarian (f) two groups of students and (g) a software consultant who had provided the school with an administrative software package. After an initial discussion with the Principal it was decided that there were two important and significant aspects of that school that needed further investigation. These were the Maori Studies Department and the Sports Academy. It was considered that, by investigating these additional areas, a more holistic picture of a successful ICT using secondary school would emerge. These areas also contributed to the uniqueness of this school as its student population was 95% Maori and Pacific Island. A Sports Academy had been set up at the beginning of 1999 to provide further learning opportunities for these students. The use of ICT in both departments was a result of the school strategy.

### Research Questions

Questions focused on how HODs and teachers in the target curriculum areas were integrating ICT into their teaching and learning. Similar questions were also asked of the HOD of ICT. The HODs of Maori Studies and the Sports Academy focused on their curriculum areas. The Principal spoke about the overall ICT strategy in the school and the librarian about the role of the library within the ICT strategy of the school. In addition to those questions outlined in Phase One, the second phase endeavoured to find out what were students' perceptions of their experiences in the use of ICT in their teaching and learning programmes. It was considered important to gain the views of students as the overall goal of the integration of ICT in the curriculum is to enhance student learning. The inclusion of students' views would add another dimension to the study and follows on from the work done by Kennedy & Chamberlain (1991)and Becker (1998). Therefore a question was addressed in this phase of the research which asked students about their experiences in being able to use ICT in the various curriculum areas.

### The School

Seaview High describes itself on the school webpage as "a multicultural school focusing on sport and information technology." It is rated Decile One on the Ministry of Education's socio economic rating system (Ministry of Education, 1999b). Decile One is the lowest rank with Decile 10 being the highest. A new principal was appointed in 1997 and, in order to combat a falling roll, a new strategic direction was set, with emphasis on sport and information technology. By its own admission the "school has invested heavily in modern computer technology to ensure that all students have access to up-to-date hardware and software" (school webpage). A Sports Academy was set up and was in full operation in 1999. As the web page states, "This is a specially designed programme for students aged 17 to 19 who are interested in following a career in the sport and recreation areas." (school webpage). ICT is integrated into this programme, hence the perceived need to interview the HOD of the Sports Academy. A special programme, He Tipua, operates for Maori students, and others, who wish to have a secondary education with a clear Maori focus. The school has a fluctuating roll of between 300 and 400 and, at the time of the collection of data, was 285. Approximately 40% are Maori, 55% of Pacific Island origin and 5% European and Asian. The school population is very transient, with a June 1997 survey showing that 50% of students had been at the school less than one year, 75% less than 2 years and 30% of 7$^{th}$ formers were new that year. Approximately 30 teachers are on the staff.

## Data Collection

Data was collected from the school using the following methods:

- Semi structured individual interviews with the Principal, HODs, teachers, the Librarian and a software consultant.
- Semi structured interviews of two focus groups of students, Year 9 and Year 12.
- Documentary evidence of school policies and plans, examples of student work and newspaper articles.

## Visits to the School

Six visits in total were made to the school. The Deputy Principal (DP) negotiated suitable times with individual staff members whom the researcher wished to interview. The first visit was an introductory one and another was to attend a breakfast professional development meeting on the use of the internet. During the other three visits teachers and/or students were interviewed, documents collected and observations were made. The duration of these visits ranged from one hour for the breakfast session to a whole day of observations and interviews. Morning staff meetings were attended on the interview days. This enabled the opportunity to mix with the staff, to gain the confidence of the staff and to have them feel comfortable with the presence of a researcher in the school. It also enabled the culture and atmosphere of the school to be absorbed in keeping with ethnographic techniques (Tolich & Davidson, 1999). At the conclusion of interviewing for the day a meeting was held with the Deputy Principal to organise subsequent visits. Interviews were organised to be held during teachers' non contact time and particular days were chosen to fit in with as many teachers' timetables as possible.

### Visit One

Visit One was an orientation visit to meet the Principal for the first time and to have a brief discussion about the research. The majority of the time was spent with the Deputy Principal establishing who would be interviewed, what documentary evidence would be collected and organising a timetable for the next visit. It was also established which groups of students would be interviewed. The DP gave a conducted tour of the school to key areas and to meet key people such as the HOD ICT, the HOD Social Sciences and the librarian. Two important ethical issues were addressed on this visit. Firstly the Principal gave permission for the school's name to be used in any publicity. Secondly, it was deemed important, for cultural reasons, that the *Student and Parent/caregiver Information and Consent Form* (Appendix 15) for the research be approved by appropriate people. This approval was given verbally by one of the other Deputy Principals (the school has three) and the HOD Maori Studies.

### Visit Two

Visit Two occurred the following week. Morning staff meeting was attended and the researcher was introduced to the staff. The interview schedule for the day was written on the Daily Notices whiteboard in the staff room and this was drawn to the attention of relevant staff members. The HODs of ICT, social studies and English were interviewed during this visit. The morning Tutor meeting of class 9X (not the real name) was attended. The researcher talked to the eight students selected by the Tutor teacher as competent ICT using students, in a separate office. The purpose of the research was explained and they were given the *Student and Parent/caregiver Information and Consent Form* (Appendix 15) to take home for parental/caregiver approval. Interviews for that day took place in the school's Board Room where it was quiet and less likely that interruptions would occur. HODs were asked for a copy of their schemes and examples of student work.

### Visit Three

During the third visit the English teacher, mathematics HOD, mathematics and science teachers were interviewed. The English and science teachers were interviewed in the Board Room. The HOD Mathematics was interviewed in the departmental office, initially, to look at software on the computer, and then in the classroom. No students were present. The mathematics teacher was interviewed the classroom while the class was working quietly. This was the most convenient place and time for the teacher on that day. The researcher was very conscious that these were not the ideal conditions, hence the interview was considerably shorter than others. Another reason for the brevity of the interview was the ethical dilemma this posed for the researcher in taking the teacher away from her class.

On this visit the researcher attended morning staff meeting and a full school assembly. At this assembly the HOD ICT explained to the students about internet access becoming available throughout the school, the need for an Acceptable Use Policy (AUP) and a Contract between parents, students and the school. The AUP and contracts were handed out and students were told that their individual internet account would be enabled on return of the signed contract. The HOD ICT also explained about safety issues and how individual use could be tracked on the school server.

### Visit Four

Visit four was a professional development breakfast meeting on the use of the internet. The school had just installed a satellite dish and the internet had been available throughout the school, via the network, for a week. Twenty four teachers attended this session, including the Principal, which was held in a room with 20 computers. It briefly covered the history of the internet, followed by a series of activities using the web-based *Living Library* as a resource. The session was taken by a Renaissance Education Solutions consultant who had a teaching background. During the activities the researcher acted as a participant observer

(Cohen & Manion, 1997) assisting some teachers when required. The atmosphere was very positive with an air of excitement.

### Visit Five

The librarian and the science teacher were interviewed on the fifth visit, as well as the two student groups. The librarian was interviewed in the library office and the science teacher in the Board Room. The Year 9 student group was interviewed in a vacant classroom next to their regular classroom. The Year 12 students were interviewed in the Board Room.

### Visit Six

An hour and a half was scheduled by the principal for his interview. The interview took place in the Principal's office and began with him going through a PowerPoint presentation on his laptop that he had compiled for the Board of Trustees, staff and other audiences to explain the strategic direction of the school. This was followed up with specific questions that had not been addressed in the presentation. Documentation was also collected during this interview and permission was received to photocopy relevant articles in the school scrapbook of press clippings since the ICT strategy was announced.

## Interviews

A total of 14 face-to-face interviews were carried out. Table 3.6 shows the people who were interviewed at the case study school. Real names are not used in this table. HODs were interviewed first. They were then asked to suggest a successful ICT using teacher in their curriculum area to interview. It was deemed that the HOD was the person best placed to make this judgment. However, as the school is relatively small, in some cases, the teacher was the only other member of that department. All four HODs of the target curriculum areas completed the Phase One questionnaire, along with the English teacher. Questionnaires from Phase One were not received from the social studies, mathematics or science teachers. The HOD Social sciences was in fact HOD Geography as there were no specific social studies classes in the Junior school. It is taught as an integrated subject with English and is called English Studies. Therefore the English and social studies teachers were English Studies teachers. The teacher who completed the Phase One questionnaire labeled himself as an English teacher. Most interviews took place in the quiet of the school board room with the exception of the HODs of ICT, mathematics, the Sports Academy and the mathematics teacher. The HOD of ICT was interviewed in his office which was also the computer server room. This proved to be rather noisy with the sound of servers and modems running in the background. The HOD of the Sports Academy was interviewed in the classroom without students present. The mathematics HOD was interviewed in her office and the teacher in her classroom with eight students present who were working on a worksheet. As previously mentioned, this was the briefest interview, for ethical reasons, lasting approximately 10 minutes, while the others ranged from 20 to 40 minutes. The interview with the Principal lasted 90 minutes. The consultant from Renaissance Education Solutions was also interviewed. This took place at an early morning meeting in a café. This was not the ideal situation as it was rather noisy, but was convenient for both parties.

*Table 3.6*

**People interviewed at the case study school.** (NOTE: these are not their real names)

| Interviewee | Gender | Position | Curriculum Area |
|---|---|---|---|
| Darren | M | Principal | |
| Stan | M | HOD | English |
| Sharon | F | HOD | mathematics |
| Robert | M | HOD | social science |
| Jack | M | HOD | science |
| Harvey | M | Teacher | English studies |
| Mary | F | Teacher | mathematics |
| Danielle | F | Teacher | English studies |
| Ginny | F | Teacher | Science |
| Ewen | M | HOD | ICT |
| Hariata | F | HOD | Maori studies |
| Michael | M | HOD | Sports Academy |
| Leanne | F | Librarian | |
| Veronica | F | Consultant, Renaissance Education Solutions | |

Students were interviewed as a focus group (Tolich & Davidson, 1999). All interviews were semi-structured (Cohen & Manion, 1997) with a set of questions prepared for each person or group according to their role in the school (Appendices 17-21). These were not strictly followed but served as a guide to ensure that all issues and topics were explored. No particular order was followed as the interviewees were encouraged to tell their stories about the their use of ICT in their teaching and learning programmes. Interviewees were asked for permission to record the interview on audio tape before each interview commenced. This was to ensure that there was a complete and accurate record of each interview for further analysis. An information sheet (Appendix 14) and consent form (Appendix 16) was given to each interviewee at the time of the interview. The researcher verbally explained confidentiality issues according to the Massey University Code of Ethics. What would happen to the tapes and the information given was also explained. All agreed to be interviewed. Interviews were transcribed by a professional bureau into word processor files. The transcriber was asked to sign a declaration of confidentiality (Appendix 22). A copy of the relevant transcript, together with a letter explaining the procedure (Appendix 23), was sent to each participant for verification and correction of the content. A form was attached giving instructions to cross out any material the interviewee did not want included in the research material, sign, giving their consent for the material to be used, and return. A stamped addressed envelope was included. All interviewees returned their signed transcripts.

### Justification for choosing the people to be interviewed

The HODs and teachers of the target curriculum areas were interviewed because this is the focus of the study. The purpose was to gain more in-depth knowledge about what strategies they were using to successfully integrate ICT into their curriculum areas. The Principal was interviewed as the educational leader of the school, and as such, is the person who sets the strategic direction of the school. The HOD of ICT was interviewed because of his strategic position in the school in terms of his knowledge of the school network and the software available. The person in this position also has the potential to assist staff in their attempts to integrate ICT into their curriculum areas. The Librarian was interviewed because the role of school libraries is changing to that of a wider information centre where students can access electronic resources rather than a strict focus on print material. In an initial discussion with the Principal, it became clear that there were two further elements that were important to the success of Seaview High and its use of ICT in teaching and learning. These elements were the existence of a Maori Studies department and a Sports Academy. It was decided that a case study of Seaview High would not be complete without interviewing the HODs of these two departments. After interviewing the HOD ICT it became clear that particular characteristics of a recently installed administration software package had an important effect on the use of ICT within the school. It was therefore deemed important to interview the software consultant involved to discover more about the package. Permission from the Principal was received for this to take place as more knowledge was sought about the particular setup at Seaview High.

### The Students

Two groups of students were interviewed, Year 9 and Year 12.

### Year 9 students

Year 9 students were chosen to interview because they had had one year in a secondary school and it was hoped would also be able to remember and compare their secondary experience with what they had done at intermediate and primary school in the way of using ICT in their learning. The Year 9 extension class was chosen to select students from because they received extra ICT classes and were being trained to be student leaders in the area of ICT. Eight students were selected by their Tutor teacher as being skilled in the use of ICT for curriculum purposes. Their Tutor teacher was the HOD ICT and as he also taught them ICT it was deemed that he was best placed to make this selection. Eight students were selected as this was considered to be a manageable size for a focus group. The purpose of the research and the importance of their part in it was explained to them as a group. This took place in an adjoining office. Issues of confidentiality of the data and what would happen to the results, were also explained and the students were given the opportunity to ask questions. They were told that the interviews would take place at the end of the following week. These students were given the *Student and Parent/caregiver Information and Consent Form* (Appendix 15) to take home to their parents or caregivers and return to their Tutor teacher. Only two students returned their forms and consequently these two students were interviewed. The information presented was written on the same page as the form for signatures and therefore was necessarily brief. Efforts were made to ensure that the *Student and Parent/caregiver Information and Consent Form* was culturally appropriate with a suitable level of language use. However, there may have been difficulties for parents, caregivers or students.

The students were either Maori or Pacific Island and they may not have felt comfortable with the prospect of being interviewed by a pakeha adult who was also not known to them. More time spent in class by the researcher, for the purposes of getting to know the students, and to gain their trust, may have elicited a higher response rate. This highlighted the difficulties of student perception research especially when the research subjects are from a different ethnic group than the researcher. All the issues of cross cultural research raised by Teariki & Spoonley (Teariki, Spoonley, & Tomoana), 1992) were relevant here.

It was intended that the students would be interviewed during their morning Tutor time so as not to interrupt their studies. However, on the morning scheduled, there was an extended staff meeting and a number of administrative matters the Tutor teacher had to cover, so the students were interviewed during their Period One ICT class with their Tutor teacher. They were interviewed in an adjoining empty classroom and the interview lasted approximately 20 minutes. There was one female student and one male.

### Year 12 students

Year 12 students were chosen because evidence gained in Phase One of the research showed that this year level had the most frequent use of ICT tools. Interviewing these students was an attempt to find out why this was so. It was considered that these students would also be able to reflect on their use of ICT tools throughout their secondary schooling. Students from the Year 12 Geography class were chosen to interview because their teacher, the HOD Social Sciences, was one of the leading ICT-using teachers in the school and consequently the students were used to using ICT as an integral part of their geography programme. A group of ten Year 12 students, which comprised the whole geography class at this stage, were spoken to in their classroom with the teacher present. The purpose of the research and their part in it was explained. The researcher emphasised that while participation was voluntary it would be greatly appreciated. They were given the *Student and Parent/caregiver Information and Consent Form* and were asked to take this home, discuss it with their parents/caregivers, and return it to their geography teacher if they and their parents/caregivers agreed. Students were asked to return the form to their geography teacher for administrative purposes.

Four students returned their permission forms. The relatively low response rate could have been for the same cultural reasons as mentioned above. The students were Maori and Pacific Island and may not have felt comfortable with a pakeha researcher. They were interviewed in the school board room which was chosen because it provided a quiet space where there was less likelihood of interruption. However it is acknowledged that this space may have inhibited student responses during the interview itself as the room represented authority and was rarely used by students. Clearly, other researchers can learn from this experience.

### Documentary Evidence

The following documents were collected:

- School Web pages
- ICT Strategic plan
- ITPD plan
- Directions (goals) for 1999
- Memo and draft Directions for 2000
- Use of action learning at Seaview High
- Acceptable Use Policy and student contract
- Notice of the Internet breakfast PD meeting
- Network diagram
- Newspaper articles since the announcement of the ICT strategy
- Brochure on *RM Smart-Tools*
- Departmental Schemes
- Examples of student work

Identifying features of documents included in the Appendices have been blacked out for confidentiality purposes.

### Observations

Although this was not a major feature of the research method it was considered important to observe situations where computers, especially, were used by teachers and students. The aim of the observations was to absorb the atmosphere in the school and to see how teachers and students interacted with the computers and other ICT equipment. Observations were undertaken in the staffroom, library, and the assembly where information on the internet, the student contract and Acceptable Use Policy were explained to the students.

### Participant-Observer

On one occasion the researcher acted in the role of participant observer.

### Research Diary and Self-Reflection Record

A notebook was kept which served as a research diary and self-reflection record. This was used to record events that took place on each visit to the school such as the schedule for each day, further information to be obtained, any follow up questions from people already interviewed. Other items of interest relating to the use of ICT in the school . These memos included any thoughts that came to mind from observations and/or anecdotal discussions. At the end of each visit these self-reflections were perused and any further insights were recorded.

### Data Analysis

Qualitative data from the case study were analysed by thematic coding in accordance with the research questions. A mind mapping computer program called *Inspiration* was used as a means of organising material. Interviews were transcribed by a professional typist.

### Expression of Appreciation

During the final visit to the school the researcher provided morning tea for the staff as a means of saying 'thank you'. A recently published book on ICT in secondary schools (Leask & Pachler, 1999) was given to the principal along with an informal note expressing appreciation.

## ETHICAL CONSIDERATIONS

The design of the research was guided by the ethical requirements of the American Research Association and Massey University Human Ethics Code of Conduct. It was important that all participants in the study were assured that they could take part in the study knowing that data would be confidential. In keeping with recent court rulings, as outlined in correspondence from Massey University, the researcher could not guarantee anonymity. This was carefully explained to participants. Phase One and Phase Two of the research presented different ethical issues.

### Phase One

In Phase One schools and teachers were assured of confidentiality of data and anonymity of both the schools' name and that of the teachers. Schools would not be identifiable from the report of the results, but of course they might reveal this themselves. Schools were identified by a code number which was known only to the researcher. This code number appeared on all questionnaires in order for the researcher to keep track of who had returned questionnaires and to identify which schools and curriculum areas needed a reminder letter. HOD questionnaires had a section where they identified their curriculum area. Teachers who completed the questionnaire were completely anonymous as they were chosen by their HOD. They were only identified in the research by their curriculum area. The schools and participating teachers were guaranteed the right to privacy. At all times the information provided was treated as confidential. Participants were fully informed of the purposes of the research.

Questionnaires were sent out at a time that was deemed by the researcher to be a relatively 'low' period of activity in a secondary school in order not to inconvenience schools and teachers. Principals were contacted by telephone before the questionnaires were sent out. If Principals were not able to be contacted a message was left with their secretary. Schools were invited to participate in the study and a *Permission to Participate* form was signed by Principals and returned.

A reminder letter was sent to those Principals where a *Permission to Participate* form had not been received yet whose HODs and/or teachers had sent in completed questionnaires. The information sheet sent to participants with the questionnaires, outlined the purpose of the research and participants' rights. Participants were informed they had the right to refuse to answer any question, and withdraw from the research at any time. In the data analysis care was taken to avoid reporting information that would identify participating schools and their respective HODs and teachers. Completion of the questionnaire was deemed to be an acceptance of these ethical provisions.

### Phase Two

Before any interviews were conducted in Phase Two permission was received from the Principal, who consulted the staff and Board of Trustees, to conduct the case study within the school. The Principal was informed, via letter, of the criteria used to select this school as a 'successful ICT-using school' from data received in Phase One. There was an ethical issue here with the power relationship between the Principal and the HODs and the teachers.

Phase Two presented different ethical issues in that the case study school had a high percentage of Maori and Polynesian students. Therefore cultural issues of partnership, accountability and ownership (Teariki et al., 1992) pertinent to those groups had to be addressed, especially when interviewing the two student groups.

HODs and teachers who were interviewed were informed that their participation was voluntary, that they could ask questions at any time, that they had the right to withdraw at any time, to refuse to answer any questions. Interview times were negotiated with the deputy principal in order to minimize disruption to the school and to the teachers classroom programmes. Participants were informed of interview times well in advance of the actual visit. They were also informed about what would happen to the information they provided; that it would be transcribed by a professional who had signed a confidentiality form and erased from tapes at the successful conclusion of the research. The transcripts were returned to them within a week of the interview for the purpose of confirmation that what was recorded formed an accurate account of the ideas and issues discussed during the interview. They were told that if there was any information present that they did not want included in the research to rule a line through the relevant phrases and this would be deleted from the research. They were assured of confidentiality and privacy within the bounds of the law.

The student information sheet and consent form was approved by the Principal, Deputy Principal and another Deputy Principal who was deemed appropriate. Permission from the local iwi was deemed to be not required by this group. A number of parents and caregivers of students speak English as a second language therefore the information sheet provided was written in language that was accessible by them. Permission was sought to record the interviews with students. It was clearly conveyed to them that the information would be treated confidentially, that no students would be identified by name; that the interviews would be transcribed by a professional who had signed a confidentiality form; that tapes would be erased after the successful conclusion of the research. Students were interviewed outside of normal classroom time as far as was possible, in order not to interrupt their studies.

There was a commitment that no participant 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. All participants will receive an executive summary of the research findings on the conclusion of the thesis.

## 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.

### Phase One

The size of the sample is a limitation as 18 schools from a metropolitan area cannot be considered a representative sample of secondary schools in New Zealand, nor can the response rate of 51% with the contributions of 90 HODs and teachers be representative of these groups. The method of selection of the 'ICT-using' teacher was left to the HOD to decide and there is no way of verifying this. If the school was small there may have been only one other teacher in the department.

### Phase Two

The criteria used to select the successful ICT-using school presented some difficulties because of the problem identifying what is perceived to be 'success'. Criteria were based on information gathered in Phase One but appropriate data from which to measure success, may not have collected. Frequency of use is not necessarily a measure of success. Just because a teacher uses ICT frequently does not mean that they are using it in educationally sound ways. Frequency does not tell us anything about the ways in which the technology is being used. While the principal was very willing for the school to participate and be identified, there is an ethical issue concerning the power relationship between the principal and the staff. Individual staff participating may have been reluctant participants, and those who were agreeable, may have felt unhappy about their school possibly being identified. The participation of students and issues relating to cross cultural methods may have impacted on the fact that only two Year 9 students returned their permission slips.

## SUMMARY

This chapter has outlined the overall methodological approach and described the two 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 phase of the study, the questionnaire.

# CHAPTER FOUR - RESULTS: PHASE ONE

## 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 secondary HODs and teachers of English, mathematics, social studies and science. The findings are divided into five sections that relate to the main research questions. The first section outlines the gender, background, and experience levels of participants, while the second describes attitudes and opinions of HODs and teachers relating to the integration of ICT into their curriculum areas. The third section presents data on how teachers are integrating ICT into their curriculum areas while the fourth section reports the role of professional development. Section five examines school systems in place to support the integration of ICT into curriculum areas. Data are presented in a range of figures and tables with brief descriptions and explanatory notes of significant points. All calculations are rounded to the nearest whole number.

## BACKGROUND OF PARTICPANTS

This section presents background data on the participants, for example, an analysis by gender, the length of teaching experience, and length of responsibility as an HOD for those in that position. Information on the confidence levels of participants is also included. These are self reported ratings in two areas, *personally and in their work* and *in teaching and learning*. A table showing the curriculum area of each participant is also included.

Table 4.1 shows a breakdown of the sample into position and curriculum area. There were a total of 90 participants, 54 HODs and 36 teachers.

*Table 4.1*
**Sample of HODs and teachers from each curriculum area**

| | English | Mathematics | Social Studies | Science | Total |
|---|---|---|---|---|---|
| **HOD** | 15 | 11 | 12 | 16 | 54 |
| **Teacher** | 10 | 13 | 7 | 6 | 36 |
| **Total** | 25 | 24 | 19 | 22 | 90 |

Table 4.2 presents the gender of the participating teachers shown as percentages according to curriculum area and position.

*Table 4.2*
**Gender breakdown showing position and curriculum area**

| | **English** | | **Mathematics** | | **Social Studies** | | **Science** | |
|---|---|---|---|---|---|---|---|---|
| | Female % | Male % | Female % | Male % | Female % | Male % | Female % | Male % |
| **HOD** | 47 (n=7) | 53 (n=8) | 45 (n=5) | 55 (n=6) | 58 (n=7) | 42 (n=5) | 44 (n=7) | 56 (n=9) |
| **Teacher** | 80 (n=8) | 20 (n=2) | 31 (n=4) | 69 (n=9) | 43 (n=3) | 57 (n=4) | 50 (n=3) | 50 (n=3) |
| **Total** | 60 (n=15) | 40 (n=10) | 38 (n=9) | 62 (n=15) | 53 (n=10) | 47 (n=9) | 45 (n=10) | 55 (n=12) |

Table 4.3 shows that 46% of HODs and 19% teachers participating have been teaching more than twenty years

*Table 4.3*
**Length of time that HODs and teachers have been teaching**

| | 1-2 years % | 3-5 years % | 6-10 years % | 11-20 years % | More than 20 years % |
|---|---|---|---|---|---|
| HOD | 0 (n=0) | 6 (n=3) | 9 (n=5) | 39 (n=21) | 46 (n=25) |
| Teacher | 11 (n=4) | 17 (n=6) | 25 (n=9) | 28 (n=10) | 19 (n=7) |

Table 4.4 shows that 19% of participants had 1- 2 years experience as an HOD, with experience spread evenly (26% 3-5 years, 24% 6-10 years, and 27% 11-20 years) over 3 – 20 years. Of the total, 4% had more than 20 years experience as an HOD.

*Table 4.4*
**Length of time as an HOD**

| 1-2 years % | 3-5 years % | 6-10 years % | 11-20 years % | More than 20 years % |
|---|---|---|---|---|
| 19 (n=10) | 26 (n=14) | 24 (n=13) | 28 (n=15) | 4 (n=2) |

HODs and teachers were asked to rate their experience levels at using ICT in two areas. The first was, *personally and in their work*, and the second, *in teaching and learning*. They rated themselves on a scale from one (not very experienced) to five (very experienced). Figure 4.1 shows that more teachers than HODs categorised themselves as very experienced at using ICT tools, such as a word processor, to compose work related documents like unit and lesson plans.

*Figure 4.1*

**Self reported experience levels of HODs and teachers in the use of ICT personally and in their work**

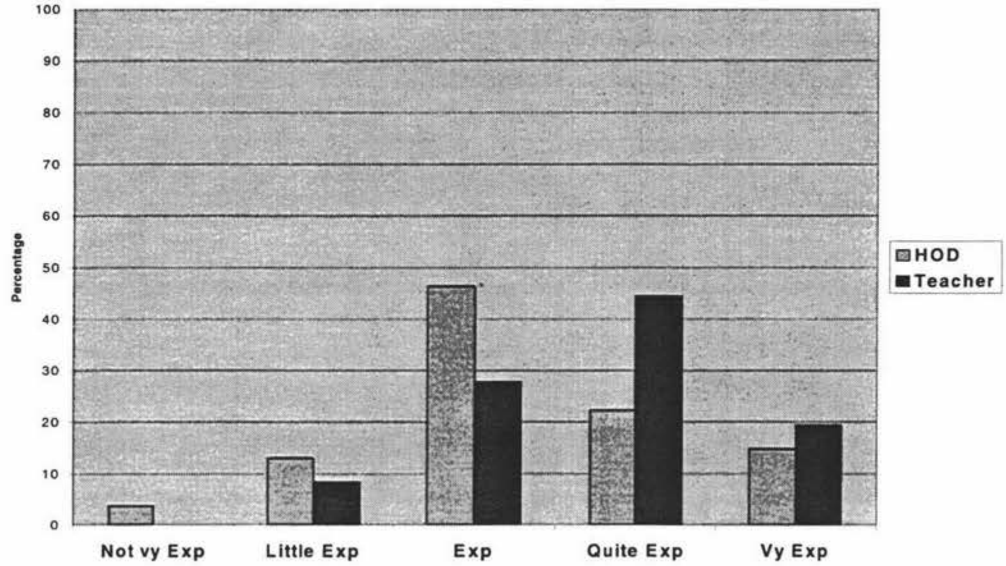
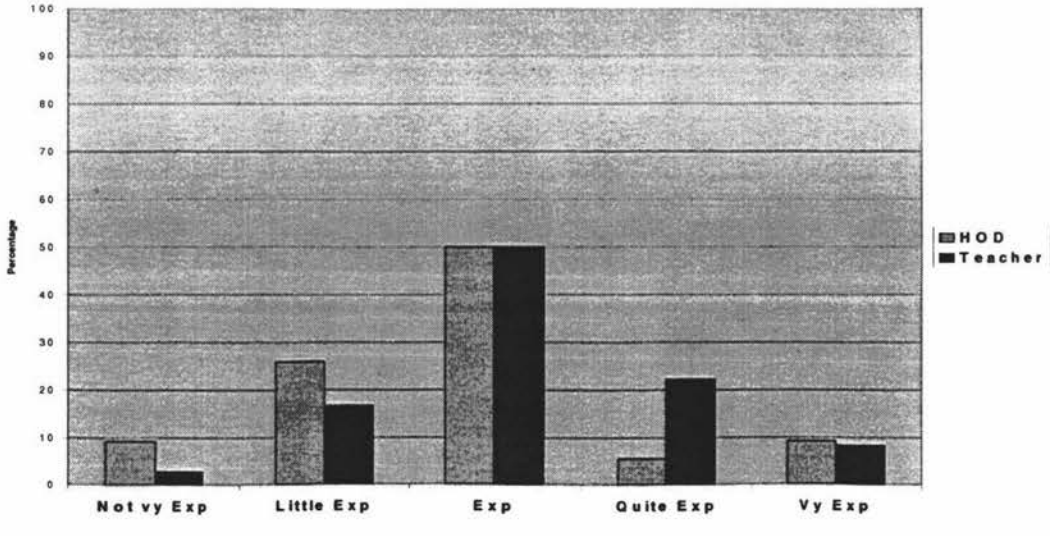



Figure 4.2 shows that less than 10% of HODs and teachers (9% and 8% respectively) reported that they felt very experienced at using ICT in teaching and learning, however 50% rated themselves as experienced. Teachers rated themselves higher than their HODs in an aggregate of the two highest levels four (quite experienced) and five (very experienced), 30% and 15% respectively.

*Figure 4.2*

**Self reported experience levels of HODs and teachers in the use of ICT in teaching and learning**



## ATTITUDES AND OPINIONS OF TEACHERS ABOUT THE USE OF ICT IN TEACHING AND LEARNING

Data in this section is presented as a series of tables and figures pertaining to three research questions which show attitudes and opinions about the use of ICT in teaching and learning. To try to determine teacher attitudes to the use of ICT in teaching and learning participants were asked to indicate their perceived importance of the integration of ICT into their curriculum area, and to outline what they thought were the three main benefits to students of using these technologies.

### Importance of ICT in the curriculum

HODs and teachers were asked to indicate the extent to which they agreed with the statement: *Integrating IT into my curriculum area is very important.*

Table 4.5 shows a high level of agreement with the statement for both HODs and teachers with 33% of HODs who strongly agreed, 37% who agreed and 26% who were neutral. Only 4% disagreed and no one strongly disagreed. Teachers surveyed responded in a similar way, with 36% strongly agreeing with the statement and 33% agreeing. Twenty eight percent of teachers were neutral, 3% disagreed and no one strongly disagreed. This indicates that HODs and teachers in the study have a positive attitude to the integration of ICT into their curriculum area.

*Table 4.5*
**Extent to which HODs and teachers think that integrating ICT into their curriculum area is very important**

| | **1** (strongly disagree) % | **2** % | **3** % | **4** % | **5** (strongly agree) % |
|---|---|---|---|---|---|
| **HODs** | 0 (n=0) | 4 (n=2) | 26 (n=14) | 37 (n=20) | 33 (n=18) |
| **Teachers** | 0 (n=0) | 3 (n=1) | 28 (n=10) | 33 (n=12) | 36 (n=13) |

## Main benefits of ICT in learning

Participants were asked what they considered to be the three main benefits of using ICT tools in learning. Table 4.6 summarises responses organised into themes based on Brown's (1995) thematic analysis of cognitive, affective/social, physical and future benefits. Occasionally, participants entered three benefits that all fitted into the same category. Cognitive benefits to student learning were mentioned 98 times, physical benefits, such as the efficiency of the tools was mentioned 71 times. Future benefits for students were stated 50 times and the social/affective benefits, for example, motivation, were mentioned the least amount with 50 comments.

*Table 4.6*
**Main benefits for student learning identified by HODs and teachers**

| | |
|---|---|
| Cognitive benefits | - access the World Wide Web<br>- wider range of resources<br>- up-to-date resources<br>- access information<br>- enhanced learning<br>- understanding<br>- supports the curriculum<br>- editing/proofing writing<br>- learning styles<br>- models of learning, discovery, inquiry learning<br>- data processing, a variety of ways<br>- extension<br>- analytical tool<br>- broadens knowledge base<br>- individualised learning programmes<br>- authentic activities |
| Physical benefits | - faster<br>- immediacy of results<br>- efficiency and effectiveness<br>- number crunching<br>- access to tools<br>- presentation<br>- variety of presentation tools<br>- storage<br>- data collection<br>- making graphs<br>- simulations<br>- instant access |
| Future benefits | - skills for future life<br>- skills for workplace<br>- modern trends<br>- tertiary study<br>- transfer skills<br>- practise computer skills<br>- improve skills in IT<br>- useful alternative<br>- computer literacy<br>- broaden their education and experience |
| Affective/social benefits | - empowerment<br>- fun<br>- interactive<br>- motivation<br>- variety of learning environment<br>- stimulating |

## Success factors and barriers

HODs and teachers were asked separate questions about success factors, and barriers to the integration of ICT in their curriculum area. Results from these two areas will be presented together in one section because HODs' and teachers' responses to each question were closely grouped around a number of issues which emerged. Each issue that showed a *positive* response to the success question often demonstrated a corresponding *negative* response to the following question about identifying barriers. Often a barrier was identified as a 'lack of' the positive success factor, for example if "access to equipment" was identified as a success factor then "lack of access" was identified as a barrier.

Table 4.7 presents the main issues that emerged with the number of *success factor* and *barrier* responses for each. Each data set is divided into HOD and teacher responses. The data for each are combined in one table, and the total responses for each issue presented in order to more clearly detect a pattern in responses for each issue. They are loosely categorised into three groups according to the total number of responses. This indicates which are important issues for HODs and teachers, whether seen as a success factor or a barrier.

Participants were asked to state three success factors or barriers. The data represents the number of times a theme was mentioned, for example, one teacher stated "time" three times, so this was counted as three responses. Occasionally a participant made two responses which could fall into the same theme. This was counted as two responses.

Access was clearly the issue that received the most responses, followed by professional development and teachers' knowledge and competence. Issues that received a moderate number of responses were, money, time, planning for curriculum integration, teacher confidence and attitude, and technical support. Issues that received the least responses were, software, vision and student motivation. These issues are outlined in more detail below.

*Table 4.7*

**Success factors and barriers to enable integration of ICT into the curriculum**

| Theme | Success factors | | Barriers | | |
|---|---|---|---|---|---|
| | Number of responses HOD | Number of responses Teachers | Number of responses HOD | Number of responses Teachers | Total number of responses |
| Access | 38 | 19 | 38 | 21 | 116 |
| Professional development | 20 | 10 | 12 | 8 | 50 |
| Teachers knowledge and competence | 17 | 8 | 12 | 7 | 44 |
| | | | | | |
| Money | 7 | 1 | 14 | 11 | 33 |
| Time | 6 | 8 | 13 | 3 | 30 |
| Planning for curriculum integration | 9 | 12 | 3 | 3 | 27 |
| Teacher confidence and attitude | 11 | 4 | 0 | 7 | 22 |
| Technical support | 4 | 6 | 5 | 7 | 22 |
| | | | | | |
| Appropriate software | 8 | 2 | 4 | 3 | 17 |
| Vision | 0 | 6 | 0 | 4 | 10 |
| Student motivation | 3 | 0 | 1 | 0 | 4 |

*Access*

"Access to ICT equipment" was clearly the main factor identified which affects the successful integration of ICT into each curriculum area. An equal number of responses from HODs identified "access to ICT equipment" as the main success factor (38) and "lack of access" as a barrier (38) to the successful integration of ICT into the curriculum. Teachers also reported access as a main factor, 19 responses as a success factor and 21 responses identified it as a barrier. Participants reported access for staff, access by students, access in labs, access by large groups, access to the internet and access to computers at home for teachers as either a success factor or a barrier. "Computer rooms booked out weeks in advance" seems to sum up feelings on this matter. One HOD highlighted the relationship between access, or lack of it, and planning for the integration of ICT; "IT machinery not available for ease of student use in curriculum area therefore tend not to plan for use of same". If a teacher doesn't have regular, reliable access then there is no point in planning for the integration of ICT. Lack of access to laptops was mentioned as a barrier: "not enough mobile computers for use in classroom", but another teacher had access to laptops yet encountered other difficulties; "Laptops, borrowed when necessary – these however need extension plugs as batteries are unavailable – only one plug in room." One teacher reported lack of access to "helpful resource people" as a barrier.

*Professional development, teacher confidence and competence*

Professional development emerged as the second most common factor contributing to the successful integration of ICT. Twenty responses by HODs and ten by teachers reported professional development as a success factor, while twelve HOD responses and eight teacher responses identified it as a barrier. HODs wanted curriculum specific professional development with one commenting, "the direction of professional development has tended to be very general – teachers do not have the time to adapt IT to the curriculum themselves – they need many examples to support them". Targeted professional development was supported by another teacher who reported lack of professional development as a barrier, and lamented on an attitude – "the idea that teachers can pick it up by some form of osmosis". Teachers not only want curriculum specific professional development but they also want it pitched at the right level, "teach teachers at the right level". The importance of the cognitive benefits for students were highlighted by the comment – "staff understanding the benefits for students" as a success factor. Teachers "trained to act as role models" and a "lack of ongoing professional development" were other comments received.

Teacher "knowledge and competence" drew 17 success factor responses from HODs and eight from teachers, and 12 barrier responses from HODs, and seven from teachers. Analysing this in conjunction with the responses for professional development, it becomes clear that professional development is a very important success factor for the integration of ICT in the target curriculum areas in secondary schools. Teachers do not become knowledgeable and competent without professional development, and they don't become confident and have a positive attitude towards the use of ICT unless they are knowledgeable and competent. There is almost a circular effect in operation. As a success factor HODs reported teacher "confidence and attitude" 11 times and teachers four times. As a barrier it was reported four times by HODs and seven times by teachers. Affective factors were identified by some participants by reporting "overcoming the fear factor" as a strategy for success, along with the encouragement of other teachers. Staff with passion for the integration of ICT was also identified. Having a competent ICT teacher was seen as important and conversely "unhelpful IT personnel" were a barrier to success.

*Curriculum planning and vision*

Interestingly teachers reported "curriculum planning" for the integration of ICT 12 times as opposed to HOD reporting nine times. This seems to be a call from teachers for leadership in planning for integration whereas HODs are in the leadership role of being able to initiate planning in their areas. Along with this goes the theme of a "vision" for the integration of ICT which teachers reported six times yet no HOD reported this as a success factor or as a barrier. This aspect arose also in response to a further question for HODs about the leadership role they take in the use of ICT in their curriculum areas. This will be reported in the School Systems section. Teachers wanted unit plans, curriculum examples and resources.

*Time*

*Time* was a success factor identified more than twice as often by teachers (13) than HODs (6). One teacher stated:

"1. time

2. time

3. time"

as her only success factor.

HODs and teachers wanted time to plan units, time in the curriculum to use ICT, time to learn and practise skills, and time to train staff. One teacher identified a lack of time allocated to their curriculum area in the timetable to be able to use ICT.

*Other themes*

More HODs (14) and teachers (11) identified "money" as a barrier rather than a success factor, HODs (7), teachers (1). One participant identified this by the use of a '$' dollar sign. Money was wanted for equipment and software. Appropriate "software" (HOD 8; teacher 2) was also identified as a success factor. The lack of it was also identified as a barrier HOD (4) and teacher (3). "Technical support" received four mentions from HODs and five from teachers as success factors, with five and seven mentions as a barrier by HODs and teachers respectively. Mention was made of computers, printers, the internet not working properly as both success factors and barriers. Only HODs reported "student motivation" as a success factor (3) and as a barrier (1).

Other barriers mentioned by participants which did not fit into any of these themes were, "control of ICT not shared, lack of power outlets and ICT used for administration rather than students" from one teacher. Another teacher responded to the 'success factor' question by stating very clearly that ICT was "not yet successful in this school."

## ICT USE IN THE CLASSROOM

This section presents data relating to classroom use of ICT in the curriculum areas of English, mathematics, social studies and science. A series of figures and tables are given showing *what* information and communication technologies HODs and teachers are using, *how often* they are using them and with *whom*, that is, what year levels. Information about teaching experiences using ICT and *where* the technologies are being accessed in a secondary school are also presented.

### HODs and teachers current ICT Use

Figures 4.4 to 4.7 show what information and communication technologies HODs and teachers of each curriculum area report that their students have used in the previous four terms. HODs and teachers were given a choice of ICT tools to choose from. Where teachers may not have known about a particular application, examples were given of common types used in schools. The calculator was included as a result of feedback from the pilot schools' Mathematics HOD and teacher.

The measure of 'the last four terms' was used because in the pilot of the questionnaires English teachers reported that if they hadn't done their senior research units by the end of Term Two 1999 then they wouldn't have anything to report. They stated that they were more likely to schedule these units in the last two terms. The results reflect a year's use from the beginning of Term Three 1998 to the end of Term Two 1999.

The word processor is the most popular technology with 92% of English teachers, 63% mathematics teachers, 79% social studies teachers and 64% of science teachers reporting its use by students in the previous four terms. Interesting aspects in these statistics are the very low reported use of multimedia authoring packages such as *HyperStudio* or *PowerPoint* in any of the curriculum areas, 12% for English and 13% for mathematics, none for social studies and 8% for science teachers. No curriculum area reported having an audioconference. Eighty four percent of mathematics teachers reported using spreadsheets and none reported using Logo.

As indicated in Table 4.8, the increasing importance of the use of telecommunication in the form of the internet, World Wide Web and email, is reflected in the relatively high levels of use across all curriculum areas. Whereas science HODs and teachers do not yet use email frequently, they do show high levels of use of the World Wide Web.

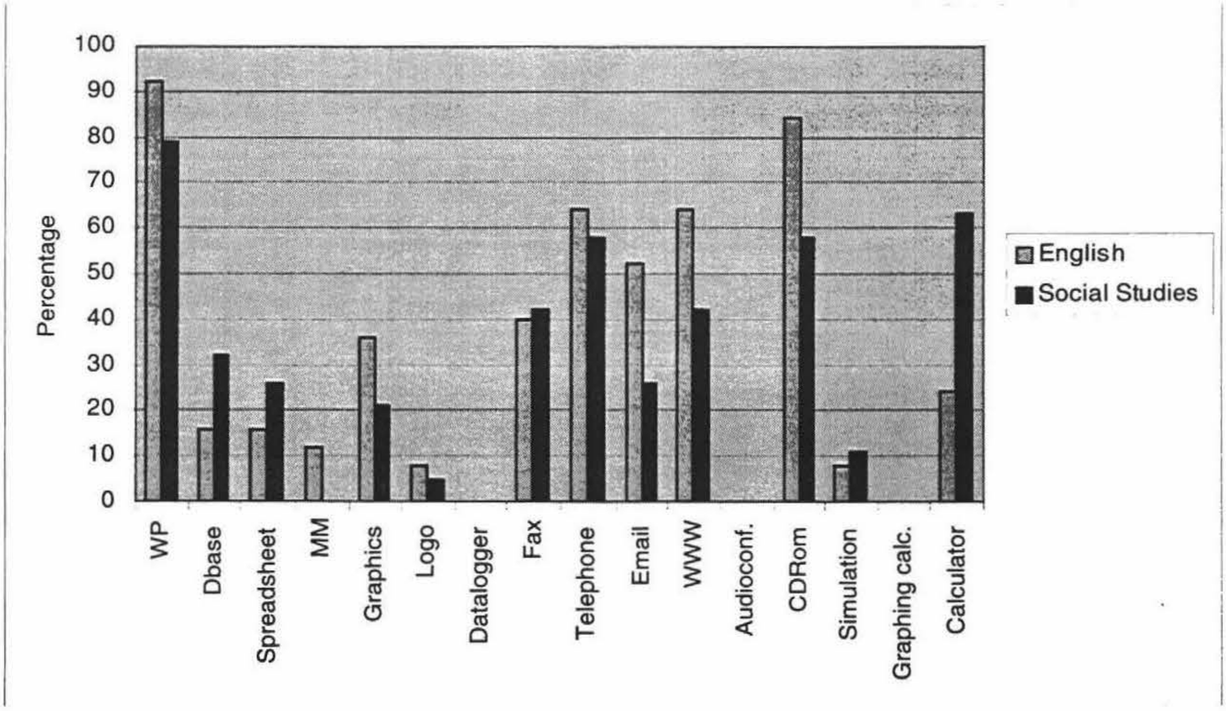
*Table 4.8*
**Percentage of HODs and teachers in each curriculum area who have used the World Wide Web and email in the previous 4 terms**

| | English HODs and teachers % | Mathematics HODs and teachers % | Social Studies HODs and teachers % | Science HODs and teachers % |
|---|---|---|---|---|
| **World Wide Web** | 64 | 25 | 42 | 64 |
| **Email** | 52 | 25 | 26 | 5 |

Figures 4.3 and 4.4 show a comparison if ICT use between the English and social studies curriculum areas, and mathematics and science. There is an interesting pattern of use between the 'arts' and 'sciences' areas. Both English and social studies make extensive use of a word processor but relatively little use of manipulating and calculating software such as databases and spreadsheets, whereas spreadsheets are used frequently in mathematics and science. Communications technologies, such as the telephone and facsimile, have high levels of use in English and social studies and not so much in mathematics and science. Technologies enabling access to large amounts of information such as the World Wide Web and CDRoms are used by English, social studies and science more so than mathematics. It is interesting to note that the use of calculators in social studies is almost as much as for mathematics and science.

*Figure 4.3*

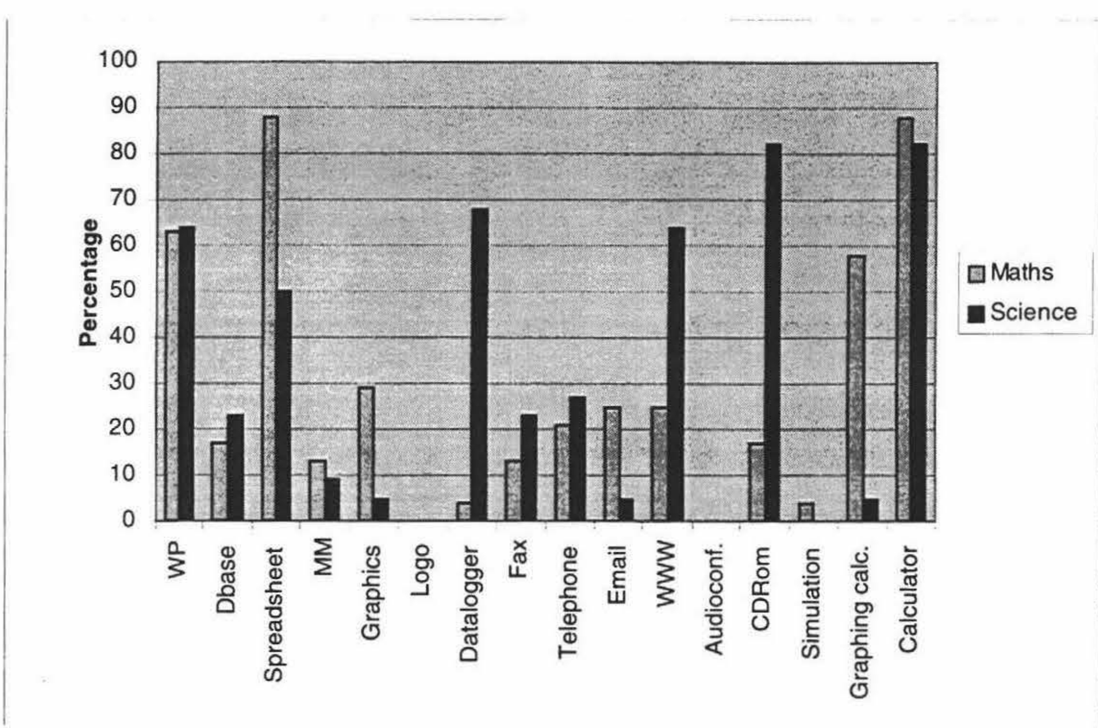
**A comparison of ICT use between the English and social studies curriculum areas**



There is a similar pattern of use between mathematics and science where they both report almost equal use of a word processor and relatively low use of multimedia. As would be expected, dataloggers are used almost exclusively in science, and graphing calculators in mathematics. Another difference is in the use of the World Wide Web and CDRoms. This could reflect the content nature of science as opposed to the process orientation of mathematics.

*Figure 4.4*

**A comparison of ICT use between the mathematics and science curriculum areas**



## Frequency of Use of ICT by year levels

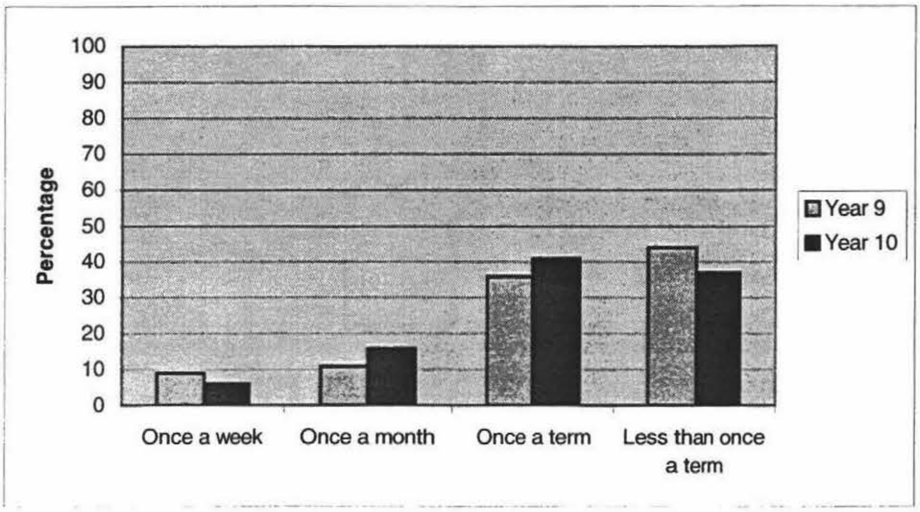
Teachers were asked how often they had used ICT in their teaching and learning programmes in the first two terms of 1999. The results shown in Table 4.9 and Figures 4.5 and 4.6 include data only from those HODs and teachers from each curriculum area who taught Year 9 and 10 during 1999. In the first two terms of 1999, 9% of Year 9 teachers and 6% of Year 10 report using ICT tools once a week in their teaching and learning programmes. Nearly half of Year 9 (44%) and just over a third of Year 10 (37%) teachers reported using ICT tools less than once a term with these classes.

*Table 4.9*
**Frequency of use by HODs and teachers of ICT with Years 9 and 10**

| | Once a week % | Once a month % | Once a term % | < once a term % | Total n |
|---|---|---|---|---|---|
| **Year 9** | 9 (n=6) | 11 (n=7) | 36 (n=23) | 44 (n=28) | 64 |
| **Year 10** | 6 (n=4) | 16 (n=10) | 41 (n=25) | 37 (n=23) | 62 |

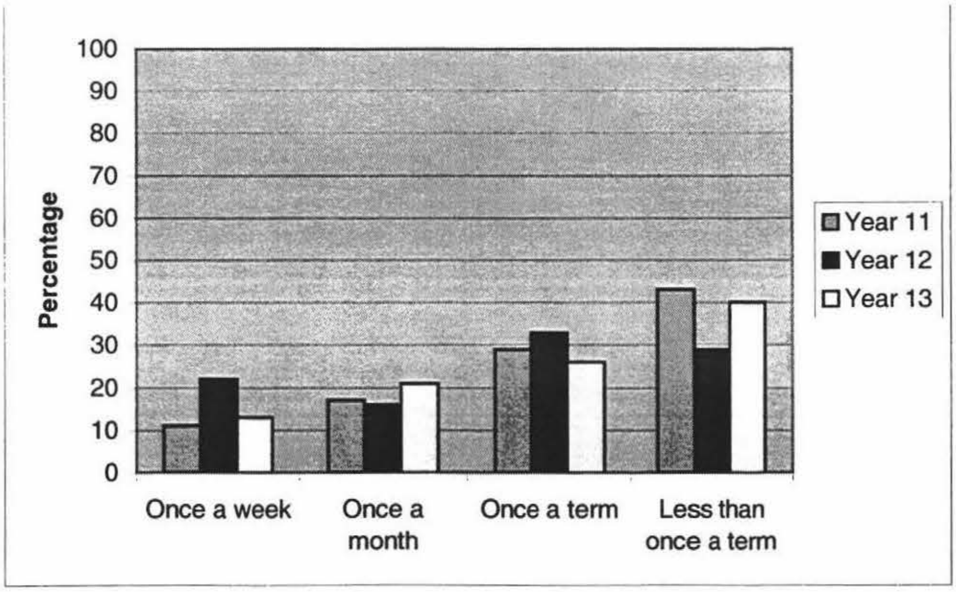
The impact of these figures is best demonstrated in the graph (Figure 4.5) below.

*Figure 4.5*
**Frequency of use by HODs and teachers of ICT with Years 9 and 10**




An analysis for Years 11, 12 and 13 show similar results with the exception of Year 12 where 22 % of teachers report using IT tools weekly (compared to 9% and 6% for years 9 and 10). This is higher than for any other year level. This finding invites further investigation.

*Figure 4.6*
**Frequency of use by HODs and teachers of ICT with Years 11, 12 and 13**



## Recent successful experiences using ICT

HODs and teachers were asked to briefly describe their most recent successful experience at integrating one or more information and communication technologies into their classroom programme. Table 4.10 summarises their responses with an analysis based on the information and communication technologies used, the year level, the learning process and the product. Activities from each curriculum area are then presented separately and in detail.

*Table 4.10*
**Overview of recent successful experience using ICT in teaching and learning**

| ICT | Learning process | Product |
|---|---|---|
| Word processor | writing | Poetic writing<br>Storybooks |
| Spreadsheet | Graphing time series<br>Moving means, trends<br>Statistics | |
| Database | | |
| Desk top publisher | Desk top publishing | Magazine |
| CDRom | Research | Assignment/project |
| World wide web | Research | Visual timeline<br>Storyboard |
| Email | Research | |
| Slideshow, multimedia | Co operative learning | Electronic presentation |
| Graphing calculator | Data analysis | |
| Datalogger | Experiments<br>Measuring sensory input/ data analysis | |
| HTML editor | Co operative learning | World wide Web pages |
| Telephone | Research | |
| Scanner | | Electronic presentation |
| Simulation | Demonstration | |
| Video editing software | | Video |
| GIS | Research | |

There was a clear delineation between the four curriculum areas as to the tool and process used and the final product.

**English**

The most frequent tool used by English HODs and teachers (6) was the word processor. It was used for some form of writing including storybooks and magazines. Research was the most frequent (8) learning process using CDRoms and the internet, with web pages and projects reported as the finished product. Four teachers reported using a desk top publisher and specified a magazine, story book and static image as the finished products. Two teachers reported using a multimedia authoring package (Powerpoint) to produce an electronic slideshow.

For example:

> *My Year 9 class used Powerpoint to present a film review of Baz Luhrman's Romeo and Juliet. It emphasised film as a visual media as well as providing a tool to present the work creatively.*
>
> (Female English teacher with 5-10 years experience)

> *Powerpoint presentations – But very stressful because no room already "setup" to which we could go.*
>
> (Male English HOD with 10-20 years experience, and 5-10 years as HOD)

> *Some success using the internet in 5th form research, some students were able to chart their path through a net search. (access, time and efficiency the barriers to all students having success here).*
>
> (Female English teacher with 10-20 years experience)

Other activities reported by English teachers are shown in Tables 4.11, 4.12 and 4.13. Activities are grouped by learning processes in the English curriculum, of writing, visual language and research.

Table 4.11 shows a range of activities reported for writing, from a relatively low level cognitive skill such as: "use word processing to type out assignment and word processing of poetry for display on classroom wall", to one of using the word processor to "craft creative writing". Teachers have commented how rewarding using a word processor is for less able or unmotivated students. The emphasis in this activity is on the finished product rather than the writing process itself. An authentic activity of creating a story book for a 'real' audience of primary school pupils enables the use of higher order cognitive skills such as planning, reflection for audience awareness, and originality.

*Table 4.11*

**Recent successful experience using ICT reported by English HODs and teachers: writing processes**

| | |
|---|---|
| Writing process | *Use word processing to type out assignment.* |
| | *Word processing of poetry for display on classroom wall.* |
| | *6 Alternative English – used Student Writers for production of final draft. The naughty boys were totally focussed as they took 3 periods to type the work in. They were really proud of the final products – I had to print two copies – one for me and one for them to take home.* |
| | *Using computers to process writing, or Year 11, writing focus. Rewarding for less able students to see their writing published and looking professional.* |
| | *Crafting in creative writing – polishing for publication*<br>- *newspaper production.* |
| | *Production of class-written storybooks for use in primary classes – using publishing program on school computers.* |

Table 4.12 shows activities including writing and aspects of visual language in the English curriculum. Here Year 9 students are working co operatively in groups with desktop publishers to enhance design and layout. Teachers have emphasised the motivational and cooperative aspect of using these tools with students who "helped one another and leaping in and using them". Classroom management techniques using small groups are in evidence here, with a CDRom used for a specific task

while other group members are involved in related activities, such as brainstorming and discussing. Students are actively engaged in the learning process, "they enjoyed the active learning style".

*Table 4.12*

**Recent successful experience using ICT reported by English HODs and teachers: writing and visual language processes**

| | |
|---|---|
| Writing and visual processes | *Yesterday my fourth form class embarked upon a four- period Desk Top Publishing unit. They loved it. They helped one another. They enjoyed the active learning style.* |
| | *Form 4 students are each producing a magazine, finished format on a computer. They are all leaping in and using them.* |
| | *Using Macbeth CDRom to generate storyboard of scene – working in groups – one on computer – rest brainstorming /discussing.* |

English teachers use of ICT for research are shown in Table 4.13. Statements from teachers ranged from, use of the internet and CDRoms for research, to a more detailed description of the learning activity. Teaching students management techniques as to how to search on the internet is emphasised in two examples.

*Table 4.13*

**Recent successful experience using ICT reported by English HODs and teachers: research**

| | |
|---|---|
| **Research** | *Use of the internet and CDRoms for Research.* |
| | *Purchasing of CDRom on the Great Gatsby for Year 13 – pupils worked with interest. Also used the internet. Discovery of the search engine "Dogpile" helped. I use this all of the time now as it shows what resources are available on all major search engines. Pupils know to go to this search engine first.* |
| | *Researching an author online. Found the web site and URL then got the kids to research the author's life.* |

## Mathematics

The main technology used by mathematics teachers is a spreadsheet (13) with its graphing capabilities. The main activities reported are time series graphs (14), moving means and trends and other statistics (3). Three teachers reported the use of graphing calculators for specific activities. Teachers also reported using a datalogger (1) database (1) and a word processor (1). One teacher had students working in small groups and three stated that these tools were used to write assignments and projects. Higher level cognitive activities are evident with the skills of processing and manipulating data, and creating 'what if' situations. For example, a Form 7 (Year 13) Maths with Statistics class used spreadsheets to analyse time series data; inputting data, manipulating cells, using formulae to calculate moving averages/individual seasonal effects, graphing data, finding trends. When teachers included a year level it was usually a senior class, Year 10, 11 or 13. Table 4.14 shows some activities reported in more detailed by teachers.

*Table 4.14*

**Recent successful experience using ICT reported by Mathematics HODs and teachers**

| | |
|---|---|
| Mathematics Learning Activities | *Used graphic calculators to look at trigonometric graphs in F6 maths.* |
| | *5 MAP students being stimulated by the visual affects of the mathematical exercise.* |
| | *With small group – using spreadsheet to plot parabolic graphs.* |
| | *Using spreadsheets in a topic on numerical solutions of equations.* |
| | *Time series graph drawing in Year 13 statistics.* |
| | *Using graphing calculators & graphing software to explore types of graphs and transformations of graphs. Especially useful for exploring Poisson/Normal approximations to the Binomial Distribution. (University Bursary Math/Stats).* |
| | *7 Maths with Statistics class used spreadsheets to analyse time series data; inputting data, manipulating cells, using formulae to calculate moving averages/individual seasonal effects, graphing data, finding trends. Approx. a week was spent in the computer room getting familiar with the program. Consequently almost all students presented their internal assessment projects with computer printouts of data & graphs (as opposed to handwritten) having felt confident to come back to the computer rooms in their own time to complete their assignment.* |

**Social Studies**

When teachers stated a year level for the activities that they reported it was with senior classes, specifically Years 12 and 13. Table 4.15 shows the types of activity that teachers reported. A number of teachers (6) reported use of the internet for research and communication incorporating authentic activities for students. Teachers have mentioned strands in the social studies curriculum, *Social Life*, *Human Rights*, *Social Justice*. One teacher reported the "use of GIS data/graphical database and mapping to measure extent of and impacts of 1995 & 96 Ruapehu eruptions on land use, towns and relief". Another teacher commented "students created a visual timeline on disc with their own commentary as part of history study". However, in contrast to this is a very tightly controlled use of ICT by the teacher, "computer assignment – designed by me – fill in the answers which involve gaining information from *Encarta*, *Encarta Atlas*, textbook & class learning". One teacher stated that they were "not yet able to do so. Can only refer students to library CDRoms or World Wide Web if available at home".

*Table 4.15*

**Recent successful experiences using ICT reported by Social Studies HODs and teachers.**

| | |
|---|---|
| Social Studies use of internet for communication | *Encarta/www technology project – design water purification model for island destroyed by tidal wave. Group work, investigation.* |
| | *Internet use in senior geography and history – provide students with (1). A variety of sites and (2). Some hard copy of internet material – material processed then presentation in a word processor – scanned images included.* |
| | *Use of the internet to study the Exxon Valdez oil spill.* |
| | *Simulation of Caesar 2 (?) building Norman City for F6 Social Life and use of website to publish material in classroom.* |
| | *Students using email as part of unit on Human Rights- Social Justice, contacting Amnesty International organisation.* |
| | *Using email in my tourism class to get information from visitor information centres around the country.* |

**Science**

Science teachers report using a range of technologies for specific learning tasks. These are largely well planned and integrated into curriculum activities. Specialised dataloggers (3) are used for collecting and analysing authentic data, for example, how fast can junior science students run? Simulation programs (4), one in particular was reported by teachers, are used to enable students to experiment with data in a safe environment. Science teachers are also making use of the internet (4) for research purposes (6) with one teacher reporting the use of email. Tables 4.16, 4.17 and 4.18 show in further detail the use of dataloggers, simulations and the internet.

Two teachers reported the "use of *PowerPoint* in class presentations". Another two teachers used spreadsheets with one using the graphing facility to use higher order cognitive skills to analyse and compare data:

> *Using excel spreadsheet and graphing wizard with Form 6 Chemistry, graphing boiling point of 1st 10 alkanes, then creating a 2nd graph with 1st 10 alkenes and alkynes to compare their trends.*

A drill and practice type program was used by one teacher for a particular purpose:

> *...using CDRom programme as a revision tool prior to end of topic test – tutorials & questions that students work through at their own pace leaving teacher free to move around & assist;*

Another showed that high tech equipment was not necessary to use ICT effectively. The teacher comments:

> *Students are encouraged to use the telephone when researching for assignments:*
> - *local industry assignment, Year 9*
> - *extraction of a natural resource, Year 11*
> - *plastics recycling, Year 10*

Table 4.16 shows how Science teachers are using dataloggers to capture and analyse data.

*Table 4.16*

**Recent successful experiences using ICT reported by Science HODs and teachers: use of data capturing equipment**

| | |
|---|---|
| Capturing and analysing data using dataloggers in Science | *Junior Science – use of dataloggers to compare how fast students can run.* |
| | *Use of Pascoe interface datalogger.* |
| | *Use of smart pulley for focus to generate a /t graphs and v/t graphs.* |
| | *F7 chemistry – datalogging equipment for use in acid –base titrations & exothermic and endothermic reactions.* |

Table 4.17 shows how a simulation program is used to enable students to experiment with electrical circuits safely. The activities were "integrated into a programme of practical work with circuits".

*Table 4.17*

**Recent successful experiences using ICT reported by Science HODs and teachers: use of simulations**

| | |
|---|---|
| Simulation programs to construct 'what if' situations | *Computer program Crocodile Clips into F4, F5, F6 and F7 courses.* |
| | *Use of Crocodile Clips programme at F4 for electricity. Allowed students to work without fear of 'blowing things up' eg using heaps of dry cells or experimenting with role of fuses. This was integrated into programme of practical work with circuits.* |

Science teachers use of the internet for research and communication are shown in Table 4.18. Here the World Wide Web is used to locate up to date information, specialised health information and, with teacher initiative, to discover and download a program for displaying "interactive models of DNA". Again these activities are integrated into the curriculum and show evidence of planning. Information management strategies are evident in the identification of a particular website and shows how the web can be used to publish student investigations. One teacher appears to have the confidence "to use the internet regularly – also CDRoms when the need arises".

*Table 4.18*

**Recent successful experiences using ICT reported by Science HODs and teachers: research**

| | |
|---|---|
| Science teachers use of the internet for Research. | *Use of www.nzhealth.co.nz to research diseases for Unit Standard on Human Biology. Whole class participated and located what they needed.* |
| | *Using the internet to access information regarding a current issues topic and sharing this with the class.* |
| | *Students wrote Biology ecosystem study reports on to web page – including photos – now part of school website (url provided).* |
| | *Using the program 'Chime' to display interactive models of DNA. (this material downloaded from the internet).* |
| | *I use the internet regularly – also CDRoms when the need arises.* |

## Where ICT, in the form of computers, are being accessed

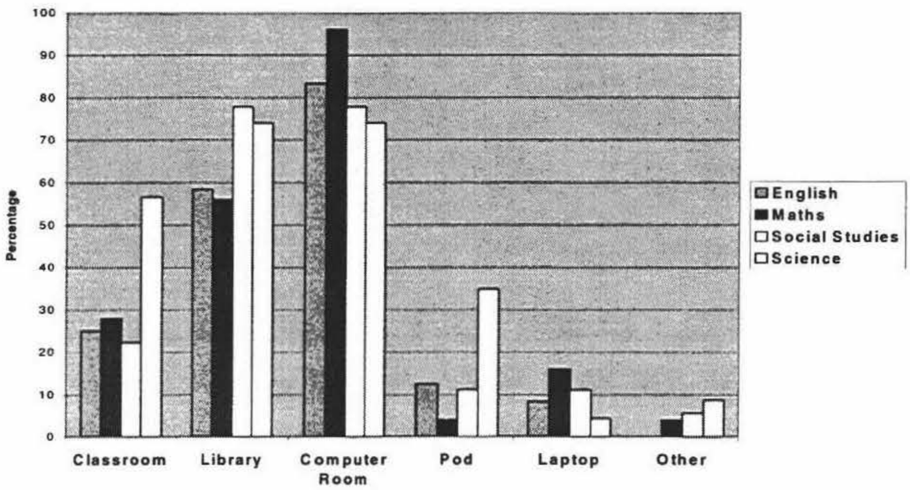
Figure 4.7 shows where students in each curriculum area **mainly** access ICT in the form of computers. Teachers were able to indicate more than one area so the percentages do not add up to 100%. Science teachers report the highest level of access to computers from their classroom at 57%, and 35% reported access from pods of computers.28 % mathematics teachers, 25% of English teachers and 22% of social studies report their main access to computers is from the classroom. Relatively low levels of access are reported by the curriculum areas of English, mathematics, and social studies to pods, or clusters of computers with 12%, 4% and 11% reported respectively.

There is a high level of access from computer rooms reported by all curriculum areas with 83% of English, 96% mathematics, 78% social studies and 74% science teachers.

A relatively high level of access to computers from the library is reported by teachers of all areas. Fifty eight percent of English and 78% social studies teachers, report that their students mainly access computers in the library and there is also a high level of use reported by mathematics and science teachers, 55% and 73% respectively.

Results indicate that laptops are not widely used in these secondary schools. Even though 'laptops' do not indicate a place where computers are housed, their portability enables them to be used where student learning is likely to be happening, i.e. the classroom. Laptops can go to the students rather than students going to a computer room.

*Figure 4.7*
**Where ICT are mainly accessed from for each curriculum area**




## PROFESSIONAL DEVELOPMENT

This section presents data on the professional development experiences of teachers in order to ascertain the extent to which formal professional development programmes have played a part in the successful integration of ICT. A series of figures and tables are given

HODs and teachers were asked in the survey if they were currently engaged in professional development in ICT, if so they were asked to briefly describe it. They were also asked if they had attended, in the previous two years, any type of in-service course on the use of ICT in teaching and learning. If so they were asked to briefly describe it. HODs were asked if any of their staff were currently engaged in any professional development in ICT, if so how many teachers and what type. HODs and teachers were asked where they had gained most of their information and ideas to integrate ICT into their curriculum area. Table 4.19 shows the percentage of HODs and teachers who were currently engaged in ICT professional development when the survey was carried out at the beginning of Term 3 1999. Thirty five percent of HODs and 19% of teachers were engaged in ICT professional development at this time.

*Table 4.19*
**Number of participants currently engaged in ICT professional development**

| | Yes<br>% | No<br>% |
|---|---|---|
| **HOD** | 35<br>(n=19) | 65<br>(n=35) |
| **Teacher** | 19<br>(n=7) | 81<br>(n=29) |

A relatively small percentage of HODs (35%) and teachers (19%) were engaged in ICT professional development at the beginning of Term 3 1999. However, Table 4.20 shows that a much higher percentage, 65% of HODs and 72% of teachers, had attended some form of professional development in ICT during the previous 2 years.

*Table 4.20*
**Number of participants attending ICT professional development in the previous two years**

| | Yes<br>% | No<br>% |
|---|---|---|
| **HOD** | 65<br>(n=35) | 35<br>(n=19) |
| **Teacher** | 72<br>(n=26) | 28<br>(n=10) |

HODs were asked if any of their staff were currently engaged in ICT professional development, if so how many and what type. Forty one percent of HODs reported that they had staff who were currently engaged in ICT professional development. Table 4.21 shows the data.

*Table 4.21*

**Staff currently engaged in ICT professional development**

| | **Yes** % | **No** % |
|---|---|---|
| **Staff** | 41 (n=22) | 59 (n=32) |

HODs and teachers reported attending a wide range of professional development programmes. The descriptions of types of professional development written by HODs and teachers were coded according to duration, type, who participated, who provided it and where the course was taught. Table 4.22 shows the types of professional development programmes HODs and teachers attended in 1999 and in the previous two years. In 1999 one teacher was attending a professional development programme that focussed on integrating ICT into the curriculum, while five teachers reported attending them in the previous two years. One HOD pleaded for more of this type, "(I) have had generalised PD without specific curriculum reference which has been of little use". The type of professional development programme that most participants were attending and had attended was a skills-based type, focusing on the use of specific computer applications. One teacher commented on these types of courses, "computer skills. Several one-off courses. This is not enough".

*Table 4.22*

**Type of professional development programmes HODs and teachers attended in 1999 and in the previous two years**

| Type | Current professional development (n=26) | Professional development in previous 2 years (n=61) |
|---|---|---|
| **Integrating ICT into the curriculum** | 1 | 5 |
| **Skills using an application** | 9 | 24 |
| **Internet – research** | 1 | 14 |
| **Web pages** | 1 | 0 |
| **Technical** | 1 | 2 |
| **Demonstration of an application** | 0 | 1 |
| **Formal course** | 1 | 1 |
| **Infrastructure of the school** | 2 | 1 |

Formal courses provided by academic institutions and which lead to a qualification were *Infolink* (Auckland College of Education), and *English Online* (UNITEC Institute of Technology). Three participants reported attending courses relating to the infrastructure of the school such as the school network, or the reporting system.

Tables 4.23 shows that six people reported attending a one-day course with only one reporting attending a three-day course.

*Table 4.23*

**Number of responses indicating duration of course**

| Duration of course | |
|---|---|
| One afternoon | 4 |
| One-day course | 6 |
| Three-day course | 1 |
| Irregular | 2 |

Table 4.24 shows that of the people who had received professional development 14 indicated that it was taught at the school.

*Table 4.24*

**Number of responses indicating where the course was taught**

| Where course was taught | |
|---|---|
| On site | 14 |
| Offsite | 7 |

Table 4.25 indicates that five people attended ICT courses taken by outside providers and four taken from personnel within the school.

*Table 4.25*

**Number of responses indicating where the providers originated**

| Providers | |
|---|---|
| Outside providers | 5 |
| School personnel | 4 |

Table 4.26 shows the range of outside providers used by schools for their professional development, and the numbers of participants who indicated attending a course run by these providers, either in 1999, or in the two years prior.

*Table 4.26*

**Number of responses indicating the range of outside providers**

| Outside providers | |
|---|---|
| Advisers | 5 |
| Academic organisation | 2 |
| Telecom | 1 |
| Computer company | 1 |
| National Library | 1 |

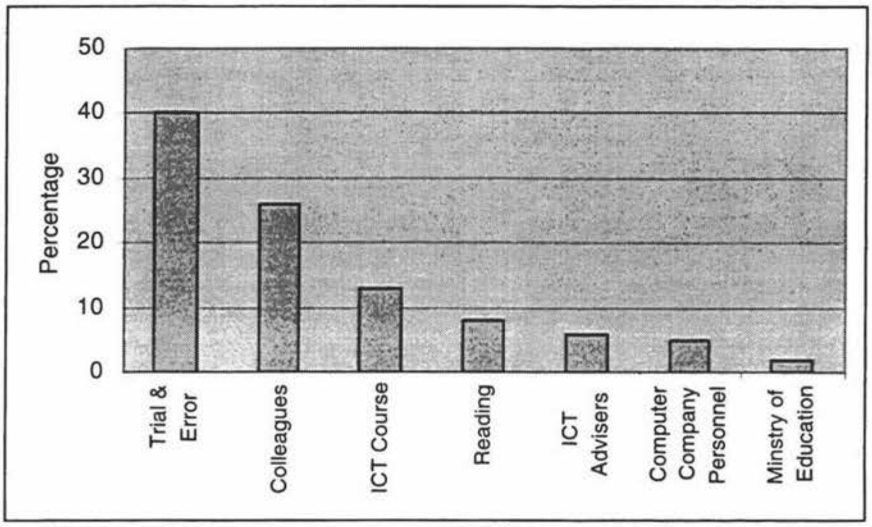
Some programmes were informal with one-on-one instruction, given by the HOD for instance, on an irregular basis. One HOD had strong views and commented on his attendance: "school-based in-service courses on an irregular, unsuccessful (in my opinion) basis". Two people included their self-taught learning as professional development. An HOD reported that a teacher in her department:

> *...has a fixed term PR (management) unit to integrate IT into extension units in F4. This is definitely giving her PD!.*

Other comments showed that three people were individuals attending a course, three were part of a whole department programme and five part of a whole school initiative, and one was part of a cluster of schools. One mathematics department "had an inservice day in which we were shown how to use a video projector to project a computer screen onto a wall". Professional development for one teacher in the previous two years was a course she did in her pre-service training. Another teacher reported attending an ICT professional development programme specifically for Maori teachers. When asked 'are you currently engaged in ICT professional development?' one HOD reported "No, but I would like to be. This is a constant dilemma for me".

HODs and teachers were also asked to state where they had gained most of their knowledge of ICT in teaching and learning. This is not a measure of *actual* knowledge as demonstrated in practice, but of their *perception* of knowledge gained and its usefulness in their teaching and learning programmes. Participants were asked to indicate this on a 1-5 scale, with 1 representing least amount of knowledge gained, and 5 for most knowledge gained. The response to the two highest categories, four and five, were aggregated and are shown in Figure 4.8 as a percentage. Data show that 40% of HODs and teachers perceive they have gained most of their ICT knowledge from trial and error and the least from Ministry of Education contracts.

*Figure 4.8*
**Where HODs and teachers reported gaining their most knowledge about ICT**

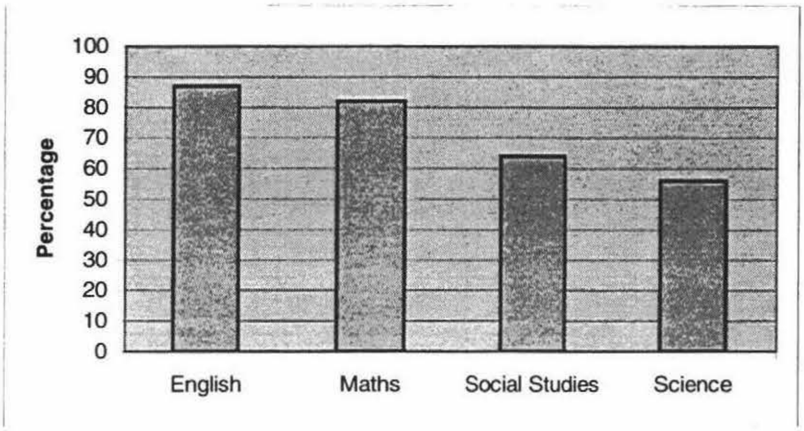



## SCHOOL SYSTEMS

This section presents data on the systems in place in schools to assist teachers to integrate ICT into their teaching and learning programmes. HODs, as part of their curriculum leadership role, were asked if ICT was mentioned specifically in their departmental scheme, and to list three things that they did to support teachers in their curriculum area who want to use ICT tools in their teaching and learning programmes. HODs and teachers were also asked to rate their school's support of ICT on a 1- 5 scale with 1 being the least supportive and 5 being the most supportive.

Figure 4.9 shows the percentage of departments which have ICT specifically mentioned in their schemes of work. All secondary school departments are required to produce a scheme of work for their curriculum area giving policy guidelines to teachers, for example, units of work covered at each level, resources available, assessment and reporting procedures. Eighty seven percent of English departments and 82% of mathematics departments have ICT specified in their schemes while 64% of social studies and 56% of science departments have ICT specified.

*Figure 4.9*
**Percentage of departments which have ICT mentioned in their schemes**




HODs were asked to list three leadership strategies they used to support teachers who wanted to use ICT in their teaching and learning programmes. Table 4.27 shows the strategies that HODs reported using, however, not all HODs listed three strategies. The most frequent strategies revolved around providing access to equipment and resources for teachers. Professional development opportunities, both formal and informal, were also a major strategy. Concrete assistance in the form of units of work with ICT integrated into them sat alongside the more informal strategy of encouragement. A single strategy listed by one HOD was to, "Remind them (the teachers) that the use of ICT is specified in the curriculum"

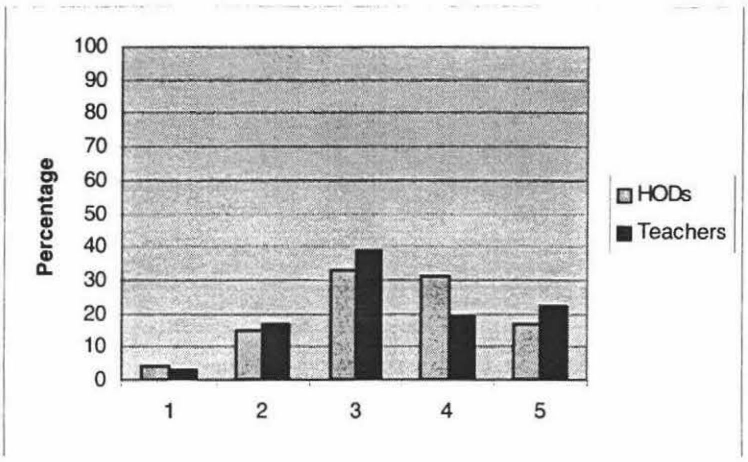
*Table 4.27*

**Leadership strategies HODs reported using to encourage the integration of ICT into their curriculum areas**

| **Strategy** | | **Total No of responses** |
|---|---|---|
| Professional Development: | | 49 |
| | No of responses related to professional development | |
| - formal professional development | 15 | |
| - informal, site-based | 15 | |
| - general | 7 | |
| - informal, share ideas | 6 | |
| - teacher within dept with ICT responsibilities | 3 | |
| - set up buddy system | 2 | |
| - professional development linked to appraisal | 1 | |
| | | |
| Provide resources | | 16 |
| Arranged access to ICT tools | | 15 |
| Curriculum planning, ICT written in to units of work | | 12 |
| Provide encouragement | | 11 |
| Give teachers time | | 2 |
| Use in administrative tasks within the dept e.g. record keeping | | 2 |
| Provide a laptop | | 2 |
| Make it compulsory | | 1 |
| Model use themselves | | 1 |
| Encourage for personal use | | 1 |

HODs and teachers were asked to rate how supportive they thought their school was to the integration of ICT into curriculum areas. A scale from 1 - 5 was used with 1 being the not at all supportive and 5 being very supportive. Figure 4.10 shows that 17% of HODs and 22% of teachers rated their schools as very supportive. However, more HODs (31%) than teachers (19%) rated their schools as quite supportive and 33% of HODs and 39% of teachers rated them supportive. Fifteen percent of HODs rated their school as mildly supportive and 4% as unsupportive. Seventeen percent and 3% of teachers gave the corresponding ratings.

*Figure 4.10*
**HOD and teacher ratings of school support for the integration of ICT into curriculum areas**




## SUMMARY

These results show that teachers are more experienced than HODs at using ICT. Teachers were twice as likely to rate themselves as 'quite experienced' or 'very experienced' than their HODs at using ICT in teaching and learning. A majority of HODs and teachers agreed or strongly agreed that integrating ICT into their curriculum area was very important. Most teachers access computers in a computer room, with science teachers having most access in the classroom or to a pod. The library is also used extensively for access by all curriculum areas.

Generally, low levels of ICT use were reported, with less than 10% of Year 9 and 10 teachers using ICT weekly. Over all levels and curriculum areas, one quarter of the sample use ICT less than once a term. Year 12 students had the most frequent weekly access with Year 11 having the least access of all year levels.

The most frequent tool used by English and social studies teachers was a word processor. CDRoms and the internet were used by both groups for research with two thirds of English teachers having used the World Wide Web and over half using email. Over 40% of social studies teachers had used the World Wide Web and a quarter had used email. No English teacher had conducted an audioconference and only 12% had used a multimedia authoring package. No social studies teacher reported the use of a multimedia authoring package but a third had used a spreadsheet and a database.

Mathematics teachers made extensive use of spreadsheets and graphing calculators, with less than 20% using a database. The World Wide Web and email were also making inroads into mathematics and science programmes with just under one third of mathematics teachers and two thirds of science teachers reported using them. No mathematics teacher reported using *Logo* in the previous four terms. Activities mentioned most by mathematics teachers were time series graphs, moving means and trends. Two thirds of science teachers used dataloggers for collecting and analysing data. Word processors were used by nearly two thirds of both groups. Just over half of science teachers had used a spreadsheet, but only a quarter had used a database.

Participants reported that cognitive benefits were the main advantage for students using ICT in learning. They also mentioned physical benefits, such as the efficiency of the software, future benefits for students, as well as the social/affective benefits, for example, motivation.

Responses to questions about success factors and barriers were closely grouped around a number of themes which emerged. Each theme that had a positive response to the *success* question, often had a corresponding negative response to the following question about identifying *barriers.* Often a barrier was identified as a 'lack of' the positive success factor, for example if *access to equipment* was identified as a success factor then *lack of access* was identified as a barrier. *Access to ICT equipment* was clearly the main factor identified which affects the successful integration of ICT into each curriculum area. This was followed by professional development leading to teacher confidence and competence. Other issues were curriculum planning, vision, time and money.

Nearly all English and mathematics departments had ICT specified in their schemes with just over half of social studies and science departments mentioning it. Just over a third of teachers rated their schools as 'supportive' with half of them rating their schools as 'quite supportive' or 'very supportive'. Very few HODs and teachers rated their schools as 'not at all supportive'.

Approximately one third of teachers were engaged in some form of ICT professional development in 1999 with two thirds having received professional development in the previous two years. Teachers had received most of their knowledge about ICT from trial and error. The least knowledge was gained from Ministry of Education contracts, computer company personnel and ICT advisers. Colleagues were also an important information source for teachers.

# CHAPTER FIVE – RESULTS: PHASE TWO

## INTRODUCTION

This chapter details results for the second phase of the research; a case study of a school, here called Seaview High, which is perceived as being successful in using ICT. Information presented was obtained from interviews with key personnel in the school, including the Principal and students. Data are presented as selected extracts and direct quotes relevant to the main research questions. The findings are divided into seven sections. The first section gives background information about the demographics and philosophy of the school using statistics and information obtained from the Deputy Principal and the school website (1999). The second section presents data relating to school support systems, policies and procedures obtained from interviews with the Principal, the HOD ICT, the Renaissance software representative and the Librarian, as well as from documentary evidence and press cuttings This includes information on the school network and software available. Sections three, four, five and six present data on each of the target curriculum areas, English, mathematics, social studies and science. Data within each area are grouped according to emergent themes which relate to the research questions, such as learning activities, attitudes, professional development, success factors and barriers. Data on the role of the library and the frequent use of ICT by Year 12 students are also presented. Section Seven presents data relating to an extra dimension of the case study school, the significance of Maori studies and the inclusion in the school of a Sports Academy. The final section contains data from the students themselves.

## BACKGROUND INFORMATION

The case study school shall be referred to as "Seaview High" for convenience. The main heading on the school's 1999 website describes it as a "Multicultural school focusing on Sport and Information Technology".
A further web page emphasises that it is a school:

- *With excellent teaching;*
- *With good, up-to-date facilities and equipment;*
- *With very good learning support and study programme;*
- *With an extension programme;*
- *With personal care and guidance for each student in a family type environment;*
- *With a wide range of extra-curricular activities;*
- *Where input and participation by parents, families and the community is welcome.*

The school's commitment to education is described as follows:

- *To provide all students with good career education and guidance;*
- *To ensure that students sit School Certificate when they are ready;*
- *To guarantee all students access to Form 6 courses;*
- *To give every student a report stating what they have achieved in every course;*
- *To give every student a profile folder containing school awards and a school testimonial as they leave the College;*
- *To give every student the assistance they need to go on to further education, further training or to get a job when they leave the College.*

At the time of the case study visit, November 1999, the school had a roll of 285 students; down from 380 in March of the same year. The school has a decile one rating on the Ministry of Education (Ministry of Education, 1999b) socio-economic community indicator. This puts the school's catchment area in the lowest 10% of New Zealand communities. Extra funding is received under the Targeted Funding for Educational Achievement (TFEA) initiative which aims to lower barriers to learning for students from low socio-economic communities (Ministry of Education, 1999b).

The school caters for students from Year 9 to Year 13, 40% of whom are Maori, 55% Pacific Island and 5% European and Asian. The student population is very transient. A survey in June 1997 revealed that 75% of the school population had been at the school less than two years and of the 7th Form (Year 13) students 30% were new to the school that year.

## SCHOOL POLICY, PROCEDURES, AND SUPPORT SYSTEMS REGARDING ICT USE

### ICT Implementation Plan for 1999-2000

At the time of the case study visit the school did not have a specific ICT policy but it did have an ICT Implementation Plan for 1999 – 2000 (Appendix 26). This was prepared using planning guidance for schools, in the accompanying documentation to the national ICT strategy, *Interactive Education* (Ministry of Education, 1998). All schools were required to prepare these plans in order to receive government funding. Four key aspects, as recommended by the planning guide, were addressed in the plan: teaching and learning, professional development, administration and management, and infrastructure.

Included in the specific objectives in the Teaching and Learning section of this plan are:

- *Integrate ICT fully into Extension Class programmes Year 9 and 10;*
- *Integrate ICT into teaching programmes at all levels and bands;*
- *Assess and evaluate software usage and needs;*
- *Develop Internet Policy and the methodology for students to use the WWW as a resource for research;*
- *Use ICT as a revision tool for examination candidates.*

The performance indicator for the objective, "Integrate ICT into teaching programmes at all levels and bands" is:

> *Students undertake a range of research projects across the curriculum and at a variety of levels using a wide range of resources including WWW, video, fax and phone.*

Another performance indicator, this time relating to the use of ICT as a revision tool for examination candidates, is:

> *Revision material available on the network. Revision programme in use. (Study Buddy presently on the network).*

*Study Buddy* is a drill and practice behaviourist piece of software linked specifically to the New Zealand curriculum.

Included in the specific objectives for Professional Development are:

- *Assess needs of all staff;*
- *Train minority of staff in basic computer applications;*
- *Continue training of 4 network administrators;*
- *Staff: Internet use;*
- *Teaching staff: use of curriculum related software;*
- *All staff: use of intranet.*

The specific objective for Administration and Management is:

- *Introduce the RM School Management and Administration software.*

Included in the specific objectives for the Infrastructure of the school are:

- *Install wireless internet connection;*
- *Extend network to all classrooms;*
- *Develop ICT centre (dependent on Financial Assistance Scheme) application;*

**OR**

- *Mobile pods for classrooms;*
- *Continue video/TV upgrade. Link to computer network.*

These objectives indicate that the school had given careful consideration to all aspects and were trying to provide the most up-to-date technology for the school, such as a wireless internet connection. At the time this was very new technology. The school also had contingency plans if an application for special funding did not eventuate.

## The Principal

### *Background context*

The Principal took over leadership of this school in 1997. The school is decile one surrounded by decile 5-10 schools. Over the previous 15 years the roll had dropped significantly from 1200 students to 370. The Principal analysed local demographic data and found that about 800 secondary students were leaving the area daily to attend other schools. He also found that 40% of primary students did not attend local schools. Another significant factor he discovered was the very low achievement levels of the students based on the Progressive Achievement Tests (PATs). The majority of the Year 9 intake for 1999 were below the national average, with 90% of students two years behind the average achievement level for their chronological age. It was not stated if this applied to specific curriculum areas or across all. The Principal was concerned that the school was not attracting a cross-section of the community, which in turn affected the academic achievement of students. This was the catalyst for the Principal deciding that a larger vision, and a new strategic plan was needed.

### *The vision*

The Board of Trustees adopted an approach used in a number of North American inner city schools and decided to become a 'magnet school'. The Principal explained that magnet schools in North America have a specialised curricular theme where a very specific method of instruction is incorporated into a strong academic programme. The two curricular foci for Seaview High school would be *information technology* and *sport*. Information technology was chosen because it was seen as the way of the future and as having strong vocational links for students. Professional development for staff was a priority as it was considered that the cross curricular focus of the ICT approach could well give the staff the opportunity to become curriculum leaders in secondary education. The school also wanted to provide community education in ICT. The Principal believed that, with the increased exposure to ICT, students would be attracted to ICT vocational technical training, and lead to an increase in student achievement. It was even envisioned that the school may eventually offer distance education courses to students off campus.

*The strategy*

The Principal acknowledged that, at the time of the interview, he was "the team", and the time-frame he wished to work to was, "as soon as possible with the money available". However, the teachers were included in framing the school's ICT goals each year. Goals for Information Technology for 1999 were:

> *Goal:*
> *The information technology upgrade will continue with the aims of networking the school and introducing the use of computers into 'normal' classrooms.*
> *Objectives:*
> *All staff will be given the opportunity to gain professional development in the use of information technology.*
> *A minimum of one assessment task within each course will incorporate the use of and/or be presented using information technology.*

A memorandum dated 3rd November, 1999, to Heads of Departments and Teachers in Charge of Areas, gives notification of a meeting to review the 1999 goals, invites them to reflect on achievements in their areas, and share best practice in order to set goals for 2000. The draft of Directions for 2000 includes the goals for information technology:

> *Goal:*
> *To increase the use of information technology in the delivery of the curriculum.*
> *Objectives:*
> - *Key staff will receive advanced training in the use of information technology.*
> - *All staff and students will be trained to use the internet and email for a variety of purposes*
> - *Staff will become fully familiar with and proficient in the use of the new administration software.*
> - *Each Department will make a contribution to the development of the school's website.*

The intention is that ICT is to be integrated throughout curriculum areas with the view to having a computer in every classroom. The Principal believes the students' motivation to learn increases through use of ICT. In 1999, the top Year 9 students were identified and an extension class was created. This was consistent with the 1999 goals:

> *An extension programme for the most able and well motivated* Year 9 *students will be set up. Extension programmes will be developed in curriculum areas with objectives being:*
> *To have extension units in place and taught in every curriculum area.*
> *To have students use information technology as part of the programme in every subject area.*
> *For students to undertake a curriculum related trip designed to extend the practical application of subject matter in every curriculum area.*

This class has the HOD ICT as their form teacher and receives extra lessons in ICT.

*Professional development*

There is convincing evidence to show that the Principal has a sound understanding of the role of professional development for teachers as they embark on their journey to fully integrate ICT into each curriculum area. As noted previously, an objective for 1999 stated that all staff were to be given the opportunity to engage in professional development in the use of information technology. This was to be developed concurrently with the infrastructure of the school's ICT system; specifically the new network structure. The Principal also acknowledged that teachers need professional development in pedagogical strategies associated with using information technology effectively. Seven teachers were studying, during 1999, the *Infolink* course on information literacy offered by the Auckland College of Education. Professional development opportunities are provided for teachers before an initiative is implemented, for example, writing reports using computers. However the Principal did acknowledge that he was not quite sure where the integration of ICT into curriculum areas was going to lead: He stated "I don't know where curriculum people are going to take this. I don't think they know."

A proposal for information technology professional development was prepared in order to apply for Information Technology Professional Development (ITPD) funding for 2000. The proposal included the goals:

- *To develop a level of competency and confidence that will enable the staff to maximise the use of IT;*
- *To improve knowledge and understanding of the effective use of IT in the school curriculum;*
- *To encourage and develop a range of teaching and learning approaches appropriate to IT across the school curriculum;*
- *To enable participants to develop and trial selected aspects of IT in their classroom programme;*
- *To develop an overall strategic development policy in IT;*
- *To enable teachers to set both personal and professional goals;*
- *To foster a willingness and receptiveness to new ideas;*
- *To encourage reflection of the teaching and learning process.*

In the plan there is an emphasis on the understanding, by teachers, of the teaching and learning process. Also highlighted are the importance of planning to include new ideas, reflection on practice, and the development of a supportive buddy system.

Enthusiastic teachers were actively supported. For example the HOD Social Studies, identified as an enthusiastic teacher, was given extra time in the computer room during 1999. This creates the opportunity for staff to become leading ICT teachers in their curriculum area. For 2000 a goal is to train seven key ICT teachers. Seaview High has a policy of including ICT skills in job advertisements for new staff, "an interest in the use of IT an advantage". A recent appointment was made on the grounds of the teacher's ICT skills.

*Educational pathways and community involvement*

The Principal also wanted to establish educational pathways for students by making contact and liaising with local primary and intermediate schools. A university has a local satellite campus with which it also intends to make links. The local schools are working towards a systematic programme emphasis which would run through primary, intermediate and secondary schools and on into the tertiary sector. The Principal stated:

> *How can we (local schools) combine so that parents think that there's a systematic programme, the education's going to run right through until they qualify and get a good job? It's all about empowerment and empowering people by giving them specialised skills.*

The idea is to create an upward spiral - to build up achievers in the school who will become role models and leaders and help to change attitudes so that "it becomes cool to achieve". The specialised nature of modules at the school would mean preparation for the future in terms of tertiary education and employment.

Establishing links with the community was seen as vital. The Principal discovered that computing and information technology at the school was attracting both adult students and community education students. Local business links were established and there was a deliberate strategy to attract positive publicity about the school's two foci in order to help change perceptions about the school. The Principal remarked on using the press as a "public perception changer":

> *... you can't really talk too much these days about the fact that you've just bought some new mathematics books. And you know it's that profile thing whereas you know IT, you know in a very pragmatic sense in a school, and for a school like us, it's sexy ......and that sounds sort of cynical. It's not, but it's part of the deal. Its no good doing brilliant things if no-one's going to know about it.*

A partnership was entered into with a major software company, Renaissance. It was agreed that the company would supply a new administrative package and in return the school would be a reference school serving as a model for other schools to visit. This involved the school in the wider educational community in a positive way: Seaview High is seen as a leader.

Alongside the success generated by the educational pathways, it was hoped that the involvement of community members in the school would lead to the retention of potential leaders. The Principal commented:

*You can't keep having decile one kids coming out with nothing at the end of it, because you create ongoing social issues. So, the whole theory is, you provide specialised education modules and put that in combination with perception- altering promotion and that has the potential for increasing external demand, while simultaneously raising standards and expectations within the school. So we provide the highly attractive curriculum options, again that's, say, something like the sports academy, but it's also through the use of IT, you draw quality students into the school, you raise standards and expectations within all the students and retain their academic and social leaders. That strengthens the quality and attractiveness of the education provided and all of a sudden you've got an upward spiral working.*

*Benefits to students*

The Principal stated that "the use of ICT is, in itself a motivation". The school has found that students with severe learning dysfunctional behaviour respond positively to the use of the computer because it is not something that judges the student, they can work at their own level and get instant feedback. This implies an emphasis on drill and practice type software, usually mathematics or grammar, where students work independently on skills. Another benefit seen by the Principal is that students spend less time doing mechanical tasks and can spend more time on analysis of actual data.

*Infrastructure*

The Principal recognised that, for the strategy to be successful, it was essential that the infrastructure was in place so that access and reliability of equipment were not issues. This was a responsibility of management. Finance for the project came from the Achievement in Multicultural High Schools (AIMHI) project which is a Ministry of Education funded initiative for low decile schools (Ministry of Education, 1999a).

Software distributed by Renaissance Education Solutions called *RM Smart-Tools* was chosen as the administrative package for the school's network. Since its installation it has been a major success factor in the teachers' use of computers in the school. The network is more stable and teachers feel 'safe' and, therefore, use computers more. This is evidenced by observations made by the Principal:

> *I think it's been a key towards staff getting in behind it because they feel safe...you'll say to the staff, what are you doing, "oh I'm taking my class up to Room 26" and they're not sort of shaking thinking I hope it's gonna work. And you know, teachers will not use ... technology unless they feel that technology is going to work for them.*

Comments from teachers in subsequent interviews confirmed this. They found that student work does not get lost. Technical issues were more easily solved and the school did not have to employ a technician. Back up support is available from the software company when required. Their technicians can log into the school server and fix any problems remotely. This solves 'housecalls' by expensive technicians. Staff are trained by the software company before they are expected to use it. This training is free by virtue of the school being a reference school for the company.

The strategy aims to have computers in classrooms rather than using mobile pods. The long term goal is to have three or four computers in every classroom by 2004, with one computer in every classroom seen as being achievable in 2000. During 1999, while this was still being achieved, enthusiastic teachers were given more access, or more equipment, and encouraged to become models for other teachers. The ultimate aim is to give staff, then students, access to the network from home, thus enabling distance education to be provided.

*Business links*

The Principal is an active promoter of business links and partnerships. As mentioned previously the school has a partnership agreement with Renaissance to use their *RM Smart-Tools* software and to be a reference school which other schools can visit and see the software in action. The Principal would like to see a greater role being taken by the Ministry of Education in negotiating bulk purchasing of products, such as software licenses and hardware, for all schools in order get economies of scale. He does not see a conflict with the self-managing schools concept as they would be able to opt in to certain deals if desired.

The Principal has been trying to negotiate an internet access deal with Telecom whereby staff and students log into the school server to gain internet access. A deal such as this would help reduce the inequities for the school's decile one community in gaining access to, and being participants in, the knowledge economy. The Principal believed that this proposal is not financially attractive to Telecom as they desire many individual internet accounts rather than one large one through a school.

*Issues for the Principal*

The Principal identified a number of issues which he still has to address; mainly to do with ongoing costs and savings. What is the cost effectiveness of the strategy? At present one department has reduced their photocopy bill to 10% of what it was the previous year and there is evidence that the amount spent on textbooks is reducing as teachers access online resources. He still has to address, and factor in, ongoing costs of hardware replacement, software licenses and professional development. Another important issue is how to maintain the computer-student ratio if and when the school grows.

*Evaluation of the strategy*

Evaluation of the strategy will occur within the school's annual review process. There is a system in place that will track student achievement and student intake against their goals for ICT. *RM Smart-Tools* enables student data to be collected and analysed easily. The English HOD had just reported that six students achieved 80% in the school English exam. (The year level was not stated.) This is part of building the upward spiral which will have a flow on effect and influence other students, according to the Principal.

## Access to ICT equipment - 1999

Most of Seaview High's ICT equipment is based around computer technology. At the time of the visit they had a computer-student ratio of 1:3. Table 5.1 shows a breakdown of where the networked computers are located. There are three rooms with computers; 16, 18 and 20 networked Pentium computers respectively. Each room has two printers and one has a scanner. Three servers control the network, one being a proxy server, and one has a CD tower attached. There is one networked Pentium computer in the science resource room, with a printer, and two non-networked 486 computers in the science department. The mathematics department has one networked Pentium computer with a printer in the office. The English department has two networked Pentiums with one printer in the office and there is also one networked Pentium in a classroom. Three Pentium networked computers are in the language resource room with one non-networked 486 computer with a printer attached. The art department has one networked Pentium with a scanner and printer, and one non-networked 486 computer. Food and fabric technology have a non networked 486 computer while music has one networked Pentium. The Marae has two Pentiums with one printer and the Sports Academy has one Pentium with a printer. Two Pentium computers are available to staff in the teachers' workroom. The school also has a digital camera.

Using *RM Smart-Tools* software, all students have individual user accounts which means they can access their work from any computer in the school whether it be in the computer room, library or subject classroom. An internet connection was established during the time of the visit and student contracts were sent home for signing by caregivers. Laptops are not used extensively as the HOD ICT has found that they pose a security risk.

*Table 5.1*

**Number of networked computers at Seaview High - July 1999**

| | |
|---|---|
| Administration | 17 |
| Library | 10 |
| Technical | 17 |
| Computer Studies | 36 |
| Commerce | 24 |
| Miscellaneous departments | 11 |
| Total | 115 |

## Access to equipment – 2000

Budget approval had already been given for fifteen new computers which means there will be one in every classroom for teachers and students in 2000. Planned administrative uses for them include the keeping of attendance records and the placement of daily notices on the intranet.

## Head of Information and Communication Technology

The HOD ICT has no knowledge of the ICT skills that students enter the school with and does not know what is done at the local primary and intermediate schools. He reported, however, that once classes and activities using ICT begin, student capabilities soon become evident.

### *Curriculum integration*

The HOD ICT teaches information and communication technology skills to junior classes and computing Unit Standards to senior classes. Information literacy skills are also addressed with the junior classes. Students are taught how to gather information into one document, organise, edit, and add visual material so that it becomes original work and not just a "sort of plagiarism of the original". With senior classes he tries to encourage independent learning as students are at different stages of unit standards within different levels. The emphasis with these senior students is on gaining qualifications so that they leave school with credits towards a National Certificate. This is important for students from this school as traditionally large numbers have left with no external qualifications.

With junior classes he concentrates on teaching skills in the various applications, word processing, spreadsheet and database, so that classroom teachers do not have to teach these. However he did express frustration and was aware that this method of teaching ICT skills limited the students in terms of transfer to other curriculum areas. He did ask them what they were currently studying in, say, English, so that he could attempt to link the skills with that area, but was acutely aware that some of the projects he was "inventing" were "totally valueless" and expressed a desire to get together with other curriculum teachers to prepare a truly integrated approach. He gave an example from his time as an HOD of a technical department where he had seen an integrated curriculum work in practice so was aware of the value in terms of student learning of this type of approach. The HOD reported:

> *... in the ideal situation, it's another thing I harp on every year, and it's probably in the too hard basket to organise or something, but I say, look I'm here teaching them how to use the bloody tools, and I'm inventing projects and topics for them to work on, which are totally valueless things, you know, oh well, not quite totally, but, if we got together and said right, what are we all teaching, and it's just not between me and English and mathematics and science, it's between English and mathematics and science as well.*

He gave an example to illustrate one approach:

> *... when I was teaching in the UK a few years back, and I was going to do a project, in woodwork, metalwork shop, on keeping something warm, you know making a sort of thermos box for keeping your dinner hot on the way home from the curry shop, wherever it was wherever you got it, and I went to talk to the science department and said do you do heat transfer, you know in the fourth form, and they said yes, and when are you doing it, and they sort of told me, and I said well any chance you could do it at the same time as I'm doing this project, because you can do all the theory work on heat transfer and insulation stuff like that, it's in your bloody curriculum you've got to do it, and then we can do the design for our job here and apply it. And I went to the English department and said, you know writing out reports and things like that, and research, and I said, you do that sort thing here, can we do that all together. And we*

*did it all together, so we're all in the same term, you know, basically they did one job across three departments.*

The following quotation shows that it does happen at the school to some extent but in the HOD's view:

> *... I think not nearly enough, I think we, really need to get together as departments, with a big wallboard or several computers or something like that, and say, right, what are the things that we have that are common, and let's do all of those in one part of the year. I mean, obviously, some things aren't going to click together, some things that you do in English have no relevance whatsoever to science, and some things that you do in mathematics have no relevance whatsoever to something else. Fine, we'll do all those in Term Three or Term Four, let's do all the common ones so we're all building on each other, and what they've just done in English, is reinforced when they walk into ICT or mathematics or anywhere else. It's a really difficult one to get up, I whinge about it every year, but...*

His awareness of the success of an integrated approach was expressed by describing a relevant, authentic activity such as:

> *I've seen the benefits of it in the past, ... the thing is they get marks, ... these kids did extremely well, in those topics, because I was teaching heat transfer for science and report writing for English. English was using my stuff there, and it was getting reinforced, reinforced, reinforced, and the kids did bloody well, they all got great marks.*

*Teacher Attitude*

The HOD ICT reported that teachers had a very positive attitude towards the use of ICT which stemmed from the strong encouragement from the Principal for anything to do with ICT. This included budgetary support, i.e. anyone who asked for a computer received one. However not many teachers had actually asked for one. The HOD ICT explained this in terms of teachers' natural cautiousness in requesting high budget equipment from a school's scarce resources. There was no need to encourage reluctant teachers as he was kept busy with all the enthusiastic ones. Departments were required to have ICT included in all curriculum documents and schemes so, in his view, the encouragement was filtering down. Teachers were also being given increased access to equipment so previous access arguments no longer held.

*Use of the internet*

An Acceptable Use Policy and student contract for internet use had just been prepared and was to be sent home that week. Preference was for open unrestricted access with clear guidelines for responsible student use. Students were informed that all access can be traced. This was to encourage mature use of the internet.

*Technical support/network*

The HOD ICT is the main technician in the school. The use of *RM Smart-Tools* has enabled him to be quite self sufficient, as Renaissance provide technical support for the network if required. He acknowledged the difficulty schools have of paying market rates for a technician but saw the possibility in the future of 3 or 4 schools sharing a technician.

*Student response*

Students respond very positively to the use of ICT tools in their learning, but one of the hardest things the HOD ICT finds at the beginning is for them to see the computers as tools rather than toys. In his view, their previous experience is to play computer games, or to view someone else's computer. The novelty value of computers arises from the fact that very few students have computers in their own home.

*An ideal situation*

As previously stated, the HOD ICT would like to see more integrated use of ICT tools across a range of curriculum areas. He sees computers as equivalent to pen and paper. He was also able to foresee the future as possibly not having computers in schools at all, but where students logged in from home to do their work. He did acknowledge though, that perhaps the younger students especially, needed the benefits of human contact, largely to keep them on track.

## Network software

An interview with the Renaissance software representative elicited material which helped to explain the relevance of *RM Smart-Tools* to an educational organisation and the case study school in particular. *RM Smart-Tools* was developed by a UK-based organisation called Research Machines (RM) who specialise in developing software to help teachers enhance teaching and learning. There are different levels of the software that schools can purchase. *RM Smart-Tools* deals with the network infrastructure. It works in conjunction with an industry product, Microsoft Windows NT, and consists of a set of administrative tools. It enables users to have a highly secure environment which they can control at different levels. Curriculum teachers can control their own environment and the administrator can perform necessary functions without needing detailed technical knowledge about a network. It gives teachers control over previously difficult tasks like file management (no lost files!) and clearing printer queues. Teachers can also perform simple administrative functions like allocating more printer credits and changing passwords. *RM Smart-Tools* enables students to log on from anywhere on the network and still see their own applications and work folder.

If a student alters any settings they are all reset by the server when that student logs off, so the machine is standard again when the next person logs on. Schools are unique in that they have to cater for hundreds of new users at the beginning of each year and to delete the same number at the end. *RM Smart-Tools* imports student names from the school database and automatically creates user accounts. Accounts can be tailored individually or in groups such as year levels, or curriculum studied. Accessing and monitoring internet use is straightforward as all individual use can be tracked.

*RM Smart-Tools* is customised by each school according to their needs. There are modules which can be added on at a later date. All use is audited by the software so that a school can clearly see which parts of the network and what applications are being used and make management decisions based on these data. Table 5.2 gives a summary of functions that can be done by various user levels as described by the HOD ICT.

*Table 5.2*
**Summary of *RM Smart-Tools* functions**

| | |
|---|---|
| The Network Administrator can: | • Rebuild machines in five minutes from any machine on the network.<br>• Set up user profiles from the school roll database.<br>• Call for specialist help to log in from a remote situation and repair anything that is outside the bounds of the network administrator. |
| Teachers can: | • Work in own environment from anywhere in the school, for example, different classrooms, teachers' workroom.<br>• Manage own files and folders easily, no more lost files.<br>• Clear printer cues.<br>• Allocate more print credits.<br>• Change student passwords. |
| Students can: | • Access their work and relevant applications from anywhere in the school.<br>• Manage own disk space and printer credits.<br>• Hand in assignments.<br>• Retrieve worksheets from a particular curriculum area. |

The Network Administrator, who is usually a teacher, is freed up to spend more time with teachers and students.

## The Library

The library has a very positive, friendly atmosphere and was visited on two occasions. On both these occasions students were using the ten computers available to engage in curriculum related activities. The internet was not available from the library at the time of visiting, but was about to be connected. The Librarian is an ex-pupil of the school. She relates well to the students and acts, not only as an advisor on aspects of information literacy, but also as a friend and counselor to the students in relation to their work habits. The Librarian commented:

> *...we had a student earlier that was ready to drop out of all his bursary subjects, he was a Seventh Form student and I was "Look, you've done a whole years work, you can't, you cannot drop out at this point and waste all this work that you've put in through the whole year" ......then the next day I said "so how are you today" he goes "I'm going to do it, I'm going to do it". So, I think when you give them a bit of encouragement and positive, feedback that they have actually done good work this year, I think it really brightens them up and encourages them to do better, to do more.*

The librarian had been at the school for three years so she has seen a big increase in the numbers of computers situated in the library; from one in 1997 to 10 in 1999. The librarian did the *Infolink* course with the teachers earlier in the year so was able to help the students with their research.

She found the new network beneficial for student use because it was a "simple system" and all students knew how to use it. Students were able to carry on with class assignments during interval or lunch time because they had access to the same material from the library as they did anywhere else in the school. Microsoft *Encarta* was the main research tool used by students and the librarian reported that students now accessed this before they looked for books. Books were used as a backup if suitable information could not be found on *Encarta.* Sometimes students would compare information found in the print media with that in *Encarta.* Maths students used a spreadsheet to continue with class work and also used *Study Buddy*, especially before exam time. Science classes went to do research also but the Librarian reported that not many science classes used the library.

A homework centre operates in the Library after school until 5.30pm, four nights a week. It is staffed on a rostered basis by senior students who get paid for supervising and helping students. Teachers also 'drop in' after school to see if any of their students are working and to offer assistance. One of the visits to the library coincided with the first fifteen minutes after the end of school bell. Between 15 – 20 students and three teachers arrived during that time. The teachers were observed interacting with students about their class work.

## ICT USE IN ENGLISH

### Types of Activities

The relevant part of the English scheme states:

> ***Further tools for writing***
> *There are no (English) classes timetabled to use the computer room. However, the classroom teacher can book time in one of these rooms. Use of a computer takes the frustration out of the writing process. Basic skill work becomes much more bearable if done using a computer.*

This reflects a very narrow use of the computer in the English curriculum. There are no links to strands or achievement objectives within the English curriculum document. Two pieces of student work from Year 9 students were given to the researcher. Each was a novel study and used a word processor to present ideas in text and images. Images included clip art and photos from an electronic source, for example *Encarta*. Headings were used to assist students to organise their ideas.

Activities reported were wide-ranging but mainly individualistic with very few co-operative learning situations and strategies used by either the HOD or the teacher. Most activities involved using the computer as a tool. The teacher could see many possibilities in English. Although he mainly used a word processor he could see how a spreadsheet and a database could also be used in an integrated way, for the presentation of raw data with tables and graphs. He commented that the use of the computer was "... at its core, it's got to do with communication". Neither the HOD nor the teacher knew what the students' level of ICT skills were on entering the school. They had no knowledge of what students did at the local primary and intermediate school.

*Research and Information Literacy*

The HOD was very enthusiastic about the internet and had used it at his previous school. As it had just become available at this school he was providing introductory activities, for example, in using the browser, with all classes. The Year 9 extension class were being taught how to search using key words. An activity sheet had been given to them with a series of questions to answer using the internet. The questions were English related, for example, "name a play by Frederico Garcia Lauca", but were not specific to the curriculum document. The aim was to demonstrate to the students how they could access different material, "really weird stuff. I don't want Shakespeare because I can get that from my book". The students needed much guidance in regard to the right sort of key words to use, as well as what to do with the information on the screen. The HOD noted that the students almost expected the answer to be there on the screen, not realising they had to read and analyse the material to find the answer. He commented that he did not think they had made the link between using key words to search for information in the Library and the same process when using the internet.

The HOD expressed surprise and slight annoyance at the lack of skill of the students, but then related their difficulties back to when he first used the internet and admitted that at first he was lost. He then recalled what strategies he used and realised that the key was practice. However, he did note that some students, about four or five, performed remarkably well. They were able to find information quickly and efficiently, they were confident and very computer literate. In this Year 9 extension class the majority were able to "plod" along and complete the task, but there were three students who were lost. This indicates that any future task involving the use of internet could be designed to take into account these varying levels of skills and knowledge of students and not just rely on a 'one size fits all' activity.

The internet was used also by senior students to access information on literature such as *Othello*, *The Crucible* and *The Great Gatsby*. The HOD bookmarked relevant websites to assist students to find information. The students were told to focus their inquiries on aspects of literary study such as character and theme.

The HOD had not used email at this school, as the internet had only just become easily accessible, but had used it at his previous school. A particular email activity that he had used was "ask an expert" where students could email a writer. The HOD was surprised:

> *... that a writer, no matter how important, would reply to people and answer their questions.*

*He recounted a story where a friend, who was interested in writing, emailed the writer Stephen Donaldson:*

> *Now I would have thought a writer of his calibre is not going to waste his time emailing someone in New Zealand. And they got on and they emailed every day or so, and she got all this information on how to be a good writer etcetera, and people do respond to that. And I couldn't believe, I would have thought he'd say, go away don't annoy me. ...*

He realised that 'Ask an expert' not only applied to writers but was also useful for other research. He explains:

> *... for fifth form research topics or any research topics. Get in contact with anybody and we tend to always have this idea that famous people won't spend the time giving out information. There are so many famous people who are quite prepared to do all sorts of things..., and it's wonderful. Also famous people also have their home pages. Just go straight to the home page, you don't have to ask for the personal questions or individual questions, their answers are there... and it just keeps building and building and all of this information, it's out there.*

The English teacher had not yet used the internet for research but had a number of ideas he was going to try, one of which was to send questions to people asking for information. Students would write questions in a word processor, be checked by the teacher, and then send them as email attachments.

*Film Study*

The internet was also used to access information on films such as *Schindler's List*. This activity was done with junior social English classes and involved the integration of English and social studies. The HOD was able to tie elements of English and social studies to the unit. He thought the internet was "marvellous at integrating studies".

*Book reviews*

The Year 9 extension class also used MSPublisher and MSWord to write book reviews. These were written, presented and marked entirely electronically. The HOD commented on the motivation of the students since he has been using computers to do this activity, "the quality of the work just zooms. It's been utterly, it's just amazing". The students design the title and the borders and insert clipart, "kids like designing" and they can use colour. The review is put into a class electronic folder where it is marked and is then made accessible to other students. Very little work is printed off; in fact almost none. The advantage of keeping the work on the screen is that it is in colour.

*Visual Language*

The teacher mainly used a word processor with his students for typing and presenting but this year he had experimented with using a desktop publisher for static image production in Year 11. Students were asked to illustrate a picture book or a poem. Some students adapted clip art and one student persuaded the HOD ICT to scan an original image for him and was able to insert this into his work. The teacher commented that the students responded well to visual images; that seeing an image on the screen "seemed to cement ideas in their heads".

*Effect on writing and student motivation*

As mentioned earlier, students responded very positively when given the opportunity to use a word processor for writing. It affected their whole attitude to writing.

The HOD commented:

> *Kids who* (usually) *write very very poorly, writing very well because you've got spell check. Any mistake, underline it. And the quality of the writing with perception of the writing, and the pride that they take in their writing, therefore they write far far better because they're getting something out of it and they look at it, their presentation is as good as anyone.*
>
> *So you look at the kids who write messily. There's a kid there with dyslexia, he produced this really nice looking piece of writing with no spelling mistakes because he's got spell check, it's got typing ... you can see them looking at the work all period they were busy working on it, asking questions, do we have a computer room today can we go up and work on this. Can we work on it at lunch time? You know, working one up, we'll go to the library after school. And here are kids interested in work. The reason for that, the use of computers. That's the only reason for that keenness, um, to do the work.*

The teacher concurred, that students respond "overwhelmingly positively" when using ICT and stated:

> *I can ask them to write an essay or do a piece of writing in class and we'll get this sort of, a great deal of reluctance and a chorus of disapproval - "what do we have to do this for, this is boring", if I ask them to do the same task up in the computer suite umm, naught can be heard, but the tapping of keys and the questions are related to how do I do this and umm, how can I say this better and that sort of thing. Rather than, "Why are we doing this and what's the time".*

## Use of ICT with Year 12

Analysis of data from Phase One of the study, showed that Year 12 students had experienced the most frequent use of ICT. HODs in Phase Two, the case study, were asked why they thought this was so.

The HOD English expressed surprise at this result and commented:

> *I would say that, 5th Form have got School Certificate, 7th Form have got Bursary and this middle group is internally assessed. Therefore you don't have the pressure of an external exam, therefore let's spend more time on information technology. That's the only logical explanation I came up with because, ah, what the irony of that is, I think the people sitting the exams probably need it more. Ah, it suggests to me that people are maybe looking at it as a cushy option. Let's use it more with Year 12,*

*let's do less of bookwork, classwork and whatever and give them a good time using the computer.*

He went on to say that he had no doubts about the fact that the use of ICT would help $5^{th}$ and $7^{th}$ Form students pass exams because of the amount of information available on literature via the internet.

## Attitude

### *Affective factors*

The HOD had not always been a fan of computers, "I must admit I was a reluctant teacher 10 years ago". He recounted his early experiences at university which, he admitted, was where his original hostility had stemmed from. He thought they (computers) were a "form of evil. I spent all this time and it was a total waste of time" in the days when binary punch cards were used and results were received a week later. However he did acknowledge that his attitude has changed and that now the changing nature of ICT has to be acknowledged and accepted. He no longer resists change and admits that "it's more exciting" now. He continued:

> *...it's that continual change that's going on. And in the old days, I think resisting change and so I won't do that because it'll be out of date and now it's more exciting as well. That although the technology improves, it doesn't really go out of date as such, it just changes, it adapts, it gets better, it gets easier. Um, the thing that really annoyed me about that first computer thing, learning that binary system was so hard.*

An experience at another school while relieving was a turning point for this HOD. He saw the results that the use of ICT had on students, their work and their motivation for learning. He explained:

> *... What turned me around was seeing it work...That if someone comes in and says, I've got this new scheme that's going to take you hours and hours and hours to understand it, but at the end you're going to think it's really good, you're going to say what rubbish, nah nonsense. What you need to do is see it working with someone making it work well and then you suddenly think, hmm this could be work. And what changed it for me ...*

*I went into a computer room and the kids were difficult to control and whatever and I had them in the classroom and they'd really be demanding on you. When we went to a computer room, all these rough kids sitting down, total silence, printing out stuff on their computer. And I'm going, what! what's the secret here. What I saw was it working, kids taking pride in their work, correcting mistakes, um, putting up hands, they didn't have a spell check, this was 10 years ago, but they would underline mistakes. And they'd ask to put their hands up and say, how do you spell this word sir, what's wrong with this sentence. And I've never, I've never ever struck that before and it was like a little light lit up inside and I said this is marvellous and I've been a fan ever since.*

The importance of early experiences, both bad and good, have a significant effect on teacher attitudes to using ICT. The HOD reported that his teachers were all positive about using ICT and there were no reluctant teachers in the English department. The youngest teacher was also the most enthusiastic.

*Own skill and knowledge*

The HOD had a negative attitude to the use of *PowerPoint* because he had never seen it used well – "it tends to suggest to me just tricks and gimmicks and games rather than content", despite the fact that he been to a course on it. This suggests a misunderstanding or limited knowledge of how a multimedia authoring package can be used to help students develop higher order cognitive and metacognitive skills, such as planning, reflection, and having a sense of audience. In order for positive attitudes to occur the teacher must understand how student learning can be enhanced by the use of ICT. However this lack of skill and knowledge on the part of the teacher had not prevented students from experimenting and handing in work using *PowerPoint*. The teacher discovered this when he could not open the student's file in Word or Publisher.

The HOD showed enthusiasm for a speed reading programme that he had used in his previous school. He said students reported an increase in their reading speed which was achieved through the use of exercises and games. He was not sure if it transferred to their reading of novels.

### Use of the library

The HOD acknowledged the increase in use of the library for accessing information electronically and reported that the students preferred to find information electronically rather than in print. He commented that the students who used computers well were very good at finding information. He was not sure whether these skills had been learned at home or at primary school.

### Professional development

English teachers were encouraged to participate in school-based programmes, for example a breakfast meeting on use of the internet, in particular the site *Living Library*, was held during the researcher's visit. The previous English Department meeting was also on the internet, using search engines. This was taken by the HOD. The HOD said he got most of his ideas from discussions with other teachers. He had also used *English Online* (Halliday & Girven, 1999), a teacher resource site specifically related to the NZ English curriculum, but he had not visited the site for two or three months. The English Adviser attached to the Auckland College of Education had also been consulted. The teacher reported that he gained most of his ideas from talking to others. He was aware of *English Online* but had not used it very much.

### An ideal situation

For his English classroom of the future the HOD wanted computers around his classroom; one for every student. He saw four or five computers as a compromise situation. The teacher would like to have ten computers in his classroom "one kid using one, one kid doing something else". However he didn't think that was necessarily a good use of money and that access to a suite for one or two periods a week for each class would be more feasible. He felt that in this way you could actually plan to integrate the IT aspect of the work into every unit. If the teacher was offered ten computers he said he would grab them and even come in over the holidays to get everything up and running, "and do a lot of the building work to accommodate it myself I think".

### School support

The teacher, who had been teaching 13 years at this school, commented on the innovative nature of the school. A number of things had changed over the previous year "that have greatly, sort of enhanced our ability to use the technology". The teacher was referring to the new network software, *RM Smart-Tools* which had recently been installed:

> *the new software that enables ... kids to have secure access because they know that unless they give somebody their password their work is safe and...they also know that they can hand it in electronically now which they couldn't do before. and ...that ...opens a whole ...raft of possibilities to them. But also be able to sit on any computer anywhere in the school and access a CD for example. I mean you don't have to be in a certain location where the computer that had those things, were, you can be anywhere.*

## ICT USE IN MATHEMATICS

### Types of activities

Student activities in mathematics range from investigations using a spreadsheet, as a tool for learning, to drill and practice, tutor-type exercises, using behaviourist software such as *Study Buddy*. Spreadsheets are mainly used for statistics and graphing. The teacher reported that spreadsheets are principally used as a productivity tool for time-saving. The HOD uses a spreadsheet with Year 13 as part of their internal assessment. A time series project has been set up which students complete on a spreadsheet. The HOD transfers these to a disk to take home for marking. Comments for students are written in a word processor and pasted into the spreadsheet. *Study Buddy* is used for reinforcement at Years 11 and 13. The HOD commented that she would like to use *Study Buddy* as a teaching tool right through all levels in the applied mathematics classes. An interest was expressed by the teacher at using drawing tools for geometry and transformations. The HOD did not see a possibility of students at this school using graphing calculators because of economic factors.

*Cross curricular activities*

The HOD expressed an interest in collaborating with teachers from other curriculum areas to integrate mathematics skills into programmes. She reported:

> *... that, for example, mathematics teachers could teach specific, say transformation geometry, skills, how do you identify them, what are they, what are their names, do you need a mirror, how do you find a mirror line, you know all that kind of thing. How do you describe a translation, what's a vector and so on and then the computing teacher could use that to then do part of the computing topic because he says what he's doing is continually inventing things. He says he is inventing things for the students to do in computing and it would be really good if we could say, by the end of March we would have finished some transformation geometry, that will be a good time then for you to work with them with CorelDraw and then when you've done that then maybe we could get together and revisit that and I could do the mathematics part and you could do the computing and we could get them to do some assignment using the mathematics skills side and of it and the computing skills side of it ...*

She went on to describe a particular situation where mathematical concepts were not being used correctly:

> *but I have seen students working on CorelDraw with XXX and it worries me sometimes because they will do things that they haven't got the mathematical base, like I've seen for example heading up something 'rotation', when its actually 'reflection'.*

...and calls for more cross curricular cooperation:

> *... so, you know even though they are wonderful programs I think it would be really good if we could tighten up the way that they're using, just make sure that they are used correctly mathematically. Because I know that's also one of the problems that mathematics people have in dealing with geographers. That geographers use a lot of mathematics in a way that mathematicians would call incorrect.*

The HOD went on to talk about using graphs in geography and home economics and concluded:

> *... I mean the end result is the same, but I don't think it does the kids any service to say do this and you'll get the right answer when you could be coordinating better across the curriculum.*

She mentioned that a possibility could be theme-based work across the curriculum but acknowledged the difficulty in organising this when assessments were different for each area.

*Research and information literacy*

The mathematics teacher had taken part in the information literacy course, *Infolink*, and intended using the internet for research when it became fully available. The HOD was aware that there were useful study and revision programs on the internet but acknowledged that she was "pretty hazy" about exactly what these were. Using the internet for research was a possibility for the HOD. However she did know that the New Zealand Council for Educational Research (NZCER) has a teacher resource bank online.

*Access*

Computers are accessed from the computer room. The teacher has occasionally sent a small group of students to work independently "but very rarely". The HOD has three 286 computers in her classroom which are used informally by the students for basic mathematics games when current work had been completed. The HOD expressed a wish to have greater access to the computer rooms. She commented that even though they had a high computer to student ratio there was still difficulty gaining access to the computer rooms when she wanted them:

> *... I tried all last term, I couldn't get my* Year 11 *kids in, I've managed to get them in for one period a week this term. Now, basically we're using that for revision and Study Buddy.*

Use of ICT at Year 12

Year 12 students do a statistics investigation and now ask if they can do it on a spreadsheet so they have the idea that computers are used for a tool:

> *... so they're sort of deciding now when they, so they're getting the skills now to see that if they're doing a task, they could use an application as the tool to complete that task.*

This indicates that the students are more in control of their own learning and can recognise when an application suits their purpose. The HOD did stress that a check should be kept on students in this situation, that they were actually competent with the tool they had chosen and did not go off and complete the task incorrectly, for example, they needed to know what formula was required to get the desired result.

## Attitude

*Affective factors*

Both the HOD and teacher were very positive about the use of ICT in mathematics. The HOD commented that not enough time was given by the Ministry of Education for curriculum changes or exam prescriptions to be assimilated into teaching and learning programmes. Teachers needed time to be comfortable with the changes, especially where the use of ICT is concerned. Teachers do not have to know it all but they need to be reasonably confident otherwise the students lose confidence in the teacher.

*Students*

The HOD reported that the students responded positively to the use of computers and ventured some reasons for this:

> *I think they find computers quite motivating. I've had some interesting discussions with other teachers about computers and I think it's a difference in generations. Our generation was brought up reading and if you were an artist you were brought up with pencil in your hand and crayons and pastels and so on which of course there is still a place for, but these kids are brought up with access to computers and they like to do their drawing on computers, they like to do their graphics on computers, they like to do a lot of things.*

*Own skill and knowledge*

The teacher said that she would like ICT to be more important but was not sure where it could be integrated into the mathematics curriculum, apart from the obvious areas like using a spreadsheet and graphs for statistics. She expressed a desire to know more about specific programs that were available. Most of the HOD's knowledge had come from talking to colleagues and going on courses. She commented that some of the mathematics teacher's activities were original.

### Use of the library

Phase One of the research showed that there was a high level of usage of the library by mathematics students When asked to comment on this finding, the HOD Mathematics stated that she thought it was an access issue rather than the types of activities that mathematics students do. To support this statement she commented that the Year 13 Mathematics with Statistics students use the library for revision because that is where they can gain access to computers. The HOD's students showed a measure of independence, motivation and control of their learning:

> *My class has said at times... "we want to work on the study buddy" and I've said "well the room's not free" and they've said "well we can go to the library and you can teach half of us". So, they are really keen, too and they like working on the computers*

As mentioned earlier, the mathematics teacher intended to use the library more for research, as a result of what she had learned in her *Infolink* course.

### Professional development

The HOD and teacher both expressed a desire for more professional development, especially about where ICT fits in the mathematics curriculum, and more time to become familiar with programs that they already have. The HOD described the effect that going to courses had on her:

> *you go to a course and you're absolutely bombarded with all these wonderful ideas, but to come back and actually sit down and say which of these ideas can I use, how can I integrate it into my programme, how can I get familiar with it myself, how can I package it in such a way that the kids are not going to run riot in the classroom? You know, ......, it takes a whole lot of time.*

This indicates the difficulties teachers have attending short term courses and how difficult it is to assimilate so many new ideas as well as having the time to decide on appropriate integration strategies.

### An ideal situation

The HOD would prefer better access to computer rooms rather than have computers in her classroom. She expressed the view that she did not think she had the skill to make effective use of them five days a week.

### School support

The HOD commented that "the Principal is supportive and always pushing the use of ICT".

## ICT USE IN SOCIAL SCIENCES

The HOD Social Sciences has largely worked in his own area, geography, at Years 11, 12 and 13. He has been teaching for 5 - 10 years and has been an HOD for the same length of time. At the time of the case study he had no responsibility for social studies at the Year 9 and 10 levels as this was integrated into English and called English Studies. From 2000, social studies will be taught as a separate subject. The HOD can be seen as a technology leader in the school owing to his relatively extensive use of ICT. The teacher interviewed teaches English Studies with Year 9 and 10 classes.

The HOD sets activities that are generally individual, while the teacher usually has her students doing group activities. Both use the computer as a tool. The HOD has endeavoured to make full use of the new networking facility, not only for administrative purposes but also for students to access worksheets and assessment tasks. He makes extensive daily use of computers. His activity worksheets and assessment tasks are all electronic and held in a dedicated folder for each class on the school network. This has the advantage that students do not lose their worksheets or assessment task sheets, or if they do, another copy is available on the network. He reported that students, therefore, were more likely to complete and hand in assessments on time. Assessments are posted electronically to the *Assessment* folder. They are dated and cannot be retrieved by students. The work is marked electronically and returned to students in the same way. The HOD reported that the photocopy budget had reduced to 10% of what it previously was. Neither the HOD nor teacher have a computer in their classroom; they each access them in the computer room.

The relevant part of the Geography Scheme states under Skills:

> *Geography students will attempt to attain competency in the following skills:-*
>
> *(i)* *practical skills specific to Geography*
> *(ii)* *thinking skills – critical thinking, creative thinking, decision making, values exploration*
> *(iii)* *social skills – independent work, co-operative group work*
> *(iv)* *personal skills – communicating information*
> *(v)* *information technology skills – use of computer applications in assignment work and learning.*

These skills are from the *New Zealand Curriculum Framework's Eight Essential Skills* (Ministry of Education, 1993). No relationship is made here between the various skills, or any indication given that the use of ICT can promote skills mentioned such as thinking, social and personal skills.

### Types of activities

Examples of two types of activities from Year 12 were provided for the researcher. One is an inquiry and the other is an individual assessment task sheet. They both involve the use of a word processor.

The Geographic Inquiry shows evidence of a variety of features of a word processor being used for higher order thinking. Features, such as *draw tools* and *text boxes,* are used to create a mind map and spider diagrams. These are used to assist students to brainstorm questions, show relationships, draw conclusions and present information. Tables and graphs are included to present and analyse data. Graphics such as photographs, clip art and maps are included in the work.

The assessment task sheet is accessed via the network and submitted in the same way. Colour is used to guide students in their completion of the task sheet, "enter all your answers in the red boxes". Students are also directed to use resources other than print, such as a CDRom, like *MSAtlas*. Tables, graphs and maps are used to present data for students to interpret, as well as to help them give their answers. Colour is also used by students to indicate their selections, "use *Fill Colour* to shade in two statistics from each country which are extreme". Spider diagrams using textboxes also help students organise their own ideas.

Other activities involve finding information, for example statistics from various countries, from an electronic atlas on a CDRom and entering the data on the worksheet. Analysis of the data and the construction of graphs is all done using a spreadsheet. Students exhibit a high level of computer skills to complete these tasks, to use the network structure efficiently, to be able to have a number of applications open at any one time and to be able to retrieve and utilise information for a particular purpose. An object from one application, such as a graph, is able to be inserted, or copied and pasted, into another. The students learned these skills during the year since the new network was installed. Initially, the HOD had to ensure that no students were disadvantaged in assessments through lack of knowledge of how to use the software.

Cut and paste activities involving geographical concepts, which used to be done physically on paper, are now also done using the same function on a computer. The HOD commented "it's all the activities that you see in class and it's done in class, but on a computer". Computer applications are used as a means to completing the task not as an end in themselves, "it's taking the various software tools and blending them together". A more unstructured geographical task for Year 12 and 13 students involves constructing cross sections using graphs and draw tools in a spreadsheet.

The English Studies teacher has her Year 10 class booked into the computer room once a week doing book reviews, posters and video covers using a word processor or desktop publisher.

### Research and information literacy skills

The inquiry process in the social science area is structured to help students manage the process. ICT tools have assisted in this area with a word processor or desktop publisher being used to present their information as, for example, a book, a magazine or a poster. Graphs are used frequently in the social science area to represent information and these are created via a spreadsheet and included in the final presentation. Some of the inquiry activities such as process mapping, required a high level of cognitive processing. The students "worked out if they scanned the process map and then used drawing tools to identify things they could get it done like that" (HOD).

Multimedia authoring packages such as *PowerPoint* have not yet been used by students for presentation of work because of the teachers' unfamiliarity with using the program. This has not stopped the students from experimenting with it and even teaching the teacher how to use it. The teacher was just waiting for an opportunity to use it. Activities tend to be more individual rather than group activities using cooperative learning strategies. However the HOD has an activity in mind to use with the Year 13 students in 2000.

The English studies teacher uses *Encarta* for research purposes. Completed work is 'handed in' to the class folder on the network and marked electronically by the teacher.

### Use with Year 12

The social science HOD's comments on the frequent use of ICT at Year 12 from the phase one results were similar to the HOD English, "maybe the lack of formal exams at the end of the year."

An example was given of difficulties encountered when trying to transfer knowledge, gained and understood using ICT, to an exam situation.

> *... you can do a pie graph on Excel and all they have to do is put European 72%, Maori 12.3% and as long as they know the software they can produce it perfectly. Come exam time, now construct that on a piece*

*of paper, you know, get your protractor out and construct it and times each one by 3.6 and all....*

## Attitudes

### *Students*

Students are very positive about using the computers and are focused for a longer time than previously. Even though they are working individually on computers the students still talk with their neighbours, but it tends to be about class work. The HOD reported that work productivity increases when students use the computers. This applies to less able students as well. When working on computers they are less likely to disrupt other students and have a distinct strategy for coping with difficult work.. The HOD reported:

> *....it has other advantages and this is probably the reason why it's focused, because those kids that struggle with work, in their classroom.... and can't do it on a piece of paper, so what are they going to do, they're going to interrupt their mates. On the computer this year, those kids that have struggled with.... learning and there are some, will have a game of cards in behind, Solitaire, on their computer and at first I was in to them and then I realised after talking to them, what they did is that they'd identify the bits that they could do, they put up their hand "I'm stuck here Sir", I'd say "well start off with this one" and it might be, there was one with lines of age/sex data and here was the data and all they had to do was colour in the lines on the age/sex data, which was a pretty simple task. When they finish, they open up their cards and play their cards. Put up their hand, I'd say "I'll be with you in a minute", and they play their cards. When I came over, they close their cards down. When they're bored, what do they do - they play the game.*

The HOD also stated that using computers would give the students confidence and that when they entered the workforce, they would not be intimidated if someone mentioned computers. The teacher commented that her students loved using the computers and they were always experimenting to find new and different ways of completing tasks using different features of the programs. The teacher had found that the students in her class who were not very good at writing on paper were much better at expressing their opinions using a word processor.

*Own skill and knowledge*

The HOD has largely developed his own skills and knowledge since the new network was introduced, with the help of the HOD ICT. As mentioned earlier, this teacher can be seen as a leader in the school in the use of ICT. He said one of the factors which made him use the technology was the access to equipment, mainly computers, that was available to him. He has been able to book the computer room for 4 –5 periods a week for each of his three Geography classes. He was offered, by the Principal, a computer in his classroom but declined in favour of increased access to a whole class of computers. This teacher is convinced that enough computers for every student is preferable to having one computer in the classroom.

He reported that he has taken an action learning approach, units of work already taught were adapted and developed for use via the network. Advantage was taken of the software available. These units were trialled, evaluated and reworked until he was satisfied. This HOD is not afraid to try new innovations and to push the boundaries of the new network.

### Use of library

The HOD doesn't use the library in a formal sense, as his students access information electronically rather than from print-based media. He prefers to use computer rooms so students can have individual access and there are not enough computers in the library for this. Students, however, access the library for independent work. The teacher is booked into the library once a week with her English studies class for research purposes. Students mainly use the print media as there are only 15 computers available. Some students use them to complete work begun in the computer room.

### Professional development

The HOD has received no formal professional development in ICT but has gained most of his skills and knowledge mailny by trial and error. The HOD intends sharing this knowledge with social studies teachers in 2000. The teacher has gained most of her knowledge informally from other teachers. She said having a computer at home has been an advantage. The teacher attended the workshop on the internet and the *Living Library* held during the week of the interview. She thought the *Living Library* had potential because of the specific nature of the material and that it was focused on students.

### An ideal situation

The HOD would like to have one computer for every student in his classroom in order to use them every period with every class. Failing that, having access to a room of computers for four or six week blocks, for three or four periods a day, to coincide with particular teaching topics, would be ideal. The ideal situation for the teacher would be to have two computers in her room. She envisaged using them for extension students who finish their work early. She had already identified a small room off her classroom where they could be sited.

### Using the computer as a personal productivity tool

The HOD was very positive about how efficient and effective it was to have all student assessments, marks and reports on the computer. There was no duplication of records, data could be selected, documents merged and reports produced without the use of any paper.

## ICT USE IN SCIENCE

The HOD has been teaching for 10 – 20 years and has been an HOD for the same amount of time. He has no knowledge of the ICT literacy levels with which students enter the school and the kinds of activities that are done at the local primary and intermediate schools.

### Types of Activities

Most activities done in the science department revolve around the use of dataloggers to measure some form of sensory input. The HOD maintains that activities are only limited by the teacher's imagination and the number and types of sensors that a school has. At the time of the interview the school had sensors for temperature and velocity so experiments were based around those. Year 9 and 10 students use light gates to "measure how fast they can run a hundred metres compared with Ben Johnson". Seniors use the same equipment to measure acceleration due to gravity. In the HOD's laboratory there are "a couple of old 386s and the dataloggers are used with that, either to show what's happening in real time or to download and do some sort of manipulation with information afterwards".

Dataloggers have the advantage that they can be taken, along with the sensors, to where ever the data is to be collected. Returning to the classroom, they need to be connected to computers and the appropriate software to view the data. The HOD sees benefits here in students' learning; they can "manipulate the raw data giving acceleration, velocity, speed, what ever you want". He commented on this use of 386 computers: "you can do a lot of really good basic stuff with quite limited tools". Another advantage of dataloggers that the HOD saw was that the students were collecting raw data, "their data", and have a lot of control over what it is that they measure and how they want to manipulate the data "to answer some of the questions they have come up with".

The HOD discussed the fact that using dataloggers, especially at senior level, can be quite demanding for the students. For example, the teacher sets the task, the students are already familiar with the software and the dataloggers, so they can set up the experiment and all the "tedious stuff" is taken out of it. He continued:

With dataloggers...

> *you can do experimental work as is always intended that you do and not a set piece demonstration or a very well stage-managed type of experiment. ......, the data logger is so easily managed that you can let them go away and come up with their own experiments.*

The students are;

> *much more in control and they can very quickly get results and that's an important thing when you're working in a lab. You can very, very quickly get results and they can concentrate on, on thinking about what it is that the results are telling you.*

Activities are not included in the science scheme in a systematic or progressive but way but rather they "use what we've got whenever the opportunity arises".

The science teacher uses ICT, dataloggers, *Encarta* and the internet, mainly with her senior classes. She expressed reservations about students using spreadsheets and graphs because of the situation in exams where they do not have a computer to produce graphs. Therefore they need to know how to draw graphs themselves. Her strategy was to:

> *... teach them how to do the graph manually and then I'll teach them to let the computer do it. So that way they should learn how to graph and then learn how to use the computer to make the graphs for them.*

At present the teacher does not use ICT with her junior class, a Year 10 class. They had been shown the dataloggers but had not used them yet.

*Research and Information Literacy*

The HOD thought that the internet was exceptionally useful to learning in science because of the interesting sites available, but also expressed caution:

> *... it's a bit of a distraction and that really when you come right down to it you want to learn how to do some science, you want to do some interesting investigations and you want to build on your concepts and yeah, you can get lots more information off the internet, but there's some pretty serious structural learning has to go in before there's really any progress in science.*

The HOD felt that for the amount of money spent on internet access, a few more key datalogger sensors would make a big difference in science.

The teacher was very positive towards the use of the internet and *Encarta* for research. Tasks students were given revolved around a unit standard with a series of questions to be answered. The teacher was adamant that, as the performance criteria are very definite, students could not copy and paste from either source because they would not then be able to answer the questions. In other cases the teacher had her senior classes research a biotechnology topic like *cheese making*. They then processed the information using a word processor or desktop publisher to produce a flow chart, together with the results of their research.

### Cross curricular potential

The HOD expressed a desire to work in a cross curricular way with other departments in the school, such as the mathematics department, "mathematics are always looking for raw data for things and you could use your datalogger to record events". The Sports Academy is another area where there could be cross curricular cooperation. Activities, such as measuring heart rate for people's fitness levels, were possibilities. The HOD had already put a joint proposal, with the HOD Sports, to the Principal for some sensors using money from each departments' budget.

### Access

Computers for the science department are accessed mostly from the science laboratories. There is one networked computer available for administrative purposes, but it is used for curriculum purposes as much as possible. The teacher has two computers in her room, one with network access and one for the dataloggers. When she wants to use the internet a computer room is booked. The teacher reported that students are very resourceful and know where they can go at odd times to access a computer and/or a printer, sometimes the library, sometime a computer room, sometimes certain teachers' offices.

### Attitude

#### *Affective factors*

The HOD was very positive about the use of dataloggers in science but felt that more money was needed to purchase more sensors. He commented... "my attitude is if you want to see the school as an ICT school then it's quite reasonable to ask for the equipment to do the job". (Money was allocated for this purpose in the 2000 budget after the interview with the HOD Science and while the researcher was at the school.) The science teacher was also very positive towards the use of ICT and took a proactive stance to increase her understanding of the use of ICT in science. (this is described further in the following section on professional development)

*Students*

The HOD and the teacher reported that the students respond very well to the use of the dataloggers. Students also had a positive attitude to researching using Encarta or the internet. The teacher reported that her students were very confident at using the computers and would often get extra information on the topic and give her copies. The teacher gave this example of how she was using the computer to motivate a student and to encourage her to feel positively about science and the use of a computer:

> *... I have this student, she's really been negative. The one who's doing the project on beer and she said "Oh, I hate the computer, I hate using the computer because it's too complicated for me". I said, "No because with a computer once you've made a mistake all you have to do is go back delete that mistake, you don't have to repeat the whole thing. You don't have to do the whole thing all over again. With typewriter you have to pull out the paper, put fresh new ones, you have to redo everything," and I hope I have changed her. And then of course that's when I showed her how to do the drawing.*

### Use of library

Science classes occasionally access the library and the computers in there for research purposes, especially at the beginning of a unit.

### Professional development

The HOD and science teacher had just been to a two day course (the HOD attended the first day only). They reported that the types of activities provided at the course were what was happening at this school anyway. The teacher had attended a community computing course in 1991. She explained:

> *... so I would be brave in handling the computer because before then I was really scared stiff to pass the computer because I had this impression that if I touched anything wrong it would erase everything.*

Since then she has taken the opportunity to attend any relevant professional development course available. She had just attended one run by the Education Advisory Service on dataloggers and spreadsheets and also used her husband to help her if she had a particular problem. She found the HOD very helpful in showing her new ways of using ICT, for example, a mail merge for student reports. The teacher also reads widely about the use of ICT in science.

*Learning from students*

The teacher often learned new techniques from the students, such as using the *AutoShapes* in *MSPublisher*. These skills were then passed on to other students. She described a particular situation:

> *... One day we were working on the science department computer and they were drawing straight from the computer.* (using drawing tools and auto shapes in *MSPublisher) I said "how do you do that?" "Oh, easy Miss" ....then they showed me and then last week there was this girl and she was doing this flow chart on beer making and she said "Miss, I cannot draw this barrel". I said "it's easy. You just click on this, which is the oval and then you click on those two straight lines, that's your top and that's your sides and click again and then you get a barrel.*

The teacher's confidence had grown and she was now able to teach her husband a few tricks:

> *And I've also taught my husband how to do some and my husband was saying " you're getting good". I said I just learned it from my students. I did this umm, you know in electricity where you have to draw the symbols like circle X or circle A and you just draw those lines like that, before when I do that I just do it with my pen and just draw it on the paper, I typed the words or the questions and then I just do the drawings, but I learned how to do the drawing in the computer because of my students.*

This teacher is comfortable with being a learner alongside the students. She summarises the effect this has had on her confidence level:

> *I learn a lot of things from them, just watching them work and I mean to me it's a success. They're not only teaching me, but teaching themselves and each other and then of course when I work I said how do you do this? "I'll show you Miss, its easy." I mean, I'm really pleased especially with the progress that I've made, like I told you about 4 or 5 years ago I was scared to touch the computer. I wouldn't touch it, but now I can't do anything without using the computer.*

### An ideal situation

The HOD wanted more data loggers, "10 would be brilliant", with a wider range of sensors available. More computers, with software installed, to be used within the science laboratories, was also a desire. The HOD had obviously thought carefully about the use of dataloggers in science. This was evidenced by the fact that he was quite specific about the types of sensors he wanted, a carbon dioxide sensor for experiments with photosynthesis, an oxygen probe for environmental monitoring, a pressure monitor and motion sensor for building a weather station and a pH sensor for measuring acidity in liquids for chemistry. The HOD longed to get rid of his old ammeters and voltmeters, the point being "if it's logged for you, you can do something with it (the data)". The teacher wanted to be able to use the internet, graphing and dataloggers more and be able to use them with her junior classes. She wanted access to at least ten in her laboratory and saw this as a distinct possibility over the next five years. Alternatively she would like a projector to show certain sites or experiments to all students.

## EXTRA DIMENSIONS TO THE CASE STUDY SCHOOL

### Maori Studies

There were two stand alone computers available for students studying Maori, with the teacher wishing to have six new ones. These are used for students to type up practical work, such as interviews with local kaumatua, as well as translating from English to Maori. Some senior students had made kowhaiwhai patterns using the computer. The HOD Maori Studies was not able to have the level of access to the computer room that she wished, but occasionally took the Year 9 students there. The Maori Studies rooms are quite separate and some distance away from the main teaching block where the computer rooms are located. At the time of the interview the HOD was very excited about the amount of information relevant to Maori Studies that was available on the internet. The HOD ICT was helping her and the students to access relevant information. She acknowledged that she is a learner alongside the students; "I'm like the kids, I'm still sort of looking." While seeing the potential that ICT has to offer these students, she is currently building up resources and working to ensure the students have a positive attitude to learning. She is concentrating on the Year 9 students as she would like them to stay until Year 13, "there's so many Maori students dropping out of school and I would like them to stay."

### Sports Academy

The Sports Academy had only been in operation for eight months at the time of the visit. The philosophy is to give the students a wide variety of experiences with a sporting focus so they can choose a vocation to pursue. The HOD, a Year One teacher, realizing that a big part of today's society is about using information technology, has integrated the use of ICT tools for students to complete their work.

> *...50% of our course, or the papers that we teach for unit standards, do require some sort of written presentation or visual presentation, so that's when we bring in the computers.*

Five or six periods a week are spent in the computer room for students to write up reports, make their own pamphlets, use the scanner. Students record and graph their fitness levels on a spreadsheet. The video camera is used to record coaching sessions, while dataloggers from the science department measure the students running for speed, distance and power. There is a lot of cross curricular cooperation with the HOD Science helping the students to use the dataloggers and the HOD ICT training them in the use of email and the internet. The students were currently working towards the unit standard on setting up and using email. The Sports Academy HOD intends using email to communicate with companies, sporting organisations and sporting individuals. The internet (World Wide Web) would be used for research. Assessments are authentic, for example finding a job, and students are expected to use whatever technology is appropriate. The HOD reports on their progress:

> *At the beginning of the year it was a bit daunting, but now as soon as I say Computer Room, they just walk in, they sit down and they know exactly what to go through.*

Future developments include putting all notes, worksheets and assessments on to the network for students to access in a similar way to the Geography department. This was seen as a distinct advantage as all work will be readily accessible and students will not lose work. CDRoms on anatomy and physiology were earmarked for future purchase.

## THE STUDENTS

### Year 9

Only two Year 9 students from the extension class returned their consent forms, one female and one male. These two students were interviewed. The extension class had the ICT HOD as their form teacher and spent more time than other Year 9 classes learning how to use ICT tools.

One student reported using a word processor in primary school for publishing work and had used CDRoms at intermediate school. They had not used a fax machine and were allowed to use the telephone "only if it was necessary". One student reported using a multimedia authoring programme like *KidPix* or *HyperStudio*.

At their present school they had learned how to use a scanner and how to access information from *Encarta* and the internet. In English they reported using the internet to find out information "sort of like research" and "they'd give us questions". Answers to these questions were recorded on paper. They had also used *Corel Draw* and were currently using that for an English assignment on the Wild West. The work was to be presented as an essay using the word processor.

One student reported that they found that using these tools made their learning "a lot easier", especially the spell checker. Both students responded positively when asked if they found that the skills they learned in their ICT class with the HOD ICT could then be used in English.

In science they reported using a datalogger to measure speed of their running and in mathematics they reported using the draw tools in *MSWord* for angles. The digital camera had been used on class trips with photos being put in the computer "so later on we could look at it". These photos were used in the ICT class to write a story about themselves. The students were encouraged to use clipart and one reported knowing how to ungroup clipart, manipulate it and group it again.

Both students used the homework centre that operates in the library four nights a week after school. One student reported doing research during this time. At the end of the interview, the student who had been most vocal during the interview stated that "I'm not really into computers".

### Year 12

These four students were interviewed as a group in a room that is normally used for Board of Trustees meetings. It is located opposite the principal's office in an area usually out of bounds for students. It was chosen for its quietness and possibility of not being interrupted. However, in retrospect this was probably not a place where the students felt comfortable and may have lead to their reluctance to discuss their ICT activities without a lot of prompting from the researcher. What follows is a summary of their brief replies.

The students reported that they had used a spreadsheet in geography to draw cross sections and graphs. In English they had mostly used *MSPublisher* for assignments, creative writing and letters, but not for newspapers. The internet was used to find information on famous people for English but they were just learning to use it for geography. Computers were accessed mainly in the computer rooms but they did report the availability of one in the careers room and one in their English classroom. In the library they mainly accessed *Encarta* for information. *Study Buddy* was used in mathematics, as well as a spreadsheet for producing graphs. Students had used the digital camera, although this was mainly used by the teacher for yearbook photos, and a scanner, so they could put images into their work. They had not used a fax machine. They reported using the computers more this year than they had in previous years and agreed with the statement "that the teachers in general were becoming more aware of how they (students) could use computers in their learning".

When asked how they thought the use of computers helped them in their learning they replied that they helped them to get information, to get up-to-date information and to present their work neatly and professionally. The spellchecker was also seen as an advantage. They reported they were able to work faster in the 'paperless' environment they were now working in. One student liked the draw tools in preference to drawing with pencil and paper. The students agreed that the network was stable but occasionally the "printers didn't work". These students did not take science.

## SUMMARY

The situation at Seaview High was the direct result of a deliberate strategy to focus on the integration of ICT into each curriculum area. There is evidence to show that the school has a systematic policy, with procedures in place, to support teachers in meeting this goal. ICT leaders are supported by gaining greater access to resources but, even though there is a high computer-student ratio of 1:3, other curriculum teachers still report access difficulties. The network was very stable and the network software used is empowering for teachers as they are fully supported in organizational and technical issues.

A range of student learning activities were reported, requiring different levels of cognitive processing and control by students. This often reflected the teacher's own level of skills and knowledge. There was a dominance of individual student activities rather than those requiring cooperative learning strategies. Students showed a high level of resourcefulness in their use of technology and often made their own decisions as to the appropriate technology to use for a learning task, independent of teacher direction. Teachers responded positively to this student initiative and were willing to learn from students. The library was in demand during school hours and as a homework centre after school, for independent study.

Professional development for these teachers was largely informal and occurred mainly on the job. The difficulty of attending short courses was outlined, some workshops covered work that they already knew and others contained so many new ideas that it was impossible, because of time constraints, for the teacher to assimilate them all and introduce them to a classroom programme. Students at Seaview High responded positively to the use of ICT tools and perceive learning benefits such as working faster and producing more professional work.

# CHAPTER SIX - DISCUSSION

## INTRODUCTION

Chapters Four and Five presented a detailed analysis of results for Phase One and Two of the study. This chapter discusses the research findings according to themes that emerged in relation to those presented in the literature review. It concludes by addressing the main research question concerning the extent to which secondary schools are integrating ICT into the curriculum areas of English, social studies, mathematics and science. As there were no major discrepancies between the use of ICT in these curriculum areas, discussing the findings from a thematic basis will amplify some of the key issues to emerge relating to the successful integration of ICT in secondary schools. In turn, this will help address, the related questions of the research. Themes identified are (1) school systems - policies and procedures; (2) professional development; (3) pedagogical knowledge; (4) role of the teacher; and (5) access and location.

These themes are discussed in relation to their significance at the macro, mesa and micro levels of a secondary school as discussed in the review of literature. They are presented in priority order, however this is somewhat arbitrary and is not intended to imply a temporal gap between the addressing of each issue, as the research findings from this study concur with previous literature that there is a complex and finely balanced relationship and interconnection between all these issues. Many need to be addressed simultaneously, as the research shows successful integration, where there is systemic change in a school as a result of using ICT, will not be achieved unless they are all specifically addressed.

It is fair to say that the relatively low levels of use of ICT by secondary students in the target curriculum areas shown in previous studies, including the IEA study done in 1989 (Nightingale & Chamberlain, 1991; Pelgrum & Plomp, 1993) and the follow up case study in 1990 (Chamberlain & Kennedy, 1991), continue a decade later in this sample group of New Zealand secondary schools. However this study occurred at a strategically important time in New Zealand. The Government's national ICT strategy, *Interactive Education*, (Ministry of Education, 1998) announced in October 1998, was just beginning to be implemented in 1999. The first initiative was *Principals First* workshops, held in various locations around the country, which were attended by nearly all principals. This initiative reinforced the idea of the principal as the strategic curriculum leader in a school. Attending principals received a folder containing specific planning guidance (Department of Education, 1999) Hence the following themes need to be understood in the context of recent developments.

## SCHOOL SYSTEMS - POLICIES AND PROCEDURES

The findings from this study and the previous research (Bendigo Senior Secondary School, 2000; Chamberlain & Kennedy, 1991; Department of Education, 1998; Morrison, 1989; Pelgrum & Plomp, 1988) are clear about the importance of a school's vision for the use of ICT in all curriculum areas and having the systems in place to ensure it happens, and is maintained. Evidence suggests that this happens at all three ecological levels in a school, the macro, mesa and micro.

At the macro level the principal's vision includes ICT as a strategic goal. The principal of Seaview High held such a vision. It is stated on the home page of their website and in many press releases. From this basic vision a policy can be developed and a strategic plan written. *Interactive Education* gives guidance for New Zealand schools in the essential areas of curriculum planning, professional development and infrastructure. Specifying these areas ensures that they are addressed, whereas in the past many computers were bought without schools knowing exactly why and how they were going to be used (Chamberlain & Kennedy, 1991). Included in the planning guide are templates for different types of schools, from small primary schools to large secondary schools.

This strategy of targeting principals and providing specific workshops appears to have worked. The ITAG report for the end of 1999 (Sullivan & Anso, 2000) shows that the main action of principals as a result of attending the *Principals*

*First* workshops was to establish an ICT strategic plan followed by the formation of an ICT committee and the writing of an ICT policy. However, this may not have been entirely because of the workshops. An incentive provided by the government as part of the national strategy, was that extra funding was available for schools who had their plans approved by the Ministry of Education by 1st December 1999.

It is at this macro level, with a school's ICT plan, that a number of barriers such as, access, technical support, time, curriculum planning and professional development, identified in previous studies and confirmed in this study, can be addressed. In order to complete their plan a school must reflect on how ICT is going to be used in each curriculum area which means that pedagogical issues must be addressed. Although driven by pragmatic reasons of a falling roll, Seaview High had pre-empted the national strategy to focus on ICT. At the time of the research visit they had yet to develop a formal policy. However, the process of developing a formal school policy is just as important as the outcome. Seaview High was clearly addressing the issue.

Three to five years has been identified as an ideal time span for a strategic ICT plan to cover. An annual review will allow achievements to be monitored and goals to be set for the following year. In this way new technological developments can be taken into account (Crawford, 1997). Seaview High was in the process of reviewing their plan and setting goals for the following year, at the time of the researcher's visit. HODs were involved in this process. Teachers must also be involved in the planning in order to have school-wide ownership (Fullan, 1991) other wise change will not occur.

Compartmentalisation of the secondary school curriculum can be addressed at the macro level. The separateness of each subject, and the timetable with 45 or 60 minute periods, were barriers for some teachers in this study. The lack of cross curricular opportunities were also identified as difficulties, especially in mathematics, which has elements in a number of other subjects including geography and science. Teachers expressed frustration at being not being able to develop an integrated curriculum. It is possible to timetable to allow team teaching to occur (Bendigo Senior Secondary School, 2000) but this takes vision and motivation and can be risky for many schools. The timetable must address equity issues in line with the National Education Goals, so that groups of students are not disadvantaged.

Linking ICT goals to the school's appraisal system is also decided at the macro level. This will provide added motivation for staff to upskill in this area but will also recognise their achievements in a positive way.

Some of these issues can also be addressed at the mesa level with the departmental scheme. Teachers in this study were aware of the importance of ICT as more than 50% mentioned it in their scheme. The beliefs and attitudes of the HOD and the learning culture of the department can influence the extent to which ICT is integrated. Whether the whole department is involved or individual teachers, depends on this. Working in teams has been shown to be most successful (Fullan, 1991). In order to have a systematic approach across all class levels and in each curriculum strand, units need to be available that have elements of ICT built into them. Units of work that are already taught can be adapted to the use of ICT. Teachers do not have to design new units but can teach current units in a different way. This goes some way to addressing the barrier of not having enough time that many teachers identify. If a department works as a team to develop units of work, then all teachers share in the load. At Bendigo Senior Secondary School, one of the navigator schools in Victoria, each learning area was required to develop a teaching and learning ICT plan, consistent with the goals of the school and was signed off by the Principal (Bendigo Senior Secondary School, 2000).

The computer department in a secondary school plays an important role in assisting the integration of ICT into other curriculum areas. The attitudes and beliefs of the computing HOD are absolutely crucial. Policies that prescribe rules for internet access can either help or hinder a classroom teacher's access to, and use of, telecommunications (Boyd, 2000). Equity issues arise when computer studies and text and information management (TIM) students gain automatic access. Inequities abound also where senior students (Years 12 and 13) have priority over junior students (Years 9 and 10). Access to technologies has emerged as the main barrier to teacher use and will be discussed in more detail later.

In the departmental planning stage, opportunities can be identified to work with teachers in other departments. Thematic units can be designed to include elements of all the target curriculum areas, but this will only happen with either a direct policy of the school or the goodwill of teachers.

It is at the micro level, the individual classroom, individual teachers and their teaching and learning programme, that the ICT policy and plan of the school comes to fruition. Here all aspects of the plan come together, the curriculum planning, the professional development and the ICT infrastructure all combine to provide innovative learning experiences for students. However, it is not good enough to mention ICT in the departmental scheme and then not act upon it. Units of work can be adapted at the micro level, by the classroom teacher, to include the use appropriate technologies. It is also at this level that teachers can team teach with teachers from within their own departments or with colleagues from other departments. This is possible, but it depends on the individual teacher's motivation and commitment (Hadley & Sheingold, 1993; Halliday & Cubitt, 1996). The generally low level of ICT use in this study indicates that the relatively high level of ICT occurring in schemes is not followed through with action at this micro level.

## PROFESSIONAL DEVELOPMENT

There is much evidence to indicate that professional development is crucial to the successful integration of ICT into the curriculum. Many ICT reports over the years have recommended to government that professional development be a priority. Teachers in previous studies over the last decade, and teachers in this study all confirm the centrality of professional development. If teachers do not have the appropriate knowledge and skills, and the literature suggests they do not, then they cannot be expected to integrate such a complex innovation as using ICT effectively in their classroom programmes. Forty four percent of teachers in Phase One of this study reported trial and error as the main way in which they have gained their knowledge about the use of ICT in teaching and learning. This indicates that professional development in the use of new technologies has not reached this group of teachers.

Professional development relates closely to the relationship between a teacher's pedagogical knowledge and how they use ICT in their classroom practice. Teachers reported not only a lack of skills in using ICT but also a lack of knowledge about *how* to integrate ICT into their teaching and learning programmes. The evidence also suggests a direct relationship between the knowledge and skill level of a teacher and their reported confidence and competence at using ICT.

As identified in this study it is not enough that teachers attend ICT courses, the type and duration are also important. It is not the quantity that counts, but the quality. Successful ICT professional development programmes contain certain features. Whole school development ensures that all teachers are involved and committed. The inclusion of pedagogical issues, rather than just concentrating on skills, has been found to be important. Professional development based on curriculum areas gives teachers a context within which to transfer their new-found knowledge. This contextual basis, plus an element of reflection, assists teachers relate their education to their own teaching and learning programme.

The number of teachers in this study who had gained their ICT knowledge by trial and error or were self taught, implies that they were struggling alone, with no support structure, professional network, or guidance from colleagues. Strategies such as team teaching and peer coaching, assist teachers and give them much needed support and guidance throughout their journey. It is recognised that ICT professional development is a long term process (Becker, 1998; McKenzie, 1998).

Important decisions about the amount and type of professional development are made at the macro level of a secondary school. These decisions will be reflected in the professional development section of a school's ICT plan. However ICT professional development must take its place alongside all the other competing demands for professional development in a secondary school. The degree of priority for ICT professional development depends on the priority set by the Board of Trustees and the principal. Decisions also have to be made about what proportion of the ICT budget goes into professional development. Previous studies show that most of an ICT budget was spent on hardware, whereas recently writers in the field have recommended that 25% of the budget be spent on professional development (McKenzie, 1998).

Principals stated in the 1999 ITAG report that they spent only 5% of the ICT budget on professional development in 1999, but 69% intended to spend the extra ICT funding on it in 2000 (Sullivan & Anso, 2000). This indicates an awareness of the importance of professional development. Principals also expressed a wish to learn more about ongoing professional development for staff.

At the macro level the culture of learning in the school can be established. Collaboration and the establishment of a social learning environment for staff has long been identified as a key success factor (Fullan, 1991; Hargreaves, 1994). Staff development is an integral part of school development and will never be successful if small stand alone projects are undertaken. Teachers in collaborative schools view their own learning as cumulative and developmental and tend to discuss ideas and issues more with colleagues. It is clear that the research on professional development and change is often not considered in schools when they plan their ICT professional development programmes. No teacher in this study reported that their ICT professional development was part of a whole school approach. Most were of the short, one-off skills based variety. This could be because the national ICT strategy had not yet impacted on policies and practice.

Although the culture of learning for the whole school is established at the macro level, the same principles apply at the mesa level, especially in a large secondary school where the staff numbers in a major curriculum area such as English can equal the total staff in a small primary school. Again the attitude and beliefs of the HOD and the culture of each department affect the learning environment. As with whole school development, evidence in this study suggests it is important to have the whole department involved to create a critical mass of competent ICT – using teachers in order to effect change. Teaching teams and peer coaches can be set up at departmental level which means that the whole department is moving forward at the same time with the same goal in mind; to improve learning outcomes for students.

HODs demonstrated that they are aware of the importance of professional development and consequently have to make decisions as to the type of professional development programmes which will be implemented in a department. Consideration of the needs of individual teachers and the demands of each curriculum area will ensure success. In the past, undue emphasis has been put on skill training rather than pedagogical knowledge and integration strategies (O'Donnell, 1996). That an emphasis on skills training continues, is confirmed by this study, whereby the main type of professional development in ICT reported was skills in using an application.

The results from the Phase One survey show that only one teacher in 1999 was attending a professional development programme that focused on integrating ICT into the curriculum, while five teachers reported attending them in the previous two years. One HOD pleaded for more of this type. He had received generalised professional development without specific curriculum reference which, he commented, had been of little use. One teacher commented on that several one-off courses on computer skills were not enough. There may be a change in these results as professional development is one of the main strategies of the national policy.

At the micro level, the research shows that it is often the individual, enthusiastic, innovative and committed teachers who lead the way in a department that is lacking policy and vision. These teachers are largely self taught in the area of ICT and received their professional knowledge and skills by trial and error. With effective policies and plans in place these teachers can be used as peer coaches or ICT lead teachers in their departments. Often these teachers have integrated ICT intuitively because they felt it was the right thing to do for their students but cannot actually articulate their reasons. In this situation further professional development in pedagogy meets the needs of these teachers.

It is surprising to discover the lack of impact that the Ministry of Education sponsored IT contracts and the advisory services have had on the secondary teachers in this study. This has implications for the current ITPD programmes and the ICT lead schools. The Ministry of Education must ensure that professional development programmes in ICT reach teachers of the major academic secondary curriculum areas if the present strategy is to be successful. A question here would be 'whose job is it to provide ICT professional development for teachers?' Is it, as has happened in the past, the ICT users, or, those who are trained in teacher education, especially professional development (Collis, 1994)?

The ICT professional development lead school model continues what Collis (1994) identified as a weakness in the ICT professional development of teachers. That is, the separation of ICT professional development from teacher education. Collis considers the relationship between the educational technology community and the mainstream teacher education system. She contends that much of the education teachers receive about using ICT in teaching and learning has occurred **outside** the teacher education system. The historical development of 'computers in education' societies have developed in parallel and worked to further splinter, rather than integrate, these two communities. The premise of her research is that:

*"the majority of teacher education makes little or no reference to computer related technology, and that much computer related teacher education is stimulated and delivered by persons without an academic background in teacher education."* (p. 8).

There is a danger that unsound practices can be perpetuated and pedagogical issues may or may not be addressed. ICT lead schools can of course choose to have professional ICT teacher educators involved. But do they? It would be interesting to know to what extent ICT lead school professional development is underpinned by contemporary learning theory.

This also begs the question, what is happening in New Zealand pre-service teacher education programmes? If newly trained teachers are not graduating with an in-depth knowledge of how the use of ICT can enhance student learning and the skills to use it in their day-to-day work, then inservice professional development providers will have a difficult job to upskill the teacher workforce. This is an area for future research.

This study shows a lack of formal training in the use of ICT with only two teachers in the survey reported being involved in such a programme. Formal courses containing carefully crafted learning experiences can help teachers construct knowledge, and act as an impetus for them to use ICT in a different way and contribute to their professional growth (Dexter, Anderson, & Becker, 1999). However, the importance of formal learning was recognised by the principal of Seaview High in supporting seven teachers to study an information literacy course, *Infolink,* at the Auckland College of Education.

The provision of online ICT professional development has been a recent development in New Zealand (Halliday & Girven, 1999). *English Online* was set up to use new technologies to train teachers in the English curriculum. Email, audioconferences and the world wide web were the main means of communication. Here teachers learn to use these technologies while engaging in an authentic, purposeful activity. However, training 50 teachers annually for two years, fewer than half of them secondary teachers, means a critical mass of English teachers will not have been reached. Relatively few English teachers in this study reported being involved in the project, although a number were familiar with the website.

## PEDAGOGICAL KNOWLEDGE

Evidence suggests a strong relationship between pedagogical knowledge of how ICT can be used effectively to enhance student learning and professional development. Effective ICT-using teachers have been found to have strong pedagogical knowledge and a belief that the use of ICT can enhance student learning. A change in teachers' teaching style and their role as a result of using ICT has been well documented (Becker & Ravitz, 1999; Hadley & Sheingold, 1993). They have been able to transfer and adapt their current pedagogical knowledge to using ICT for better learning and are more likely to follow social constructivist teaching styles rather than the more traditional 'transmission' model.

At the macro level in a secondary school the importance of the principal and Board of Trustees in setting the vision has already been emphasised. Principals who have a strong pedagogical knowledge will have a vision for the use of ICT in their school and be able to create a culture of learning whereby the integration if ICT can flourish, by providing motivating, innovative, and authentic learning opportunities for students. However, there is still some way to go for this is to be achieved when New Zealand principals report, at the end of 1999, that one of their learning needs is to understand how to integrate ICT into classroom programmes and how the use of ICT can enhance student learning (Sullivan & Anso, 2000) . This is also reflected in the fact that in 2000, only 5% of secondary schools had at least one computer in every classroom (Education Review Office, 2000). There is no evidence that this need of principals is being addressed. If secondary principals do not have this basic understanding then the question must be asked - how can they make educationally sound strategic decisions about the location and use of ICT in their school?

It could be that New Zealand Boards of Trustees and principals do not have the clear-cut curriculum policy of the UK with statutory orders for student achievement at key stages. Nor do they have the National Educational Technology Standards for students and teachers that have been introduced in the USA (ISTE, 2000a; ISTE, 2000b). Instead they have the challenge of implicit guidance in the national curriculum documents which encourages the use of ICT as part of the learning process as well as more explicit guidance from *Interactive Education*, the national strategy.

However, setting standards for students and teachers, and giving policy guidance alone clearly does not meet the needs of principals, to help them understand the pedagogical rationale enough to plan for the successful integration of ICT into all curriculum areas, and ensure access for students at all levels. Schools are left to their own devices as far as integration strategies and style of teaching are concerned. Secondary schools, in particular, are free to continue in traditional 'transmission' teacher-centred practice which meets the needs of an examination orientated curriculum.

It would appear that the traditional examinations system, currently dominating the senior school curriculum at Year 11 and 13 in New Zealand, mitigates against any change in teaching style. It is not unexpected then, that results in frequency of ICT use by Year 12 students was the greatest of all year levels. Year 12 students currently study for Sixth Form Certificate, which is internally assessed. The less frequent use of ICT was Year 11 where the School Certificate syllabus and examination predominates. Teachers reported that syllabus constraints and the pressure of teaching time were barriers to their use of ICT. It will be interesting to see if the new National Certificate of Educational Achievement (NCEA), which is due to be introduced in 2002, has any effect on teaching style and use of ICT in secondary schools. This will be an area for future research.

Perhaps it is also not surprising that the most successful ICT-using school chosen for the case study is decile one and has a history of low achievement in the examination stakes as well as a falling roll. The use of ICT is seen as an innovation to attract more students and to increase student achievement.

The Principal of Seaview High realised that, along with the increased availability and use of ICT, professional development in pedagogical issues was essential hence his support the teachers studying the *Infolink* course in April/May 1999. However he did also express a degree of uncertainty when he commented that he wasn't sure where the curriculum teachers were going to take this (the integration of ICT) and he didn't think they knew either.

It is even more important, at the mesa level, that the HOD have an understanding of the pedagogical implications of using ICT. The beliefs and attitudes, indeed the educational philosophy, conveyed by the HOD will influence teachers and, by implication, what happens in the classroom. Rather than concentrate just on skills, schemes of work can outline the cognitive benefits for students and professional development programmes can emphasise these. Software is bought to reflect this philosophy. If computers are seen as individualistic, rewarding certain behaviour, and providing a competitive game-like environment, then software that is behaviourist, largely of the drill and practice type, will be purchased and encouraged. Teachers view learning as a series of skills to be taught, learned and observed rather than as a cognitive process. This is also evidenced by teachers expressing as their ideal, a class set of thirty computers. The power of the computer and telecommunications for collaborative learning and team work are not understood, therefore not fully utilised.

It is at the micro level, the individual teacher in the classroom, that the pedagogical knowledge is evident. One of the problems identified in the 1989 IEA study was a lack of teacher skill and knowledge. The results of this study indicate that, over a decade later this is still a problem. Data from the survey in phase one showed that teachers were using activities with a high level of cognitive processes such as analysing, processing, reflecting and evaluating, but on further investigation of activities at Seaview High, teachers did not articulate these. Valid reasons were given for the use of ICT but these clustered at the lower end of the cognitive skill range such as retrieving information and presenting it in an attractive way. Spreadsheets and graphs were used to save time, but no mention was made of the analytical and reflective skills involved.

Consistent with previous studies, the software teachers use and the way they use it depend a lot on the teachers own level of skill and knowledge. A number of teachers in this study expressed a desire to use ICT more often but lacked the prerequisite knowledge and skill to do so, and as a consequence they lacked the confidence to try. Teachers also reported a lack of time to sit down and find out how to best utilise these technologies. Students, however, were not constrained by teacher lack of knowledge. They often went beyond the teacher's own level of expertise and experimented with using new programs or tried new techniques with programs that they were already familiar with. Thus their boundaries were extended, not by their teacher but by their own efforts.

Teacher skill and knowledge has a significant bearing on the use of the internet. As mentioned earlier an understanding of the use of the internet, that it is more than just a huge repository of information, is vital if students are going to use it effectively to enhance their learning. The use of the internet in education is increasing at an exponential rate but the evidence does not indicate that it is being used to its fullest potential. Research shows that students have not gone beyond the basics of using the internet as an information retrieval source (Boyd, 2000; Schoolsnet Australia, 2000; Sullivan & Anso, 2000).

In a recent case study of internet use by two secondary schools, Boyd (2000) reported that teachers had a low level of information literacy skills. They were not able to pass on to students sophisticated search techniques, such as, the choice of an appropriate search engine, entering key words using Boolean logic, and skim reading quickly to evaluate material on the screen. If, through lack of professional development, teachers have an inadequate level of skill and knowledge of these techniques, then they are not in a position to help students (Boyd, 2000).

Contrary to these findings, teachers in the phase one survey who reported using internet activities, appeared to have carefully planned them to be integrated into units of work to enhance the learning of students. The activities showed the full cycle of inquiry and information processing, from collecting and analysing data, to writing web pages to presenting it for a particular audience. This process shows students converting information into 'new' knowledge which is then presented. Some reported activities, showed the integration of a number of ICT tools into the learning process depending on the purpose, i.e. teachers were thinking 'what is the best/most appropriate tool for the task that I want my students to do'. While there is no evidence in this study that teachers were using the internet just 'because it is there' (Campbell, 1996) it was used as an information retrieval service in most cases, with little explanation as to what students did with that information once they had accessed it.

Teachers expectations of students can sometimes determine the types of learning activities that they set. Anyon (1981) found that in working class schools teachers set activities which required students to learn by rote and follow instructions, whereas there was more focus on problem solving, creativity and self expression for students from higher socio-economic groups. Translating this to a computer environment, Fredman (1990) describes how economically disadvantaged schools tended to use computers for low cognitive level drill and practice exercises. This trend seems to have continued until the present time. A study by Becker, reported in the New York Times (Lewin, 2001), showed that schools with students from low socio economic areas emphasise word processing and other simple tasks while those with more affluent students used computers for more complex cognitive activities in order to understand certain topics. This may account for the difference in the results from this study between the cognitive level of reported activities from each phase. Teachers from the survey, which covered all decile groups from one (lowest) to ten (highest), reported activities with higher cognitive demand than those from the decile one case study school.

Although the frequency of use of ICT is generally low, teacher attitudes are mainly positive. There is a general recognition of the potential for the enhancement of student achievement. That the use of ICT motivates students is undeniable and the results of this study are no different. Motivational aspects include features of a word processor, such as the spell check and presentation effects. Students were reported as asking more questions about how to improve the writing process. At Seaview High they were motivated enough and had the skills to move beyond where their teachers were at and identify for themselves when a particular piece of software would help them in their learning activity. Students are more likely to be motivated when they are in control of their own learning.

The difficulty for secondary schools and teachers to successfully bring together the elements particular to secondary schools, such as timetable constraints, the isolation of each curriculum area, the length of periods, the location of computers, in order to integrate the use of ICT in a more constructivist way into their teaching and learning programmes has been recognised by Crawford (1999). While a new pedagogy for secondary teachers is still being debated, he has provided a list of constructivist activities that can be used in the short term. He acknowledges that there is a need for more extensive research in this area to help teachers adopt more appropriate strategies for the use of ICT in the secondary school classroom.

Strategies have been developed by the Teacher Training Agency in the UK to help primary teachers make informed choices about the use of ICT (cited in Education Review Office, 2000). The use of ICT must be justified on educational grounds by having teachers specify exactly how the use of any particular piece of equipment is going to help the students meet identified learning outcomes. Perhaps strategies will be developed for secondary teachers also.

In developing a picture of what the secondary English classroom of the future would look like, Coogan (1999) advises that the good teaching and learning methods of today are not discarded, but rather developed and enhanced. Availability of up-to-date equipment should not an issue. Emphasis continues on the skills of reading and writing, speaking and listening with recognition of the fusion of the visual and verbal in all forms of communication (Kress, 1996, cited in Coogan, 1999).

## ROLE OF THE TEACHER

In discussing the role of the teacher it is important to note that the use of ICT is often determined by the teaching philosophy held by individual teachers. The present study did not actively investigate the pedagogical philosophy and teaching style of the participants, but it can be inferred from the activities they have described.

Studies have shown that teachers have changed their teaching style as a result of the use of ICT (Hadley & Sheingold, 1993). However, when this issue was investigated more closely it became apparent that the use of ICT alone was not the catalyst for change. There were many other variables involved, such as, a supportive professional development context, a professional culture that encourages reflection, and opportunities for trying new approaches (Dexter et al., 1999). Becker and Ravitz (1999) found a high correlation between the length of time students had been assigned computer work by a teacher, and constructivist oriented changes in their teaching approach, for secondary English, social studies and science teachers. The correlation was least for secondary mathematics teachers.

This change in teaching style has implications for teachers, especially secondary teachers who have taught for many years in a more traditional didactic, information transfer model of teaching. They may feel threatened by these new technologies and not be convinced of the value in their particular area. This may account for the slow uptake of the use of information and communication technologies in the secondary schools in general. It also makes the area of ICT professional development even more important, especially for a large secondary school with a diverse range of teachers from all curriculum areas.

It appears that mathematics teachers have the greatest challenge in the integration of ICT. Norton, McRobbie & Cooper (2000) investigated why mathematics teachers use of ICT, even in a technology rich school, was very low. In a series of case studies of individual teachers they found that use of ICT was largely determined by teaching style. The more 'transmission' oriented, content focused, and teacher-centred their view of teaching, the less potential they could see for the use of ICT. In contrast, one teacher in the school with a more social constructivist view of teaching and learning and an emphasis on providing real world mathematical problems, used computers in her teaching more than her colleagues. She could see that computers were not only a computational tool, but also would assist students to explore and conceptualise phenomena.

## ACCESS AND LOCATION

In this study, lack of access to computers was by far the largest barrier to the integration of ICT into everyday teaching and learning practice. Conversely, easy access to equipment was seen as the main success factor. Access was also identified as a major issue in the IEA study of 1989 (Pelgrum & Plomp, 1993) and again in the follow up case study in two New Zealand secondary schools (Chamberlain & Kennedy, 1991). Clearly this issue needs to be addressed urgently if integration is a serious goal, both for the government and for schools. Decisions about a school's teaching and learning philosophy, which can determine where computers are located, is made at the macro level with effects that filter down through the mesa to the teachers and students at the micro level.

Part of the problem of lack of access is *where* computers are located and who is timetabled to use them. Traditionally secondary schools have located computers in special rooms called 'labs' which have been mainly used by computer studies and text information management (TIM, formerly typing) classes (Chamberlain & Kennedy, 1991; Pelgrum & Plomp, 1993). Because these classes have had priority and been block-booked in the timetable, teachers of other curriculum classes have reported great difficulty in gaining access. Computer studies is offered at senior levels and these students have priority access, even in 'free' times such as the lunch break (Boyd, 2000). Evidence from this study shows that junior students, Years 9 and 10 used ICT less than Years 11, 12 and 13. This shows inequity of access between junior and senior students, and those taking computer studies and TIM classes, and those who are not.

Evidence suggests internet access is being allocated and rationed in a similar way. In a study of internet use at two New Zealand secondary schools students are given an internet account automatically when they study computer studies and TIM. For all other classes teachers or students apply for access (Boyd, 2000). What happens to those information and computer literate Year 9 students from primary intermediate schools? This is clearly an area for future research.

In New Zealand this is significant because it means that secondary schools may not be meeting one of the National Education Goals. Within the Ministry of Education National Education Guidelines, is a goal that schools "recognise the importance of equal educational opportunities for all" (Ministry of Education, 1997a, p. 4)

Becker (1998) argues that computers are located according to the school's philosophical teaching style. With a traditional individualistic, teacher centred and examination oriented view then computers are ideal in one room of 30 computers. If, however, a school has a more social constructivist view, then computers need to be available where the learning takes place, that is in the classroom. Having ICT equipment on hand for students to conduct their enquiry work, gather and process data, manipulate and present it, is essential if it is to be integrated into teaching and learning programmes at any level, primary or secondary.

However Becker discusses another issue that is pertinent for secondary schools – that of the scarcity of resources. ICT equipment, especially computers, is very expensive and schools have endeavoured to provide a shared space for all to gain access rather than locate them in specific curriculum areas. He maintains there can be a trade off whereby fewer computers are located in special rooms and more are moved closer to other curriculum areas. Here, though is where teaching strategies will change as secondary teachers develop skills in inquiry work, small group instruction and cooperative learning. It can be argued that ICT will never be fully integrated unless teachers and students have ready access to appropriate equipment when they need it, not timetabled for 2 o'clock on Friday afternoon.

However sufficient access to equipment is not the whole answer for, even in a school with a high computer-student ratio of 1:3, some teachers at Seaview High reported that lack of access was an issue. Therefore being in a technology rich school does not necessarily guarantee access. Other issues are at play such as the teacher's pedagogical view mentioned earlier. In a study of mathematics teachers' lack of ICT use in a technology rich school, it was found that those with a teacher-centred, transmission view of learning had a restricted image of the potential of computers in mathematics teaching and learning. In contrast, one teacher in the school who had a more social constructivist learner-centred view of learning, had a broader image of the potential of computers (Norton et al., 2000). The teacher's view of learning is also tied up with the location issue in that the teachers at Seaview High, when reporting their ideal, focused on a room with 30 computers, that is, one computer per student. This could be explained by their view of learning as teacher-centred and individualistic. This is interesting because this view is at odds with the school goal of having three or four computers in every classroom.

The library has emerged as a significant location of computers second only, in this survey, to access from the computer room. This could be because information and communication technologies are seen as part of the core business of a library, providing access to information and resources. Another explanation could be that it is a compromise on the part of secondary schools as they balance the needs of competing interests for access to computers.

It is interesting to note that the results of this survey show that it is science teachers who have most access to computers from either their classroom or a pod (small group) of computers. An explanation could be because science teachers reported a high level of use of dataloggers and these are usually linked to a dedicated computer in a science laboratory with a specific piece of software for analysing the data. This could be an area for further investigation.

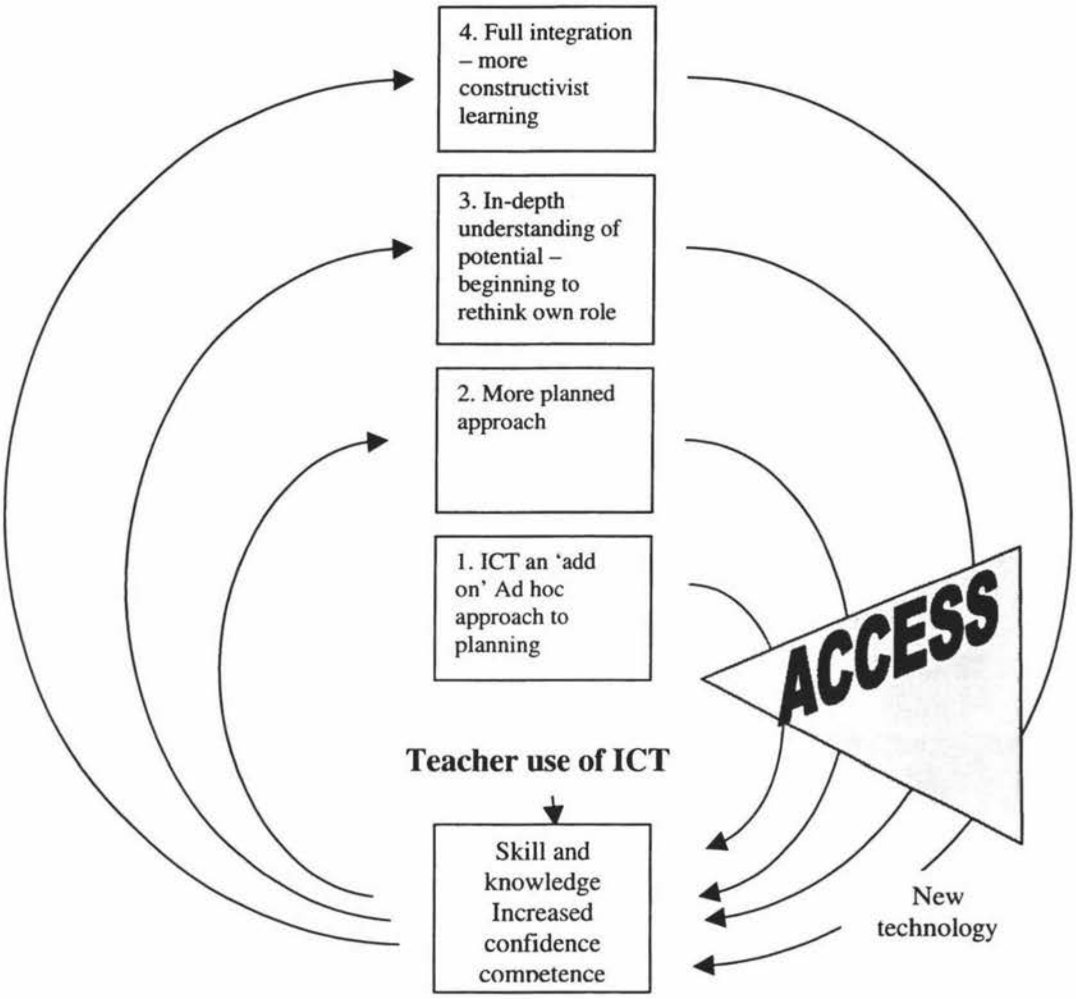
The English classroom of the future (Coogan, 1999) has fast internet access from three or four computers plus a fast multimedia machine in every classroom. A large flat screen television monitor with video, plus telephone, facsimile and audio tape recorders would also be standard equipment. A class set of laptop computers and at least one digital camera would be readily available as departmental resources. Coogan costs this out at $10,000 per classroom and gives an economic rationale of the implications of not providing this equipment in New Zealand secondary schools. He speculates that New Zealand will have to purchase future technology needs using income generated from agricultural commodities unless our education system produces lateral thinking students who are challenged to be innovative and creative.

## A MODEL OF ACQUISITION

Using Knupfer's (1995) four dimensions of ICT integration and Santos' (1999) 'virtuous cycle of evolution', Figure 6.1 shows how teachers 'spiral up' in their knowledge, competence and confidence. The relationship between use and increased pedagogical knowledge and integration strategies is shown. The importance of access at each stage is highlighted.

Teachers at the beginning level use ICT as an 'add on' to their current teaching programme. It is assimilated into their programme with no change in teaching approach. As teachers progress through the levels they increase their skill and knowledge level and they become more confident to attempt new teaching approaches in the way they use ICT. Each stage builds on what has gone before. ICT becomes fully integrated when it is planned to be used in all aspects of their teaching and learning programme with a consequent change in their role as teacher. Other models, describing stages that teachers go through, suggest that it will take four to five years for a teacher to reach the fully integrative level (Bracey, 1997). The success of this spiral approach is contingent upon access to ICT equipment. If a teacher does not have easy, reliable access to appropriate ICT equipment then they will not be able to progress through these stages. Once the full integration level has been reached teachers will have little difficulty in being able to utilise new and emerging information and communication technologies in innovative and creative ways; as long as they have access!

*Figure 6.1*
**The spiral approach to integration showing the importance of access**
Adapted from Santos' virtuous cycle of evolution (Santos, 1999)



## LIMITATIONS OF THE STUDY

While this study endeavoured to collect data from a range of secondary schools, followed by extensive data collection at Seaview High, it is important to acknowledge a number of methodological limitations.

i. The study involved a small sample of schools in an urban area therefore the results cannot be generalised to the wider secondary school population. The situation may be quite different in secondary schools in rural areas whose views were not canvassed.

ii. The selection of an 'ICT-using' teacher in each school was not a precise measure but was left to the perception of the HOD in each department. HODs in different schools and in different curriculum areas may have differing views of what constitutes an 'ICT-using' teacher.

iii. The criteria used for the selecting a 'successful ICT-using school' for the case study were not an exact measure but were identified according to those used in previous research studies and from the data that had been obtained in Phase One. This may not have been precise enough to give a reliable indication of a 'successful ICT-using school'.

iv. The research endeavoured to cover a broad range of issues relating to the use of ICT in secondary schools and may have been overly ambitious in studying four curriculum areas. The research may have benefited from more streamlining of the research questions and the concentration on just one curriculum area. The research may have been compromised in depth because of the breadth of the inquiry.

v. The questionnaire sent to schools may not have covered all aspects of ICT use that teachers consider important.

vi. The small number of students who returned permission slips from their parents or caregivers may have reflected a cross cultural aspect of the research. Whereas the teachers interviewed were mainly pakeha, the students were of Polynesian or Maori descent and they may have felt uncomfortable with the prospect of talking to a female pakeha researcher. In any further research involving students it may be more appropriate to have the interviewer more representative of the cultural group being interviewed.

vii. The interview process and questions asked, may not have elicited all relevant information regarding types of activities undertaken by students and the participant's views on the subject. Interviewees may have felt constrained by the process. In a school where there is a very overt emphasis on the use of ICT they may not have felt able to disclose their real feelings. To gain a more accurate picture the position of participant observer could have been utilised more by observing teachers and students in a classroom situation.

## SUMMARY

This chapter has brought together all the themes that have emerged from this study and the literature, relating to the successful integration of ICT in a secondary school and shown that secondary schools in general, in New Zealand and overseas, are not integrating ICT to a large extent. There are pockets of success in secondary schools, either individual teachers or individual departments, but there is long way to go before ICT is integrated into everyday classroom teaching and learning programmes.

Issues which determine success in integrating ICT into secondary schools were discussed. School support in the form of policies and procedures, along with appropriate professional development emerged as important factors. The pedagogical knowledge of teachers determined how teachers used information and communication technologies in their classrooms and consequently the role that they as took in their teaching and learning programmes. Access to, and location of, equipment, especially computers, contributed to the low levels of use in secondary schools. Again where computers are located is often determined by the school's philosophy of learning. Other variables such as culture of the school and department, attitudes of teachers and curriculum planning also impacted on the integration of ICT. Decisions made at the macro, mesa and micro levels in a secondary school all have a trickle down effect in determining whether the learning experience of students includes the use of ICT.

While factors relating to successful integration of ICT were investigated, the actual definition of 'successful integration' remains problematic. The themes that emerged help in pointing the way to the conditions that are required for ICT to be successfully integrated into the curriculum areas of English, mathematics, social studies and science.

However, given that a social constructivist approach encourages cross curricular teaching and longer, authentic, inquiry projects; will secondary schools be able to meet these challenges or will the compartmentalisation of the secondary school curriculum, timetable and the adherence to traditional 'transmission' models of teaching, still hinder the successful integration of ICT?

# CHAPTER SEVEN - CONCLUSION

This chapter draws conclusions based on the findings from this study and from previous research. These conclusions move beyond the original question of the extent to which ICT is integrated into the secondary school curriculum areas of English, mathematics, social studies and science. The conditions under which the successful integration of ICT into the secondary school curriculum can take place are established. It was deemed necessary to take the debate further because of the low rate of integration found in this study, which concurred with earlier studies. Important factors emerged in this study that show why the integration of ICT in secondary schools is so problematic.

An analysis of the literature, and data from this study, indicates the complexity of introducing a new innovation, such as the integration of ICT, into a secondary school. There is a complex interplay of a number of differing ,and sometimes competing, variables which need to be considered for the genuine integration, not just assimilation, of ICT to be successful and sustainable.

This thesis has identified a number of key factors which need to be addressed at the macro level of a secondary school in order for direction and vision to be followed at the mesa and micro levels. This synthesis between levels is important for New Zealand secondary schools to achieve the National Education Guideline of an equitable education for all students. Equity of access must prevail across all learning levels and all curriculum areas.

Policies and procedures must be in place which express a clear vision for the use of ICT to enhance the learning of all students over all curriculum areas. This must occur at all three levels of the school. If the use of ICT is not planned for then schools will continue to purchase and use ICT on an ad hoc basis, just as New Zealand was doing a decade ago (Chamberlain & Kennedy, 1991; Pelgrum & Plomp, 1993). ICT must be addressed in departmental schemes with a systematic progression through the levels and strands of the curriculum. Resources, such as unit plans, will assist teachers at the micro level to implement the policy.

Appropriate professional development for principals, HODs and every teacher in the classroom is essential; appropriate being the key word here. Professional development must be in a curriculum context and include knowledge of contemporary learning theories. The 'why' and 'how' must be covered, not just by colleagues, but by teacher educators with a knowledge of the specialist areas of ICT, pedagogy and teacher education. It is important for decision makers at the macro and mesa levels of a secondary school to recognise the long term nature of ICT professional development.

A recognition of the difference between assimilation and integration is important at the macro level for it is here that a vision can be turned into reality. The compartmentalisation of the secondary curriculum and the timetable can be addressed at this level. If not, cross curricular innovations will only happen at the initiative of individual teachers. The new National Certificate of Achievement, with less emphasis on a content based examination system, may provide an opportunity. Until the structure of the secondary curriculum is addressed teachers will only ever be able to assimilate the use if ICT and not reach a true level of integration. They will make do with half way measures such as those outlined by Crawford (1999).

The importance of individual teaching style cannot be overemphasized as the literature has shown that this is a determiner of how a teacher uses ICT in their classroom and the subsequent role that they, as a teacher, take. It has been shown that, even in a technology-rich school, if a teacher has a traditional, transmission model of teaching which is content-based and teacher-centred, then they will not see a place for ICT and if they do, it will be an add-on to their current teaching practice. If, however, they have a more social constructivist view, which is process-based and learner-centred, then they will see many opportunities where ICT can be used to enhance and extend the learning of their students. These teachers will be able to take advantage of all that information and communication technologies have to offer their students. The use of a computer can move beyond the tool level and become a window to a whole new world.

The issue of access to ICT equipment, especially computers, is not as straightforward as it initially appeared. Access, or the lack of it, is a major barrier for teachers and goes some way to explaining the low use of ICT in the secondary school curriculum. However, the actual location of computers, whether in a specialised 'laboratory', or in a curriculum classroom, is also an important factor. In secondary schools most computers are in still in special rooms with computer studies and TIM students having priority access. Scarce resources are available only for those who 'study' the computer, rather than for those who wish to use it for teaching and learning in major curriculum areas. This not only makes it difficult for classroom teachers to access the computers but also determines the pedagogical strategies that teachers use when there. The necessity of taking the whole class to the computer room at a particular time each week mitigates against using them for constructivist activities such as collaborative group work in everyday teaching and learning. Instead the whole class tends to work individually on the same task. As Ham asked in 1989, are computers being placed where the learning takes place? The answer, more than a decade later, is clearly "no".

This research has occurred at a time when two new initiatives were happening in New Zealand. One is the implementation of the national ICT strategy *Interactive Education* and the second is that new secondary schools are about to be built. How ICT are to be incorporated into the teaching and learning philosophy, and hence the physical environment, of these new schools will largely determine how secondary students of the future will be able to use these technologies as an integral part of their learning. It is all part of the social practice of school in the wider socio-political context.

The ICT national strategy is currently being reviewed and planning is in progress for the next three years. If New Zealand is to be an active participant in the knowledge economy, and secondary schools are to meet the needs of learners for the 21$^{st}$ century, then the findings of this study need to be carefully considered.

Recommendations:

i) that policy makers and school managers seek professional development opportunities for secondary teachers that are underpinned by contemporary learning theories;

ii) that teachers develop and collegial networks and learning communities to discuss and support each other in order to link the use of ICT to contemporary learning theories;

iii) that researchers determine the future direction of ICT in the secondary school and its effectiveness, from the viewpoint of the teacher.

The meaningful use of ICT in secondary schools is a complex interaction of a number of variables including, school policies, professional development, pedagogical knowledge, the role of the teacher, as well as access to, and location of, equipment.

## REFERENCES


Anderson, G. (1998). *Fundamentals of Educational Research.* London: The Falmer Press.

Andrews, P. (1997). Information Technology in the Mathematics National Curriculum: policy begets practice? *British Journal of Education Technology, 28*(4), 244-256.

Anyon, J. (1981). Elementary Schooling and Distinctions of Social Class. *Interchange, 12*(2-3), 118-132.

Ayres, D., & Nolan, P. (1987). Teaching and Learning with Computer Applications: The 1986 Freyberg Integrated Studies Project. *Delta, 39*, 18 - 29.

Becker, H. (1991). How Computers are used in United States Schools: Basic data from the 1989 IEA Computers in Education Survey. *Journal of Educational Computing Research, 7*(4), 385-406.

Becker, H., & Ravitz, J. (1999). The Influence of Computer and Internet Use on Teachers' Pedagogical Practices and Perceptions. *Journal of Research on Computing in Education, 31*(4), 356 - 384.

Becker, H. J. (1998). Running to Catch a Moving Train: Schools and Information Technologies. *Theory into Practice, 37*(1), 20 - 30.

Bendigo Senior Secondary School. (2000). *A New Kind of Education: One School's Story* . Bendigo: BSSS.

Boyd, S. (1997). *Learning By Bytes: Computers in the Classroom.* Wellington: NZ Council for Educational Research.

Boyd, S. (2000). *Entangled in the Gender Web? A Study of Uses and Perceptions of the Internet by Students at Two High Schools.* An unpublished thesis. Wellington: Victoria University.

Bracey, B. (1997). *Technology stages that teachers go through.* Available: http://prism.prs.k12.nj.us/WWW/OII/techstages.html

Brown, M. (1995a). *A study of Proficient Computer-using teachers.* An unpublished thesis. Palmerston North: Massey University.

Brown, M. (1995b). What is the Role of Information and Communication Technology in the NZ Curriculum? *Computers in New Zealand Schools, 7*(2), 7-15.

Brown, M. (1997). Educational Technology: I've Been Thinking. *Computers in New Zealand Schools*(March 1997).

Butler, G., & Zwimpfer, L. (1997). *Impact 2001 Learning with IT: the issues.* Wellington: Information Technology Advisory Group.

Butterworth, A. (1998). Information Technology at Epsom Girls Grammar School. *Computers in NZ Schools, 10*(2), 31.

Caldwell, B., & Spinks, J. (1988). *The Self-managing School.* London: The Falmer Press.

Campbell, N. (1996). The internet and teacher support in the classroom of today and tomorrow. In K. W. Lai (Ed.), *Words Have Wings* . Dunedin: Otago University Press.

Chamberlain, M., & Kennedy, S. (1991). *A Case of 'Growing like Topsy': a study of the use of computers for teaching and learning in NZ schools.* . Wellington: Research and Statistics Division, Ministry of Education.

Cohen, L., & Manion, L. (1997). *Research Methods in Education.* London: Routledge.

Collins, A. (1991). The Role of Computer Technology in Restructuring Schools. *Phi Delta Kappan, 73*(September), 28 - 36.

Collis, B. (1988). *Computers, curriculum and whole-class instruction.* Belmont, CA: Wadsworth.

Collis, B. (1994). A Reflection on the Relationship between Technology and Teacher Education: synergy or separate entities? *Journal of Information Technology for Teacher Education, 3*(1), 7-25.

Computers in Education Development Unit. (1989). *Computers in Secondary English.* Wellington: Department of Education.

Connor, J. (1999, 2 February 1999). *Lighthouse Schools, Tasmania*, [WWW]. Department of Education. Available: www.discover.tased.edu.au/lighthouse/default.htm [2000, 5 December].

Coogan, P. (1999). *The Technology Infused English Classroom*, [WWW]. UNITEC Institute of Technology. Available: http://english.unitecnology.ac.nz/article/home.html [2000, 10 February].

Crawford, R. (1997). *Managing Information Technology in Secondary Schools*. London: Routledge.

Crawford, R. (1999). Teaching and Learning IT in Secondary Schools: towards a new pedagogy? *Education and Information Technology, 4*, 49-63.

Crook, C. (1996). *Computers and the Collaborative Experience of Learning*. London: Routledge.

Department for Education. (1995). *Information Technology in the National Curriculum* . London, UK: Department for Education, HMSO.

Department of Education. (1982). *Report of the Consultative Committee on Computers in Schools: Computers in Schools* . Wellington: Department of Education.

Department of Education. (1984). *A Review of the Core Curriculum* . Wellington: Department of Education.

Department of Education. (1998). *Rethinking Learning and Teaching: The Navigator Schools' Experience* (PDF document 1). Melbourne, Australia: Department of Education, Victoria.

Department of Education, Victoria. (1999). *Learning Technologies Planning Guide for Schools: using ICT to improve teaching and learning*. Wellington: Ministry of Education.

de Vaus, D. (1995). *Surveys in Social Research*. (4th ed.). St Leonards, NSW: Allen and Unwin.

Dexter, S., Anderson, R., & Becker, H. (1999). Teachers' Views of Computers as Catalysts for Changes in their Teaching Practice. *Journal of Research on Computing in Education, 31*(3), 221 - 239.

Education Review Office. (1997). *The Use of Information Technology in Schools* . Wellington: Education Review Office.

Education Review Office. (2000). *The Implementation of Information and Communication Technologies (ICT) in New Zealand Schools* . Wellington: Education Review Office.

Fredman, A. (1990). *Yes I Can: Action Projects to Resolve Equity Issues in Educational Computing*. Eugene, OR: International Society for Technology in Education.

Fullan, M. (1991). *The New Meaning of Educational Change*. London: Cassell.

Gawith, G. (1991). *Information Skills: Today's Skills for Today's Schools.* Auckland: Auckland College of Education.

Gilmore, A. (1995). Turning Teachers on to Computers: Evaluation of a Teacher Development Program. *Journal of Research on Computing in Education, 27*(3), 251 - 269.

Gray, D. (1999). Developing a Learning Culture. *Computers in New Zealand Schools, 11*(2), 30 - 32.

Hadley, M., & Sheingold, K. (1993). Commonalities and Distinctive Patterns in Teachers' Integration of Computers. *American Journal of Education, 101*(May), 261 - 315.

Halliday, J., & Cubitt, S. (1996). *Rights, Roles and Responsibilities: Integrating IT into English and Social Studies Classrooms Using Co-operative Learning Strategies.* Paper presented at the New Zealand Computers in Education Society: Inter Net Works, Waikato Polytechnic. 14-17 January 1996.

Halliday, J., & Girven, A. (1999). Benefits of Online Professional Development for Teachers: English Online. *Computers in New Zealand Schools, 11*(3), 30-33.

Ham, V. (1989). The English Classroom: Putting computers in their place! *English in Aotearoa, June*(8), 1 - 9.

Hargreaves, A. (1994). *Changing teachers, changing times.* London: Cassell.

Harris, B. (1994). The Future Curriculum with IT: Implications for Science Education. *School Science Review, 76*(275), 15-25.

Harris, D. (1997). *Information and Communication Technology in the New Zealand Educational Context* : NZCER.

Higgo, J. (1994). Implications and Challenges of the Development for the Mathematics Curriculum in Secondary Schools. *Mathematics in School*(January 1994), 49-51.

Hill, P. (1998). Information Technology in a New Zealand Secondary School. *Computers in NZ Schools, 10*(2), 29-30.

International Society for Technology in Education, (2000a). *National Educational Technology Standards for Students* . Eugene, OR: ISTE

International Society for Technology in Education (2000b). *National Educational Technology Standards for Teachers* . Eugene, OR: ISTE.

Information Technology Advisory Group. (1999). *Towards 2001: Information Technology in New Zealand Schools 1993 - 1998*. Wellington: ITAG.

Knupfer, N. (1995). Teachers and Educational Computing: Changing Roles and Changing Pedagogy. In R. Muffoletto & N. Knupfer (Eds.), *Computers in Education: Social, Political and Historical Perspectives* (pp. 163 - 179). Cresskill, NJ: Hampton Press.

Lai, K.-W. (1996). Computer-Mediated Communication. In K.-W. Lai (Ed.), *Words have Wings: Teaching and Learning with Computer Networks*. Dunedin: University of Otago Press.

Leask, M. & Pachler, N. (1999). *Learning to Teach Using ICT in the Secondary School*. London: Routledge.

Levine, H. (1990). Models of Qualitative Data Use in the Assessment of Classroom-based Microcomputer Education Programs. *Journal of Educational Computing Research, 6*, 461 - 477.

Lewin, T. (2001, January 22). Children's Computer use Grows, but Gaps Persist, Study Says. *New York Times*, pp. 11.

McKenzie, J. (1998). *Secrets of Success: Professional Development that Works*, [Online]. eSchool News. Available: http://fromnowon.org/school/secrets.html [1999, 5 August].

Ministry of Education, (1990). *Report of the Consultative Committee on Information Technology in the School Curriculum*. Wellington: Ministry of Education.

Ministry of Education, (1992). *Mathematics in the New Zealand Curriculum*. Wellington: Learning Media.

Ministry of Education, (1993). *The New Zealand Curriculum Framework*. Wellington: Ministry of Education.

Ministry of Education, (1994a). *Education for the 21st Century*. Wellington: Learning Media.

Ministry of Education, (1994b). *English in the New Zealand Curriculum*. Wellington: Learning Media.

Ministry of Education, (1997a). *Governing and Managing New Zealand Schools. Part One: The National Education Guidelines*. Wellington: Learning Media.

Ministry of Education, (1997b). *Social Studies in the New Zealand Curriculum* . Wellington: Learning Media.

Ministry of Education, (1998). *Interactive Education: An Information and Communication Technologies Strategy for Schools* . Wellington: Ministry of Education.

Ministry of Education, (1999a). *Briefing for the Incoming Minister of Education - Addressing Under Achievement* . Wellington: Ministry of Education.

Ministry of Education, (1999b). *Operational Funding for 2000 State and State Integrated Schools* (Ministry of Education Circular 1999/37). Wellington: Ministry of Education.

Morrison, A. (1989). *Computers in the Curriculum of Secondary Schools.* Berwick upon Tweed: The Scottish Council for Research in Education.

Morton, C. (1996). The Modern Land of Laputa: Where Computers are used in Education. *Phi Delta Kappan, 77*(6), 416.

Neilson, R. (1991). Computers Across the Curriculum: The Lynfield Experience. *Computers in NZ Schools, November*, 19 - 22.

Nightingale, D., & Chamberlain, M. (1991). *A Study of Computers in New Zealand Schools: A Report of the IEA Study Computers in Education Study* . Wellington: Research and Statistics Division, Ministry of Education.

Nolan, P., & McKinnon, D. (1998). *Enhancing Secondary School Education with Computer-based Integration Curriculum Programs.* Paper presented at The Fifteenth International Conference on Technology and Education, Santa Fe, New Mexico.

Norton, S., McRobbie, C., & Cooper, T. (2000). Exploring Secondary Mathematics Teachers' Reasons for Not Using Computers in Their Teaching: Five Case Studies. *Journal of Research on Computing in Education, 33*(1), 87 - 109.

O'Donnell, E. (1996). *Integrating Computers into the Classroom: the missing key*. Lanham, Maryland: Scarecrow Press Inc.

Owens, J. L. (1996). A Survey of Computer Use in New Zealand Schools. *The Research Bulletin*(7), 1 - 10.

Papert, S. (1980). *Mindstorms: Children, Computers and Powerful Ideas*. New York: Basic Books.

Papert, S. (1993). *The Children's Machine: rethinking school in the age of the computer*. New York: Basic Books.

Parr, J. (1994). *Report Evaluation of the Computer Assisted Learning Project at Rutherford High School* . Auckland: University of Auckland.

Parr, J., & Bairstow, R. (1992). Personal Computers for Students: an examination of extended use. *Computers in New Zealand Schools, 4*(1), 36-39.

Pelgrum, W., & Plomp, T. (1988). The IEA study "Computers in Education": A multinational longitudinal assessment. In F. Lovis & E. Tagg (Eds.), *Computers in Education: Proceedings of the IFIP TC3 first European conference on computers in education.* North-Holland: Elsevier Science Publishers.

Pelgrum, W., & Plomp, T. (Eds.). (1993). *The IEA Study of Computers in Education: Implementation of an innovation in 21 education systems.* (Vol. 13). Oxford: Pergamon Press.

Podmore, V., & Craig, B. (1989). *Evaluation of Exploratory Studies in Educational Computing* (9). Wellington: NZCER.

Porteous, M. (1992, ). Towards information technology: Successful curriculum change at Kurow Area School. *Parent and School, 22,* 18 - 19.

Pressley, M., & McCormick, B. (1995). *Cognition, Teaching and Assessment.* New York: Harper Collins.

Rushby, N. (1979). *An Introduction to Educational Computing*. London: Croom Helm.

Ryba, K., & Anderson, B. (1993). *Learning with Computers: Effective Teaching Strategies*. Eugene: ISTE.

Salomon, G. (1990). Studying the Flute and the Orchestra: Controlled vs. Classroom Research on Computers. *International Journal of Educational Research, 14*, 521 - 531.

Salomon, G. (1991). Learning: New Conceptions, New Opportunites. *Educational Technology, June 1991*, 41-44.

Santos, I. (1999). *Evaluation of the Effectiveness of a Tertiary Course Delivered via the World Wide Web.* An unpublished thesis. Palmerston North: Massey University.

Schoolsnet Australia, (2000). *Teachers and the Internet* . Melbourne: Schoolsnet Australia Pty Ltd.

Sheppard, K. (1990). *Introducing Computers to English.* Wellington: New Zealand Association of Teachers of the English Language.

Sherwood, C. (1993). Australian Experiences with the Effective Classroom Integration of Information Technology: implications for teacher education. *Journal of Information Technology for Teacher Education,* *2*(2), 167-179.

Stanley, D. (1995). Teacher Professional Development for Information Technology in the School Curriculum. *Computers in NZ Schools,* *7*(3), 3-6.

Sullivan, C., Allan, J., & Paul, N. (1998). *IT in Schools 1998* (BRC #1719). Wellington: Information Technology Advisory Group.

Sullivan, C., & Anso, M. (2000). *ICT in Schools 1999* (BRC #1980). Wellington: ITAG.

Taylor, R. (Ed.). (1980). *The computer in the school: Tutor, tool, tutee.* NY: Teachers College Press.

Teariki, C., Spoonley, P., with Tomoana, N. (1992). *Te Whakapakari Te Mana Tangata: The Politics and Process of Research for Maori.* Palmerston North: Dept of Sociology, Massey University.

Telecom Education Foundation. (1996). *How Wired Are Our Schools?* . Wellington: Business Research Centre.

Tiffin, J., & Rajasingham, L. (1995). *In search of the virtual class.* London and NY: Routledge.

Tolich, M., & Davidson, C. (1999). *Starting Fieldwork: an Introduction to Qualitative Research in New Zealand.* Auckland: Oxford University Press.

Wild, M., Bigum, C., Durrant, C., Green, B., Honan, E., Lankshear, C., Morgan, W., Murray, J., & Snyder, I. (1998). Making Sense of Literacies and Technologies in Education in the Digital Era. *SET, NZCER, Technology*(9), 1 - 4.

# APPENDICES

# APPENDIX ONE

## Brochure on New Zealand Government Information and Communication Technology Strategy (Interactive Education)

# he Government's ICT Strategy for Schools

Learning in the third millennium

Hon. Dr. Nick Smith
Minister of Education

INTERNET
://www.national.org.nz/people/smithn.html
http://www.ts.co.nz/~nicksmp/

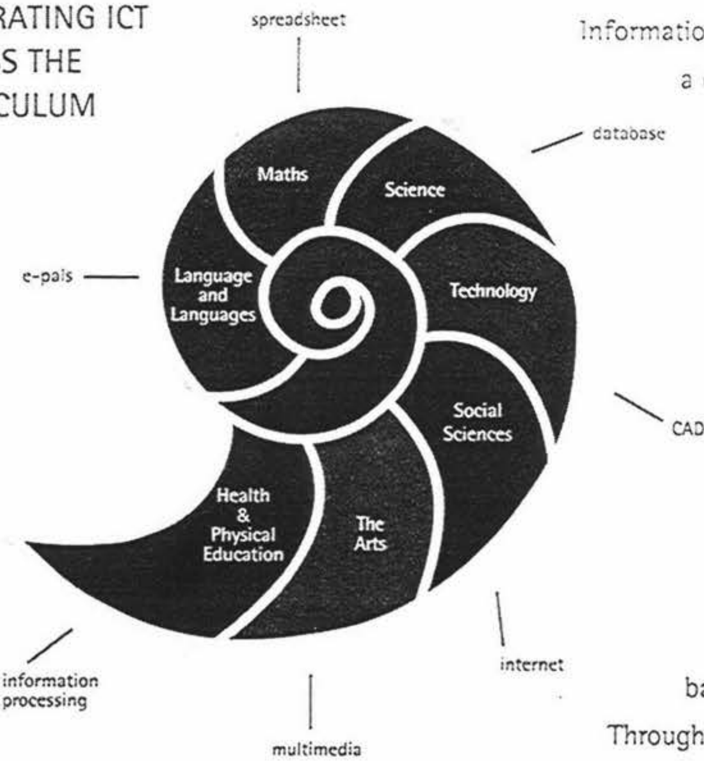
## Information Technology offers a small, smart country at the bottom of the Earth huge opportunities. Our children are the key to unlocking that potential.

Schools face a major challenge in providing pupils with the skills for the information age. This brochure is about outlining the Government's vision for Information and Communication Technologies (ICT) in schools, and how it can be implemented.

The pace of change is awesome. We have moved from faxes to personal computers, email and the Internet at an extraordinary rate. Schools have much to be proud of in how they have adapted but they need help.

Achieving this strategy requires the right balance of roles between Government and schools. Centralised purchasing of computer hardware and software would be a mistake. The Government sees its role as providing support and national leadership.

## ITEGRATING ICT CROSS THE JRRICULUM




Information technology in schools is about far more than a computer studies class. It is about giving our pupils the skills and confidence to use information technology across all seven learning areas in the national curriculum. Nor should we become mesmerised by the latest gimmickry. The most important investments we make in information technology will be in people.

We have a unique opportunity with information technology to overcome the social and distance barriers to learning. Through the Internet, the most isolated or socially disadvantaged child can have access to the knowledge banks of the world.

# The School's ICT Grant

Learning in the third millennium

The Government's ICT Strategy for Schools last year involved $16 million over three years and funded a range of projects including 23 ICT Professional Development Schools, a national series of principal seminars, computer recycling, and the Online Resource Centre.

The 1999 Budget provides a direct additional Grant for schools of $50 million over the next three years. This Grant will help but it is not intended to meet all of our schools' ICT needs. Just as other service providers have had to reprioritise to fund technology, so too must schools.

The ITC Grant is designed to be flexible. Our 2700 schools have very different ICT needs. In many, the best investment will be in professional development. Others need networking or an Internet connection. The decision on how to spend the Grant is best made by schools.

The Grant has two components:

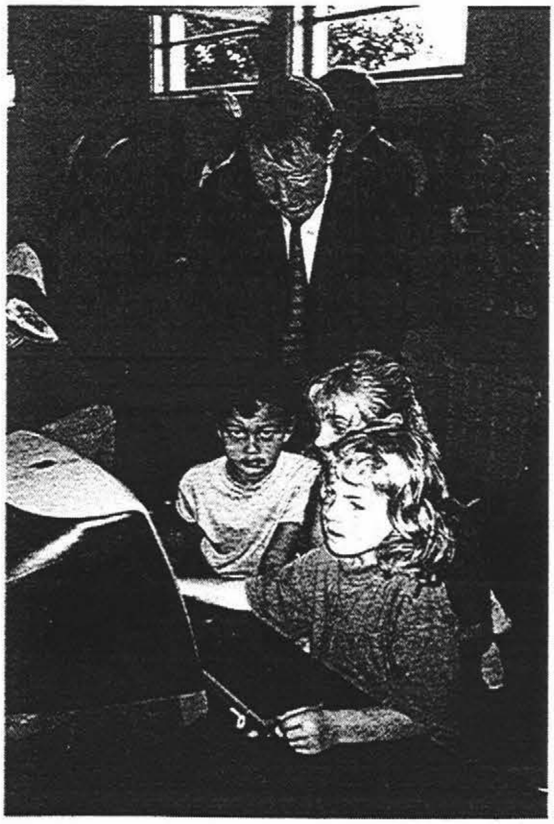
(a) a one-off ICT Grant made up of a base grant of $2500 and a per pupil grant of $25;

(b) ongoing additional operational funding of $13.60 per pupil.

**SCHOOL'S ICT GRANT**

| SCHOOL ROLL | TOTAL ONE-OFF GRANT | ONGOING OPERATIONAL FUNDING PER YEAR |
|---|---|---|
| 30 | $ 3250 | $ 408 |
| 100 | $ 5000 | $ 1360 |
| 300 | $10000 | $ 4080 |
| 600 | $17500 | $ 8160 |
| 1200 | $32500 | $16320 |

> "$50 million is a serious commitment by Government. I'm confident our Boards, Principals and Teachers will make wise use of this investment."
>
> Nick Smith



# The School's ICT Plan

Learning in the third millennium

> Schools must have a plan for professional development as well as for curriculum implementation and infrastructure. For every dollar spent on something in ICT, two dollars should be spent on someone.
>
> Nick Smith

To access the one-off Grant and ongoing funding for ICT, schools need to develop their ICT plans according to criteria set by the Ministry of Education and submit these plans to an assessment centre in their region. Schools will be notified of the assessment centres by Gazette notice in June. To meet the Ministry's criteria, school ICT plans have to address the following key aspects of ICT planning:

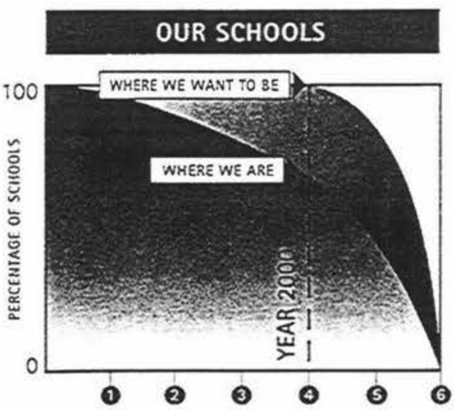

a) the use of ICT across the curriculum

b) professional development in the teaching and facilitation of student use of ICT in learning, and

c) ICT infrastructure requirements

Government wants schools to think carefully about how they can best meet the ICT learning needs of their pupils. To help, the Government has produced templates for a range of typical schools and comprehensive guidelines. The best resource, though, will be fellow schools, principals and teachers with practical experience.

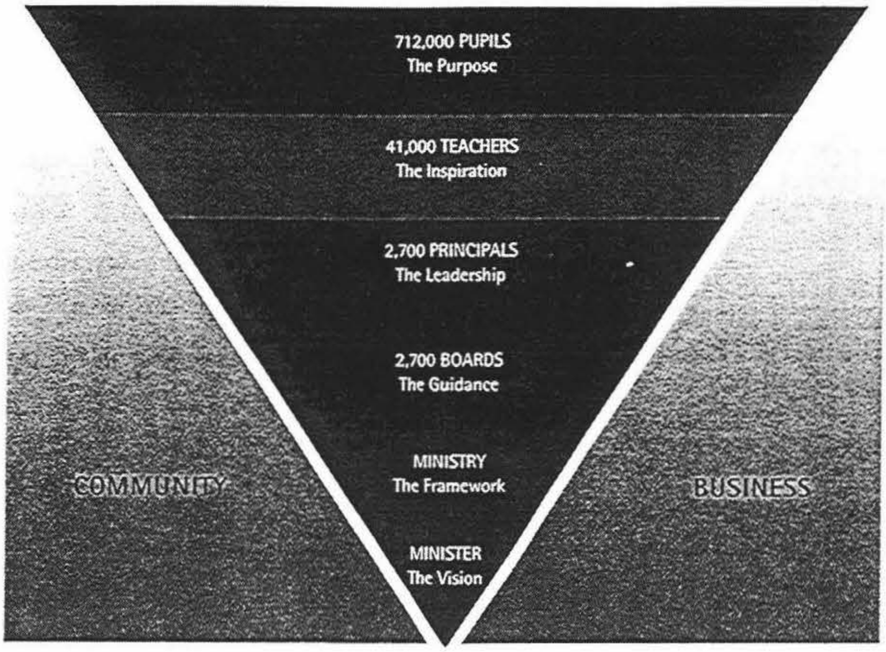
Raising the level of all schools' ICT capabilities is the objective. School plans must include an Internet connection accessible to teachers and pupils. By year's end, the plans must also show how the people skills will be built to match the infrastructure.




| LEVEL | PEOPLE | TECHNOLOGY |
|---|---|---|
| 1 | [illegible] | phone/fax |
| 2 | keyboard skills | word processor |
| 3 | | computer access |
| 4 | | internet |
| 5 | [illegible] | networked |
| 6 | [illegible] knowledge | high bandwidth |

# School's ICT — A Team Strategy

Learning in the third millennium




Providing all New Zealand students with access to information technology is such a huge challenge it is going to require a team effort. Schools, Government, business and the community all need to be committed to ensuring our young people have the skills needed for the new century.

The Government must provide the vision, framework and some of the resources, but it cannot do it alone. Schools should not be afraid of seeking the support of business and the community. NetDay is a very good example of how community volunteers can be of enormous help to schools. There are also many excellent examples of business working alongside schools to help achieve their ICT plans.

The Government's ICT Strategy for Schools sets a very busy timetable for the few months left to the third millennium. It involves 23 ICT Regional Ministerial Briefings, over 100 professional development seminars for principals and teachers, development and approval of 2700 school ICT plans, and the establishment of a new Online Resource Centre. It will be stressful and challenging but very worthwhile. Nothing is as important as our children's future.

## THE TIMETABLE

| | |
|---|---|
| [illegible] May | Budget release |
| 25 May – 25 June | ICT Regional Ministerial Briefings |
| 1 July | Ministry of Education ICT administrative guidelines to schools |
| [illegible] August | Lodging of ICT plan and Grant applications begins |
| 1 September | Online Resource Centre launched |
| 1 December | Last day for lodging of ICT plans and Grant application |

> "Progress comes through partnership. Our best results will be achieved with schools, communities, business and government working together for our children's future."
>
> Nick Smith

# APPENDICES 2 - 12
## PHASE ONE

# APPENDIX TWO

## Letter of explanation to principal

**Massey University**
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

Learning and Teaching
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

Dear

I am seeking your approval for your school to participate in a research project for my Masters in Education thesis from Massey University.

I am currently Programme Leader in Education Technology at UNITEC Institute of Technology but as a former secondary teacher I am interested in finding out the extent to which secondary schools are integrating Information and Communication Technology into the curriculum areas of English, Maths, Science and Social Studies. The literature indicates that not a lot is known about what is actually happening in secondary schools in the area of *integrating* Information and Communication Technology across these curriculum areas. This study could also provide valuable base line data to evaluate the effectiveness of the Government's new ICT strategy.

Attached is an information sheet which gives details of the methodology, confidentiality, participants rights, findings and thesis supervisors.

*Your school is invited to participate in this study but is in no way obliged to.*

It is important to emphasise that information collected from each school and participant, will be confidential to the research and will not be identified in any publications resulting from it.

If you agree to participate in this study could you please give the enclosed information sheets and questionnaires to the HODs of English, Maths, Science and Social Studies as well as a teacher in each of those curriculum areas who is perceived by the HOD to be the most competent ICT-using teacher. I have asked that the questionnaires be returned by the 31st July.

It would also be appreciated if you could send me a copy of the school's Information Technology Policy, or a policy which covers that area. A stamped, addressed envelope is enclosed for this purpose.

I look forward to working with you.

Yours sincerely

Jackie Halliday

# APPENDIX THREE

## *Information for Principals* sheet

**Information and Communication Technology in Secondary Schools**
**Masters Thesis**
**Participants' Information Sheet: Principal**

This research will be conducted in two phases:
Phase 1:
To gain an overview of what is happening a sample of Auckland schools have been chosen. Questionnaires will be sent to HODs of English, Maths Science and Social Studies in each of these schools. HODs will be asked to nominate a teacher in their department who, in their opinion, is successfully integrating Information Technology into the curriculum. Questionnaires will be sent to these teachers. Each school will be asked for a copy of the policy which covers the area of Information and Communication Technology.

Phase 2:
This will be a Case Study of a secondary school(s). It is likely that this school(s) will be successfully integrating Information and Communication Technology into the curriculum areas of English, Maths, Science and Social Studies.

Confidentiality
Information collected from each school and participant, will be confidential to the research and will not be identified in any publications resulting from it. However, in the selection of a school for Phase 2 a small advisory group consisting of experienced educators in the field of Information Technology will examine results of data collected in Phase 1. The name of the school chosen will be revealed only at the end of the process.

Findings
The findings of the research will be printed as a Masters Thesis (available from the Massey University Library) and also in subsequent journal articles. At the completion of the study summary sheets of the findings will be sent to all participants.

Participants' Rights
If you agree to participate in this research your rights are as follows:
- To refuse to answer any question about the study at any time during participation;
- To ask any questions about the study at any time during participation;
- To provide information on the understanding that your name, nor the name of your school, will be used unless you give permission to the researcher;
- To be given access to a summary of the findings of the study when it is concluded;
- To agree to participate in the study under the conditions set out in the Information Sheet'
- To have the right to withdraw at any time.


Researcher
Jacquelin A Halliday
Programme Leader,
Education Technology
School of Education
UNITEC Institute of Technology
Private Bag 92 025
Auckland
Ph 09 815 4398
E-Mail jhalliday@unitec.ac.nz

Supervisors
Mark E. Brown
Lecturer (New Educational Technologies)
Department of Learning and Teaching
Massey University
Private Bag 11 222
Palmerston North
Ph 06 356 9099
(Extn. 8626)
E-Mail M.E.Brown@massey.ac.nz

Dr. Linda Selby
Head of Centre,
Information Studies
Auckland College of Education
Private Bag 92601
Symonds Street
Auckland
Phone 09 623 8899
(Extn 8543)
E-Mail l.selby@ace.ac.nz

# APPENDIX FOUR

*Permission to Participate*
form for Principals

## Permission to Participate in Research

School:

I agree to teachers in my school participating in the research project **Integrating ICT in Secondary Schools**. ☐

I have passed the information on to relevant staff members. ☐

Signed ______________________________

Principal


## Permission to Participate in Research

School:

I agree to teachers in my school participating in the research project **Integrating ICT in Secondary Schools**. ☐

I have passed the information on to relevant staff members. ☐

Signed ______________________________

Principal

# APPENDIX FIVE

## Instruction sheet for HODs

## INSTRUCTIONS FOR HODS

Please complete the HOD Questionnaire and return it in the stamped, addressed envelope provided by 31st July 1999.

Pass the Teacher Questionnaire and the stamped addressed envelope to a teacher in your department **whom you perceive to be the most competent Information Technology user** and ask them to return it by 31st July 1999.

*Many thanks. Your cooperation is greatly appreciated.*

Jackie Halliday

# APPENDIX SIX

*Information about the Research for HODs* sheet

# Information and Communication Technology in Secondary Schools

## Masters Thesis

## Participants' Information Sheet
## HOD

I am Programme Leader in Education Technology at UNITEC Institute of Technology and am currently undertaking research for my thesis as part completion of a Masters in Education degree at Massey University.

As a former secondary teacher I am interested in finding out the extent to which secondary schools are integrating Information and Communication Technology into the curriculum areas of English, Maths Science and Social Studies. The literature indicates that not a lot is known about what is actually happening in secondary schools in the area of integrating Information and Communication Technology across these curriculum areas.

This research will be conducted in two phases:
Phase 1:
To gain an overview of what is happening in a sample of Auckland schools. Questionnaires will be sent to HODs of English, Maths Science and Social Studies in each schools. HODs will be asked to nominate a teacher in their department who, in their opinion, is successfully integrating Information Technology into the curriculum. Questionnaires will be given to these teachers. Each school will be asked for a copy of the policy which covers the area of Information and Communication Technology.

Phase 2:
This will be a Case Study of a secondary school(s) selected by the researcher and a small advisory group of experienced educators. It is likely that this school(s) will be successfully integrating Information and Communication Technology into the curriculum areas of English, Maths, Science and Social Studies.

You are invited to participate in this study but are in no way obliged to.

Confidentiality
Information collected from each school and participant, will be confidential to the research and will not be identified in any publications resulting from it. However, in the selection of a school for Phase 2, a small advisory group consisting of experienced educators in the field of Information Technology will examine results of data collected in Phase 1. The name of the school chosen will be revealed only at the end of the process.

Findings
The findings of the research will be printed as a Masters Thesis (available from the Massey University Library) and also in subsequent journal articles. At the completion of the study a summary of the findings will be sent to all participants.

Participants' Rights

If you agree to participate in this research you have the right:

- To refuse to answer any question about the study at any time during participation;
- To ask any questions about the study at any time during participation;
- To withdraw at any time.
- To provide information on the understanding that your name, nor the name of your school, will be used unless you give permission to the researcher;
- To be given access to a summary of the findings of the study when it is concluded;
- To agree to participate in the study under the conditions set out in the Information Sheet

I look forward to working with you.

Yours sincerely

Jackie Halliday


| **Researcher**: | **Supervisors**: | |
|---|---|---|
| Jacquelin A Halliday<br>Programme Leader,<br>Education Technology<br>School of Education<br>UNITEC Institute of Technology<br>Private Bag 92 025<br>Auckland<br>Ph 09 815 4398<br>E-Mail jhalliday@unitec.ac.nz | Mark E. Brown<br>Lecturer (New Educational Technologies)<br>Department of Learning and Teaching<br>Massey University<br>Private Bag 11 222<br>Palmerston North<br>Ph 06 356 9099<br>(Extn. 8626)<br>E-Mail M.E.Brown@massey.ac.nz | Dr. Linda Selby<br>Head of Centre,<br>Information Studies<br>Auckland College of Education<br>Private Bag 92601<br>Symonds Street<br>Auckland<br>Phone 09 623 8899<br>(Extn 8543)<br>E-Mail l.selby@ace.ac.nz |

# APPENDIX SEVEN

## HOD Questionnaire

## Information Technology in Secondary Schools

## HOD Questionnaire

**Purpose**

This questionnaire has been designed to gather information from HODs about how information and communication technology tools are being integrated into the "core" curriculum areas of English, Maths, Social Studies and Science in Secondary Schools. The data gathered may provide useful information for other secondary schools and teachers

*This questionnaire should take about 15 minutes to complete.*

*Please post the completed questionnaire in the stamped addressed envelope provided or fax it to:*
*Jackie Halliday, School of Education, UNITEC Institute of Technology.*
***Fax no. 815 4181** by **31st July 1999**.*

Please circle your response to the following:

1. **Gender** Female Male

2. **Approximately how many years have you been teaching?**

1 – 2 years 3 – 5 years 5 – 10 years 10 – 20 years more than 20 years

3. **What curriculum area are you head of?**

English Maths Social Sciences Science

4. **How long have you been an HOD?**

1 – 2 years 3 – 5 years 5 – 10 years 10 – 20 years more than 20 years

5. **Please indicate which of the following Information Technology tools your students have used in the <u>previous 4 terms</u> as an integral part of a learning activity:**
(tick in the box/es)

| | | | |
|---|---|---|---|
| Word processor | ☐ | Database | ☐ |
| Spreadsheet | ☐ | Multimedia authoring programme (eg Powerpoint, HyperStudio) | ☐ |
| CDROM | ☐ | | |
| Logo | ☐ | Datalogger | ☐ |
| Graphics | ☐ | Simulation program (eg Sim City) | ☐ |
| World wide web | ☐ | | |
| Telephone | ☐ | Email | ☐ |
| Fax | ☐ | Audioconference | ☐ |
| Calculator | ☐ | Graphing calculator | ☐ |

6. **How experienced are you at using Information Technology tools:** (please circle where you fit on the 5 point scale )

**6a) personally and in your work?**

| not very experienced | | | | very experienced |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**6b) in teaching and learning?**

| not very experienced | | | | very experienced |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

7. **From where do students and teachers in your curriculum area access computers for teaching and learning:** (please tick the appropriate box/es)

computers in the classroom ☐
computers in the library ☐
computers in a computer room or suite ☐
cluster or pod if computers available for your curriculum area ☐
laptops that can be borrowed when needed ☐
other (please specify) ____________________

8. **Is the use of Information Technology specifically mentioned in your Departmental scheme?**

(Please circle)

YES NO

9. **Indicate to what extent you agree or disagree with the following statement:**

Integrating Information Technology into my curriculum area is very important.

(Please circle)

| strongly disagree | | | | strongly agree |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**10. What do you consider to be the 3 main benefits for students using Information Technology tools in learning?**

______________________________________________
______________________________________________
______________________________________________

**11. What factors do you think lead to the successful integration of Information Technology tools in your curriculum area?**

______________________________________________
______________________________________________
______________________________________________

**12. What do you see as barriers to the successful integration of IT into your curriculum area?**

______________________________________________
______________________________________________
______________________________________________

**13. How would you rate your school's support for the integration of Information Technology into curriculum areas?** (Please circle)

| not at all supportive | | | | very supportive |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**14. What 3 things do you do to support teachers in your curriculum area who want to use Information Technology tools in their teaching and learning programmes?**

______________________________________________
______________________________________________
______________________________________________

**15. Briefly describe your most recent successful experience at integrating one or more IT tools into your classroom programme;**

______________________________________________
______________________________________________
______________________________________________

**16. Are you currently engaged in professional development in information technology?** (Please circle)

YES NO

**16a. If yes, briefly describe the type of professional development:** _______

______________________________________________

______________________________________________

**17. Have you attended in the last two years any type of inservice course on the use of IT in teaching and learning?** (Please circle)

YES NO

**17a. If yes, briefly describe the inservice course(s)?**

______________________________________________

______________________________________________

______________________________________________

**18. Where you have gained your knowledge about the use of Information Technology in teaching and learning?** (Please circle)

| | 1 = least knowledge gained | | | | 5 = most knowledge gained |
|---|---|---|---|---|---|
| Ministry of Education Contract | 1 | 2 | 3 | 4 | 5 |
| Talking to colleagues | 1 | 2 | 3 | 4 | 5 |
| Information Technology Advisers | 1 | 2 | 3 | 4 | 5 |
| An Information Technology course | 1 | 2 | 3 | 4 | 5 |
| Reading about Information Technology | 1 | 2 | 3 | 4 | 5 |
| Trial and error | 1 | 2 | 3 | 4 | 5 |
| Computer company personnel | 1 | 2 | 3 | 4 | 5 |

**19. Are any of your staff currently engaged in professional development in Information Technology? (if English, this includes English Online)**
(Please circle)

YES. NO

**19a. If yes, how many teachers are involved?** ________

**19b. If yes, briefly describe the type of professional development:** _________
____________________________________________________________
____________________________________________________________

**20. How often have you used Information Technology tools in your teaching and learning programme this year?** (Please circle)

| | | | | |
|---|---|---|---|---|
| Year 9 | once a week | once a month | once a term | less than once a term |
| Year 10 | once a week | once a month | once a term | less than once a term |
| Year 11 | once a week | once a month | once a term | less than once a term |
| Year 12 | once a week | once a month | once a term | less than once a term |
| Year 13 | once a week | once a month | once a term | less than once a term |

*Thank you for taking the time to complete this questionnaire.*

*Please post the completed questionnaire in the stamped addressed envelope provided or fax it to:*
*Jackie Halliday, School of Education, UNITEC Institute of Technology.*
***Fax no. 815 4181** by 31st July 1999.*

# APPENDIX EIGHT

*Information about the Research for Teachers* sheet

**Information and Communication Technology in Secondary Schools**

**Masters Thesis**

**Participants' Information Sheet**
**Teacher**

Dear

I am Programme Leader in Education Technology at UNITEC Institute of Technology and am currently undertaking research for my thesis as part completion of a Masters in Education degree at Massey University.

As a former secondary teacher I am interested in finding out the extent to which secondary schools are integrating Information and Communication Technology into the curriculum areas of English, Maths Science and Social Studies. The literature indicates that not a lot is known about what is actually happening in secondary schools in the area of integrating Information and Communication Technology across these curriculum areas.

This research will be conducted in two phases:
Phase 1:
To gain an overview of what is happening in a sample of Auckland schools. Questionnaires will be sent to HODs of English, Maths Science and Social Studies in each of these schools. HODs will be asked to nominate a teacher in their department who, in their opinion, is successfully integrating Information Technology into the curriculum. Questionnaires will be sent to these teachers. Each school will be asked for a copy of the policy which covers the area of Information and Communication Technology.

Phase 2:
This will be a Case Study of a secondary school(s) selected by the researcher and a small advisory group of experienced educators. It is likely that this school(s) will be successfully integrating Information and Communication Technology into the curriculum areas of English, Maths, Science and Social Studies.

You are invited to participate in this study but are in no way obliged to.

Confidentiality
Information collected from each school and participant, will be confidential to the research and will not be identified in any publications resulting from it. However, in the selection of a school for Phase 2, a small advisory group consisting of experienced educators in the field of Information Technology will examine results of data collected in Phase 1. The name of the school chosen will be revealed only at the end of the process.

Findings
The findings of the research will be printed as a Masters Thesis (available from the Massey University Library) and also in subsequent journal articles. At the completion of the study summary sheets of the findings will be sent to all participants.

Participants' Rights
If you agree to participate in this research you have the right:

- To refuse to answer any question about the study at any time during participation;
- To ask any questions about the study at any time during participation;
- To withdraw at any time.
- To provide information on the understanding that your name, nor the name of your school, will be used unless you give permission to the researcher;
- To be given access to a summary of the findings of the study when it is concluded;
- To agree to participate in the study under the conditions set out in the Information Sheet

I look forward to working with you.

Yours sincerely

Jackie Halliday

**Researcher:**

Jacquelin A Halliday
Programme Leader,
Education Technology
School of Education
UNITEC Institute of Technology
Private Bag 92 025
Auckland
Ph 09 815 4398
E-Mail jhalliday@unitec.ac.nz

**Supervisors:**

Mark E. Brown
Lecturer (New Educational Technologies)
Department of Learning and Teaching
College of Education
Massey University
Private Bag 11 222
Palmerston North
New Zealand
Ph 06 356 9099 (Extn. 8626)
E-Mail M.E.Brown@massey.ac.nz

Dr. Linda Selby
Head of Centre,
Information Studies
Auckland College of Education
Private Bag 92601
Symonds Street, Auckland
New Zealand
Phone 09 623 8899 (Extn 8543)
E-Mail l.selby@ace.ac.nz

# APPENDIX NINE

## Teacher Questionnaire

## Information Technology in Secondary Schools

### Teacher Questionnaire

This questionnaire has been designed to gather information from teachers about how information and communication technology tools are being integrated into the "core" curriculum areas of English, Maths, Social Studies and Science in Secondary Schools. The data gathered may provide useful information for other secondary schools and teachers.

*This questionnaire should take about 15 minutes to complete.*

*Please post the completed questionnaire in the stamped addressed envelope provided or fax it to:* Jackie Halliday, School of Education, UNITEC Institute of Technology. Fax no. 815 4181 **by 31st July 1999**. *Thank you.*

Please circle your response to the following:

1. **Gender** Female
   Male

**2. Approximately how many years have you been teaching?**

1 – 2 years    3 – 5 years    5 – 10 years    10 – 20 years    more than 20 years

**3. What curriculum area do you teach?**

English    Maths    Social Sciences    Science

**4. Please indicate which of the following Information Technology tools your students have used in the <u>previous 4 terms</u> as an integral part of a learning activity:**
(Tick in the box/es)

| | | | |
|---|---|---|---|
| Word processor | ☐ | Database | ☐ |
| Spreadsheet | ☐ | Multimedia authoring programme (eg Powerpoint, HyperStudio) | ☐ |
| CDROM | ☐ | Datalogger | ☐ |
| Logo | ☐ | Simulation program (eg Sim City) | ☐ |
| Graphics | ☐ | Email | ☐ |
| World wide web | ☐ | Audioconference | ☐ |
| Telephone | ☐ | Graphing calculator | ☐ |
| Fax | ☐ | | |
| Calculator | ☐ | | |

**5. How experienced are you at using Information Technology tools:**
(Please circle where you fit on the 5 point scale )

**5a) personally in your work?**

| not very experienced | | | | very experienced |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**5b) in teaching and learning?**

| not very experienced | | | | very experienced |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**6. Indicate whether you agree or disagree with the following statement:**

Integrating IT into my curriculum area is very important.

(Please circle)

| strongly disagree | | | | strongly agree |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**7. What do you consider to be the 3 main benefits for student learning of using IT tools in your curriculum area?**

______________________________

______________________________

______________________________

**8. What factors do you think lead to the successful integration of IT tools in your curriculum area?**

______________________________

______________________________

______________________________

**9. What do you see as barriers to the successful integration of IT into your curriculum area?**

______________________________________________
______________________________________________
______________________________________________

**10. How would you rate your school's support for the integration of IT into curriculum areas?**

(Please circle)

| not very supportive | | | | very supportive |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**11 Briefly describe your most recent successful experience at integrating one or more IT tools into your classroom programme;**

______________________________________________
______________________________________________
______________________________________________

**12 Are you currently engaged in professional development in information technology?** (Please circle)

YES NO

**12a If yes, briefly describe the type of professional development:**

______________________________________________
______________________________________________
______________________________________________

**13 Have you attended, in the last two years, any type of inservice course on the use of IT in teaching and learning?** (Please circle)

YES NO

**13a. If yes briefly describe the inservice course(s)?**

______________________________________________
______________________________________________
______________________________________________

**14 Where you have gained your knowledge about the use of Information Technology in teaching and learning?** (Please circle)

| | 1 = least knowledge gained | | | | 5 = most knowledge gained |
|---|---|---|---|---|---|
| Ministry of Education Contract | 1 | 2 | 3 | 4 | 5 |
| Talking to colleagues | 1 | 2 | 3 | 4 | 5 |
| Information Technology Advisers | 1 | 2 | 3 | 4 | 5 |
| An Information Technology course | 1 | 2 | 3 | 4 | 5 |
| Reading about Information Technology | 1 | 2 | 3 | 4 | 5 |
| Trial and error | 1 | 2 | 3 | 4 | 5 |
| Computer company personnel | 1 | 2 | 3 | 4 | 5 |

**15 From where do your students mainly access computers for teaching and learning:** (Please tick the appropriate box/es)

- computers in the classroom ❑
- computers in the library ❑
- computers in a computer room or suite ❑
- cluster or pod if computers available for your curriculum area ❑
- laptops that can be borrowed when needed ❑
- other (please specify) ____________________

**16 How often have you used Information Technology tools in your teaching and learning programme this year?** (Please circle)

| | | | | |
|---|---|---|---|---|
| Year 9 | once a week | once a month | once a term | less than once a term |
| Year 10 | once a week | once a month | once a term | less than once a term |
| Year 11 | once a week | once a month | once a term | less than once a term |
| Year 12 | once a week | once a month | once a term | less than once a term |
| Year 13 | once a week | once a month | once a term | less than once a term |

*Thank you for taking the time to complete this questionnaire.*

*Please post the completed questionnaire in the stamped addressed envelope provided or fax it to:*
*Jackie Halliday, School of Education, UNITEC Institute of Technology.*
*Fax no. 815 4181* **by 31st July 1999.**

# APPENDIX TEN

## Reminder letter to HODs

**Massey University**
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

**Learning and Teaching**
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

3 August 1999

HOD English
«School»
«street»
«street2»
«city»

Dear HOD

Recently I sent a questionnaire to your school regarding research for my Masters thesis on the *integration of Information Technology into the curriculum areas of English, Maths, Social studies and Science in secondary schools*.

I seek your assistance in completion of the HOD questionnaire and in selecting an Information Technology competent teacher in your area to complete the Teacher questionnaire. As yet I have not received the completed questionnaires from you or your nominated teacher.

As you know it is important when conducting research to have a sufficient sample from which to draw valid conclusions. As a former secondary teacher I understand how busy you and your teachers are and your cooperation in helping me to meet these requirements is greatly appreciated.

I have attached two further questionnaires (one HOD and one Teacher) in case you have mislaid the earlier ones. Your school will in no way be identified and the information provided will remain confidential. A detailed information sheet was included with the first questionnaires. If you would like another one or have any questions regarding this research please do not hesitate to contact me on Ph 376 4696.

Yours sincerely

Jackie Halliday

# APPENDIX ELEVEN

## Thank you letter to Principals who had returned *Permission to Participate* form

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

Learning and Teaching
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

Dear

I am writing to thank you for the excellent response I received from your HODs and teachers regarding the questionnaires I sent to you on Information and Communication Technology in Secondary Schools. I understand the workload of teachers at present and would like you to convey my thanks to them and my appreciation for the time and thought that they put into answering the questions.

There has been much anecdotal evidence about what is happening in Information and Communication Technology in secondary schools so it is very exciting to have some hard data to add to our knowledge. It will take me some time to analyse the data and write up the results of the study, however I will send you a summary of the results when it is completed.

I would like to assure you once again that all information provided by your teachers will remain confidential and that neither they or your school will be identified in any report of the study. If you have any questions concerning the research please do not hesitate to contact me.

Thank you once again for your cooperation.

Yours sincerely

Jackie Halliday

# APPENDIX TWELVE

Thank you letter to Principals
and asking them to sign
*Permission to Participate*
form

**Massey University**
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

**Learning and Teaching**
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

Dear

I am writing to thank you for the excellent response I received from your HODs and teachers regarding the questionnaires I sent to you on Information and Communication Technology in Secondary Schools. I understand the workload of teachers at present and would like you to convey my thanks to them and my appreciation for the time and thought that they put into answering the questions.

I note however that I have not yet received a permission slip from you. In order to complete ethical procedures I would appreciate it if you could sign the attached form and return it to me as soon as possible in the stamped addressed envelope provided.

It will take me some time to analyse the data and write up the results of the study, however I will send you a summary of the results when it is completed.

I would like to assure you once again that all information provided by your teachers will remain confidential and that neither they or your school will be identified in any report of the study. If you have any questions concerning the research please do not hesitate to contact me.

Thank you once again for your cooperation.

Yours sincerely

Jackie Halliday

# APPENDICES 13-26
## PHASE TWO

# APPENDIX THIRTEEN

## Letter to Principal

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

Learning and Teaching
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

15 October 1999

[redacted]
Principal
[redacted]

Dear [redacted]

You may remember at the beginning of Term 3 I sent out research questionnaires to HODs and a teacher in the curriculum areas of English, Maths, Social Studies and Science. This was Phase 1 of my Masters Thesis investigating the use of Information and Communication Technology in Secondary schools.

Phase 2 involves a Case Study of a school based on the data received in Phase 1.

I would very much like to conduct the Case Study in your school, [redacted]
An advisory group was not deemed to be required by the researcher and supervisor as the data clearly pointed to Tamaki College as a successful ICT using school, for example:

A preliminary analysis of the data shows that:

- the frequency of use of Information Technology tools, over all year levels, is relatively high at [redacted]
- the proportion of Depts who have Information Technology mentioned in their schemes is higher;
- a high proportion of respondents rated Information Technology as very important in teaching and learning
- all respondents gave the school the highest rating for support of Information Technology

This preliminary analysis also revealed interesting information, which in turn raises further questions:

- The most frequent use of Information Technology tools is by year 12 students. Why?
- The subject using Information Technology tools in the classroom the most is Science. Why?
- Many teachers are accessing Information Technology tools in the Library – 58% English, 55% Maths, 78% SS and 73% Science. What is happening in Libraries?

- Teachers report very low use of multimedia as a presentation tool in English and SS. What are the barriers here?

I would like to follow these up with your staff and students.
Tamaki College clearly recognises the value of using of Information and Communication Technology in teaching and learning and has a supportive environment to help teachers integrate it into their programmes. Therefore I would like to concentrate on the following question in the Case Study:
*What strategies are being used to facilitate the successful integration across these curriculum areas?*

Interviews will focus on:
- Planning
- Professional development for staff
- Siting of equipment
- Place of the library
- Types of learning activities
- Technical support
- Software being used

If you, the Board of Trustees, and staff agree to my conducting this research in your school I would like to use the following data collection methods:
**Interviews with personnel** (preliminary only at this stage. I will be guided by you):
- Principal
- TIC Information and Communication Technology
- Librarian
- At least two of the HODs who responded to the original questionnaire
- Another teacher from the four curriculum areas
- Two focus groups of 6 students each – year 9 and year 12

It is anticipated that these will be 20-30 minutes duration, and will tape recorded (with permission), transcribed, referred back to the participant, and analysed using qualitative research analysis software. Raw data will be kept in the home of the researcher and destroyed after successful completion of the Masters thesis.

**Documents**
- School Policy
- Dept Schemes
- Unit plans
- Examples of student work

**Observations**
I would like to observe one Yr. 9 **or** Yr. 10 lesson in each of the curriculum areas. The aim will be to obtain information on strategies the teacher uses, problems and solutions for the successful use of Information Technology tools such computer applications.

If possible I would like to conduct this research before the end of year and would like to negotiate a suitable time for this. I anticipate 3 – 5 days will be needed. I know that this term is a very busy one for schools and I will, of course, be discreet and fit around your teachers' busy schedules. I would like to assure you, your staff and students of complete confidentiality of information received and I would be more than happy to come and talk to staff about the proposed research.

First I would like to make an appointment with you to discuss the research, answer any questions and decide on a week suitable to you for access, if you are agreeable to the research proceeding.

Attached is a Participants' Information Sheet giving more detailed information about the research. I look forward to working with you, your staff and students to discover and document successful strategies for integrating Information and Communication Technology into teaching and learning programmes in secondary schools.

Yours sincerely

Jackie Halliday

Jackie Halliday
Ph 815 4398 (wk)
Ph 376 4696 (hm)

PS. I work at UNITEC School of Education and am doing my MEd through Massey University.

# APPENDIX FOURTEEN

## Subject Information Sheet

# Information and Communication Technology in Secondary Schools

**Masters Thesis**

**Participants' Information Sheet**
**Phase 2: Case Study**

I am Programme Leader in Education Technology at UNITEC Institute of Technology and am currently undertaking research for my thesis as part completion of a Masters in Education degree at Massey University.

As a former secondary teacher I am interested in finding out the extent to which secondary schools are integrating Information and Communication Technology into the curriculum areas of English, Maths Science and Social Studies.

This research is being conducted in two phases. Phase 1 collected data from a sample of Auckland schools. This data identified Tamaki College as a successful ICT-using school and was invited to be the case study school for further indepth investigation.

You are invited to be part of this investigation by participating in a semi-structured interview, but are in no way obliged to.
Your interview will be audio tape recorded for later analysis.

You are invited to provide some or all of the following for analysis:
examples of student ICT work
examples of unit plans and/or schemes of work

**Data and Confidentiality**
Your name will not be identified in any publications resulting from the research.
You will be identified only by your position in the school, "English teacher"
The tape will be transcribed by a professional who will be required to sign a confidentiality form.
The transcript will be returned to you for verification before being analysed.
The data will be stored in the home of the researcher.
The data on the tape will be destroyed at the successful conclusion of the thesis.
Other documentary evidence will be confidential to the researcher.

**Findings**
The findings of the research will be printed as a Masters Thesis (available from the Massey University Library) and also in subsequent journal articles. At the completion of the study a summary of the findings will be sent to all participants.

**Participants' Rights**
If you agree to participate in this research you have the right:

- To refuse to answer any question about the study at any time during participation;
- To ask any questions about the study at any time during participation;
- To withdraw at any time.

- To provide information on the understanding that your name, nor the name of your school, will be used unless you give permission to the researcher;
- To be given access to a summary of the findings of the study when it is concluded;
- To agree to participate in the study under the conditions set out in the Information Sheet

I look forward to working with you.

Yours sincerely

Jackie Halliday


| **Researcher**: | **Supervisors**: | |
|---|---|---|
| Jacquelin A Halliday<br>Programme Leader,<br>Education Technology<br>School of Education<br>UNITEC Institute of Technology<br>Private Bag 92 025<br>Auckland<br>Ph 09 815 4398<br>E-Mail jhalliday@unitec.ac.nz | Mark E. Brown<br>Lecturer (New Educational Technologies)<br>Department of Learning and Teaching<br>Massey University<br>Private Bag 11 222<br>Palmerston North<br>Ph 06 356 9099<br>(Extn. 8626)<br>E-Mail M.E.Brown@massey.ac.nz | Dr. Linda Selby<br>Head of Centre,<br>Information Studies<br>Auckland College of Education<br>Private Bag 92601<br>Symonds Street<br>Auckland<br>Phone 09 623 8899<br>(Extn 8543)<br>E-Mail l.selby@ace.ac.nz |

# APPENDIX FIFTEEN

## Student and Parent/caregiver Information and Consent Form

**Massey University**
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

Learning and Teaching
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

# EDUCATIONAL RESEARCH PROJECT
# ICT in Secondary Schools: a Case Study
## STUDENT CONSENT FORM

This research aims to find out what is happening in secondary schools about the use of information and communication technology in the curriculum areas of English, Maths, Social Studies and Science.

Your views as a student using these technologies for learning is an important part of the research.

You are invited to participate in a small focus group discussion. This will be tape recorded for later analysis. After analysis is completed the data will be destroyed.

Questions to be discussed will focus on your experiences using technologies such as word processor, spreadsheet, fax, CDRoms, the internet to help you in your learning.

---

- I have been given and have understood an explanation of the above-mentioned research project.
- I have had an opportunity to ask questions and have had them answered.
- I understand that I will not be identified in any way
- I understand that I may withdraw myself or any information I have provided from this project without penalty of any sort.
- I agree to the group interview with the researcher being tape recorded
- I understand that the tapes will be destroyed at the end of the research

**Student consent**

Name: ______________________________

Signature: ____________________ Date __________

**Parent/caregiver consent**

I give permission for ____________________ to participate in the Educational Research Project: Information and Communication Technology in Secondary Schools.
Parent or caregiver's name: ______________________

Signature: ____________________ Date __________

# APPENDIX SIXTEEN

## Subject Consent form

**EDUCATIONAL RESEARCH PROJECT**

# ICT in Secondary Schools: a Case Study

## SUBJECT CONSENT FORM

I have been given and have understood an explanation of the above-mentioned research project.

I have had an opportunity to ask questions and have had them answered.

I understand that my name will not be used in any public reports and that I may withdraw myself or any information I have provided from this project without penalty of any sort.

I understand that any documents that are provided by me will be confidential to the researcher.

RESEARCH SUBJECT

I agree to take part in this project
I agree to the interview being tape recorded

Name: ______________________________

Signature: ______________________________

Date: ______________________________

# APPENDIX SEVENTEEN

## Principal interview questions

## ICT in Secondary Schools
## A Case study

# Principal

### Interview Questions

What is your vision for the school?

Why have you made ICT a priority?

How was the decision made to have ICT as a priority?

How do you think this will affect students learning?

What reaction have you had so far?

- Teachers
- Students
- Parents

Are you developing any links to industry?

Where does the funding come from?

How do you cope with reluctant staff?

Is the strategy linked to the appraisal system?

How will you evaluate the strategy?

# APPENDIX EIGHTEEN

## HOD interview questions

## ICT in Secondary Schools
## A Case study

### HOD
**Interview Questions**

What types of learning activities are ICT mainly used for in your curriculum area?

Do you have a systematic progression through the year levels of activities that must be done to ensure all students have the opportunity to use ICT tools in their learning?

Where does the use of ICT best fit into your curriculum area?

How do you ensure equitable access by all students?

The initial questionnaires, over all subject areas, showed that Year 12 were the most frequent users of ICT. Why do you think this is so?

The initial questionnaires showed that there is a very high use of the library to access ICT. What sorts of activities do teachers in your curriculum area use the library for?

How do students respond to using ICT in their learning?

How are the teachers in your department responding?

How do you encourage reluctant teachers?

How is ICT knowledge shared amongst colleagues in your department?

Do you know what ICT and information literacy skill level the students enter the school with? i.e. do you know what they do at the local primary and intermediate schools?

What would be your ideal situation for using ICT in your classroom programmes?

# APPENDIX NINETEEN

## Teacher interview questions

# ICT in Secondary Schools
# A Case study

## Teacher

### Interview Questions

What types of learning activities are ICT mainly used for in your curriculum area?

Do you have a systematic progression through the year levels of activities that must be done to ensure all students have the opportunity to use ICT tools in their learning?

Where does the use of ICT best fit into your curriculum area?

How do you ensure equitable access by all students?

The initial questionnaires, over all subject areas, showed that Year 12 were the most frequent users of ICT tools. Why do you think this is so?

The initial questionnaires showed that there is a very high use of the library to access ICT tools. Does that fit with your experience?

How do students respond to using ICT on their learning?

Do you know what ICT and information literacy skill level the students enter the school with? i.e. do you know what they do at the local primary and intermediate schools?

What would be your ideal situation for using ICT in your classroom programmes?

# APPENDIX TWENTY

## Librarian interview questions

# ICT in Secondary Schools
# A Case study

## Librarian

### Interview Questions

What programs are available to the students in the library?

What sort of activities do students so when they come into the library to use ICT ?

Is there any difference between how each curriculum area?

Is there any difference between how each year level uses the library?

What level of information literacy do the year 9 students come into the school with?

Do you help students with information literacy skills?

Have you noticed any changes in the way the library is used in your time here?

How have you coped with these changes?

Have you had any professional development in the changing role of the library?

How does the Homework Centre work and is it successful?

Do you have any plans for the library for next year?

# APPENDIX TWENTY ONE

## Student interview questions

# ICT in Secondary Schools
# A Case study

## Student Interview Questions

### Year 9

What information technologies did you use at primary and intermediate school?

Did you use any multimedia programs like KidPix or HyperStudio?

What sorts of activities did you do with them? What subjects?

What have you used this year?

What subject areas?

Do you like using computer programs? If so why?

Do you feel they help you in your learning? If so how?

Describe briefly one activity you have done this year using information technologies.

What other ICT tools/equipment have you used this year e.g. digital camera, scanner?

### Year 12

What information technologies have you used this year?

What sorts of activities have you used them for?

What subject areas have you used them in?

Do you like using computer programs? If so why?

Do you feel they help you in your learning? If so how?

Describe briefly one activity you have done this year using information technologies.

What other ICT tools/equipment have you used this year e.g. digital camera, scanner?

# APPENDIX TWENTY TWO

## Transcriber confidentiality

## Information and Communication Technology in Secondary Schools

**Masters Thesis**

**Researcher: Jackie Halliday**

I agree to treat any information that is transcribed by me, from tapes used in the above research, confidentially.

Name: ______________________________

Signature: ______________________________

Company: ______________________________

# APPENDIX TWENTY THREE

## Letter to participants for transcript approval

Massey University
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

Learning and Teaching
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

12 November 1999

Dear

Thank you very much for allowing me to interview you recently.

Enclosed is the verbatim transcript of the interview for you to read and a space on the last page for you to sign to show that you agree that it is an accurate representation of the views and ideas you expressed.

If there is anything that you do not wish to be included in the research, or that you do not agree with, rule a line through the appropriate words/lines and this/these will be removed from the files.

Please sign the interviewee declaration on the last page of the transcript and tick the appropriate box and return the transcript in the stamped addressed enveloped to me by the 21st November 1999.

Analysis of the data will take some time. When it is complete a summary of the findings will be sent to you.

Thank you once again for your co-operation and the valuable information that you have shared with me.

Kind regards

Jackie Halliday

# APPENDIX TWENTY FOUR

## Interviewee declaration

## Interviewee declaration

*Please read the interview transcript and tick the appropriate box.*

I have read this transcript and concur that it reflects a true and accurate record of the interview I participated in. ☐

I have read this transcription and concur that it now reflects, after amendments, a true and accurate record of the interview I participated in. ☐

Signed: ______________________________

Name: ______________________________

Date: ______________________________

Please return this to me in the stamped, addressed envelope, by the 21st November 1999. Many thanks.

*Jackie Halliday*

# APPENDIX TWENTY FIVE

Final thank you letter to principal of case study school

**Massey University**
COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

**Learning and Teaching**
Private Bag 11 222,
Palmerston North,
New Zealand
Telephone: 64 6 356 9099
Facsimile: 64 6 351 3383

19 March 2001

[redacted]
Principal
[redacted]

Dear [redacted]

Please find enclosed a copy of the chapter regarding the case study of [redacted] that I conducted in November 1999 for my MEd thesis. Please accept my sincere apologies for the length of time it has taken me to write this work up. I think it is an occupational hazard for those engaged in this type of study while working fulltime! It has been a long, but rewarding, journey.

The thesis is about to be submitted and I will send an executive summary when the thesis has been passed. I would very much like to come and speak with your staff about the findings of the research. I realise that some time has elapsed since the data was gathered, however it will give the school some baseline data with which to measure progress, and new initiatives, since then.

Once again, thank you, and your staff, for all your co-operation in making this research possible, and for making me so welcome in the school.

Yours sincerely

Jackie Halliday
Ph 815 4398 (wk)
Ph 376 4696 (hm)

# APPENDIX TWENTY SIX

## Case study school's ICT Implementation Plan 1999 - 2000

# [redacted] COLLEGE

## AN IMPLEMENTATION PLAN FOR ICT 1999 - 2000

| SPECIFIC GOALS | ACTION NEEDED | PERFORMANCE INDICATORS | ACTUAL OUTCOMES | RESOURCES REQUIRED | MONITORING AND REVIEWING |
|---|---|---|---|---|---|
| Specific objectives for the year 1999 - 2000 | Tasks to be completed, when and by whom | Clear, specific indicators of expected outcomes | What was accomplished | Costs and personnel | Who is responsible and how quality is to be measured |
| **TEACHING AND LEARNING**<br>Integrate I.C.T. fully into Extension Class programmes year 9 & 10. | Extension class teachers | Extension class students use I.C.T. as a tool in all aspects of their curriculum<br>Use of I.C.T across curriculum and level groups | | ***All estimates***<br>Software – new programmes $1,000<br>Site licensing $12,000 per annum | D.P. I/C curriculum. Annual school review. |
| Integrate I.C.T into teaching programmes at all levels and bands. | Teaching staff | Students undertake a range of research projects across the curriculum and at a variety of levels using a wide range of resources including W.W.W., video, fax & phone. | | Some new software necessary.<br>$2,000 | D.P. I/C curriculum<br>Annual school review |

| | | | | | |
|---|---|---|---|---|---|
| Assess & Evaluate software usage & needs. | Curriculum committee – term 3 2000 | Usage & usefulness analysed & action plan drawn up to address issues. | | In- house. Costs – nil. | Curriculum Committee |
| Develop Internet policy & the methodology for students to use the W.W.W. as a resource for research | H.O.D. computing & H.O.Ds Policy - September 1999. Methodology – March 2000 | A range of research projects in most subject areas with a Internet component | | Teaching staff Internet connection $4,800 per annum. | P.D. Committee Annual school review |
| Develop the use of templates for student self analysis in the AIMHI ABLE assessment methodology | Teacher I/C ABLE and H.O.Ds On going throughout the year as units are developed. | Students use ABLE self assessment templates to record their own progress | | Teaching staff. Cost - nil. | Teacher I/C ABLE assessment. |
| Use I.T. as a revision tool for examination candidates | H.O.Ds & T.I.C. 'Study Buddy' in place, training undertaken. Other – ongoing. | Revision material available on school network. Revision programme in use. (Study Buddy presently on the | | Teaching staff | H.O.Ds & T.I.C.s |

| | | | | | |
|---|---|---|---|---|---|
| | | network) | | | |
| **SPECIFIC GOALS** | **ACTION NEEDED** | **PERFORMANCE INDICATORS** | **ACTUAL OUTCOMES** | **RESOURCES REQUIRED** | **MONITORING AND REVIEWING** |
| Specific objectives for the year | Tasks to be completed, when and by whom | Clear, specific indicators of expected outcomes | What was accomplished | Costs and personnel | Who is responsible and how quality is to be measured |
| **PROFESSIONAL DEVELOPMENT**<br>Assess needs of all staff. ( See Appendix 1) | August 1999 - Principal | Needs of staff determined. | | | Reviewed Term 3 2000 - Principal |
| Train minority of staff in basic computer applications | Basic word processing course. Term 4 1999 | Staff capable of word processing to an appropriate level. | | Afternoon courses – in house. | Principal – end of year review. |
| Continue training of 4 network administrators | Term 4 1999 Renaissance Ltd. | 4 qualified R.M. network administrators | | [redacted]<br>$3580 + $800 Day relief | Principal.<br>Ability to successful manage system on a day to day basis |
| Staff: Internet use | Term one 2000, In- house & outside facilitators. | Staff able to access the Internet – down load material, understand resources available, how to incorporate these into their programmes | | $1,000.00 approx. | Professional Development Committee<br>Goals set and measured through Curriculum review process |

| | | | | | |
|---|---|---|---|---|---|
| Teaching staff:<br>Use of curriculum related software | On going throughout the year | Staff of the extension classes and general staff use curriculum related software. Goal would be for all Departments to use Word &/or Excel as minimum. | | Curriculum software – as above<br>Costs – up to $3,000.00 | Curriculum committee – school review |
| All staff: Use of Intranet<br><br>*Note: 15 staff completed 'Infolink' course April to May 1999.* | Term 4 1999 | All staff are able to send and receive messages. | | P.D. – in house<br>Costs – nil<br><br>*Note: ITPD fund application made.* | T.I.C. Computing |

| SPECIFIC GOALS | ACTION NEEDED | PERFORMANCE INDICATORS | ACTUAL OUTCOMES | RESOURCES REQUIRED | MONITORING AND REVIEWING |
|---|---|---|---|---|---|
| Specific objectives for the year | Tasks to be completed, when and by whom | Clear specific indicators of expected outcomes | What actually happened | Costs and personnel | Who is responsible and how quality is to be measured |
| **ADMINISTRATION AND MANAGEMENT**<br><br>Introduce the RM School Management & Administration software. | Package installed, data transferred, staff trained – by Jan 31 2000 Senior Management team & R.M. staff. | New system installed and in use. | | To be negotiated | Principal. Operating functionality of the system |

| | | | | | |
|---|---|---|---|---|---|
| **INFRASTRUCTURE** | | | | | |
| Install wireless Internet connection. | Internet provider, September 1999. Provider technician & Teacher I/C computing. | New system installed and functioning. Multiple Internet use achieved from across the network | | 12 month contract @ $400 per month | Teacher I/C. Computing |
| Extend network to all classrooms. | Cable contractor, January 1999. | Remaining classrooms on line. | | $5,000<br>F.A.S. funds applied for. | Teacher I/C Computing.<br>Staff & students are able to access the network from classrooms. |
| Develop I.C.T. centre (Dependent on F.A.S. application) | Centre built March 2000.[redacted] architect, Building contractor, Principal – project manager | I.C.T. centre built and equipped. | | $350,000<br>$250,000 F.A.S. ,<br>$100,000 school funds. | |
| *OR*<br>Mobile computer pods for classrooms. | February 2000 | 5 sets of 6 mobile pods in operation | | $50,000<br>Teacher I/C computing | Teacher I/C computing. |

| | | | | | |
|---|---|---|---|---|---|
| Ensure Y2K compliance | August 1999 | Y2K compliant | | Teacher I/C computing | Principal |
| Continue video/T.V up grade. Link to computer network. | D.P. I./C. audio visual. May 2000 | Increase no. & quality of audio visual equipment. Staff & students begin processing audio visual information through computers. | | $3,000.00 | Principal – annual review process. |
| Conduct annual depreciation and equipment up grade analysis. | H.O.D Computing & Principal. October – as part of annual budget cycle. | Ensure currency and functionality of equipment and resources. | | Allowance made for 4 year depreciation cycle. Up grade dependent on technical advances. | Principal & Board of Trustees. |