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Notebook technology – an Information Communication Technology innovation in action

**A case study of notebook computer
enhanced education at a boys
independent secondary school
in New Zealand**

By

Duncan Andrew McQueen

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of the requirements for the
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Abstract

The use of notebook computers within educational institutions has been a relatively recent innovation. There is only limited research into the impact of this Information Communication Technology (ICT) innovation within secondary schools, particularly within the New Zealand context. The implementation of a school wide notebook programme at a New Zealand secondary school has been the setting for this research. After completing a comprehensive literature review, a two phase case study research approach was used employing both quantitative and qualitative data collection.

This study investigates the perceptions of the three key stakeholder groups, staff, students and parents, who participated in a notebook enhanced teaching and learning environment. Written surveys were conducted with samples of each of the different stakeholder groups. Areas such as participant attitudes, preferences and ICT utilisation were investigated. Possible differences attributable to student academic ability were also considered. These surveys were followed by focus group discussions with two groups of staff and also a student group. The data was analysed and examined in the context of previous related ICT research and specifically with reference to other portable computer studies in the field of education.

The findings suggest that the notebook programme has, in general, had a limited impact on the teaching and learning at the school. However for some individuals ubiquitous notebook usage has been a positive experience, while for others it has been a negative experience. In general participant perceptions were diverse and for the most part reflected their own experience within a notebook enhanced learning environment. There is a complex interaction between a number of variables, some of which appear to be beyond the control and influence of the participants. These issues include: staff and student ICT literacy and motivation, appropriate classroom usage of the technology, opportunities and support for staff professional development, notebook computer reliability and functionality.

The findings from this study have the potential to assist those in educational institutions considering or currently involved in similar notebook enhanced programmes. In

addition the research has provided the particular school with an in depth case study of the recently implemented notebook programme at the Year 9 level.

The study presents a series of possible recommendations and avenues for further research. It highlights the key factors and barriers to an effective student notebook programme. The findings of the research suggest that the notebook programme was generally considered a worthwhile and effective innovation within the unique setting of the school environment investigated.

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Candidate's Statement

I declare that this thesis is the result of my own work, except where due acknowledgement has been made. It has not been submitted, in part or in full, at this University or to any other institution for a degree, diploma or other qualification

A handwritten signature in black ink, appearing to read 'Duncan McQueen', with a long horizontal flourish extending to the right.

Duncan McQueen

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List of Abbreviations

- AAL** 'Anytime, Anywhere Learning' programme initiated by Microsoft Corporation and Toshiba America Information Systems.
- ACOT** 'Apple Classrooms Of Tomorrow' programme initiated by Apple Computers Inc.
- ERO** Education Review Office
- ICT** Information Communication Technology
- ILS** Integrated Learning System
- IT** Information Technology
- ITAG** Information Technology Advisory Group (New Zealand)
- HOD** Head of Department
- MOE** Ministry of Education
- NCEI** New Classroom Environment Instrument, designed by Newhouse (2001)
- NCEA** National Certificate of Educational Achievement
- SKC** Saint Kentigern College
- SNAP** Student Notebook Access Plan

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Chapter 1

Introduction

The significance of ICT and notebook technology in 21st century education

There is both an increasing emphasis on and a growing appreciation of the importance of Information Communication Technology (ICT) within the educational context. This is in part reflected in the international focus on the increasing use of notebook technology in education. For example, in *Time* magazine an article was speculatively entitled 'A Laptop for every kid – More schools are convinced they're worth the cost' (Time, May 1 2000 : 37). Is this drive for smaller and faster technology a sign of what is to become the 'norm' for educational institutions in the new millennium? In 2000, in the United States, the Governor of Maine proposed a funding programme whereby all seventh grade students in the state would receive the use of a notebook computer (Stager, 2000). Recently, in June 2001 a New Zealand government initiative was launched as part of the Digital Opportunities programme, with the establishment of the Notebook Valley project. This project centred on four Hutt Valley State schools, which were provided with notebook technology for staff and students (Te Kete Ipurangi, 2002). Currently a number of New Zealand independent schools have operational student notebook programmes, as do many other institutions overseas and clearly it would appear that the use of notebook technology within education is set to increase in the coming decade.

The study of the effect and impact of notebook computers in education is a relatively new field of research and as such independent rigorous and trustworthy published research reports are scarce. In New Zealand Halliday made the observation that 'there has been little in-depth investigation into student use of computers' (2000 : 29). The present study may add to the steadily increasing body of information pertaining to notebook enhanced learning within secondary schools. Whether there is any significant benefit in terms of academic performance of using notebook technology in the classroom has yet to be clearly demonstrated. However one has to question how such a correlation could possibly be demonstrated given the unique complexities of school life

and the many variables involved in the education and more importantly the learning styles of students (Lai, 1992). Thus, this is an exploratory study which seeks to understand the 'conditions' of notebook use in schools rather than an attempt to show the 'effects' of learning with technology alone.

As Blackburn suggests, 'there is very little documented evidence proving that the use of computers in schools actually improves the learning ability of students' (1999 : 26). However this begs the question as to why should we expect technology alone to improve learning? It will be the evolution of a new educational philosophy that assimilates the functionality of the technology available in such a way as to enhance student development and understanding that will ultimately bring about further improvements in teaching and learning.

This study of a student notebook computer programme will aim to tell a story; it seeks to observe, describe and understand the use of notebook computers within a 'bounded system' (Stake, 1980) of one New Zealand secondary school. This research alone can not resolve the potential issues and concerns raised regarding the use of notebook computers in the classroom. It aims to add to the knowledge base and understanding of this form of ICT innovation within the context of a New Zealand educational institution. In this regard it hopes to make a valuable contribution to future ICT programme developments with respect to the use of notebook technology within the classroom learning environment. Indeed, in the context of student notebook programmes, it has been stated that 'identifying what is happening and the successes that are emerging will be vital if parent support and the support of others is to be maintained' (Passey, et al., 1999a : 105).

Background to the study

In 2000, Saint Kentigern College (SKC) witnessed the introduction of a fully integrated notebook enhanced learning programme for Year 9 students (Form 3). Prior to 2000, participation in the student notebook programme had been voluntary. During the past five years the College, in partnership with Toshiba New Zealand, has introduced the Student Notebook Access Plan (SNAP). SKC has the expressed goal of having all students utilising notebook technology as a tool in their classroom studies by 2003. The

infusion of notebook technology within a strong existing curriculum has been the prime objective of the college notebook programme. As the SKC website (2001) states:

ICT is a curriculum tool. It will be, where appropriate, used to enhance and facilitate student learning and to create learning opportunities that otherwise may not be possible. This will ensure that our students are equipped to meet the demands of the workplace in the 21st century.

SKC is one of the leading schools in introducing this ICT innovation and has taken an active role in the promotion and development of New Zealand based notebook computer programmes. In past years at the Toshiba sponsored 'Expanding Horizons' conferences, both in Auckland (2000) and in Christchurch (2001), a significant number of the workshop sessions have been led by members of the College staff. Given the unique high profile position of the College within the community, and its role in leading the introduction of notebook technology within the classroom, SKC is ideally suited as the context for this study.

The belief that the student notebook programme is worthwhile is not sufficient and rigorous evaluation is required to establish if the notebook programme has had the desired impact and has enhanced the learning opportunities afforded at the College. We know that in the past many schools and school systems appear to have given relatively little consideration to how computers are utilised once they have them in place (Schofield, 1995). As Mumtaz (2000) states:

Even if teachers are provided with up-to-date technology and supportive networks, they may not be enthusiastic enough to use it in the classroom. Teachers need to be given the evidence that ICT can make their lessons more interesting, easier, more fun for them and their pupils, more enjoyable and more motivating (2000 : 338).

There is a strong case as Willis, Thompson and Sadera (1999) have argued, for more systematic case studies that document the way innovations in the use of technology have been implemented. Thus with this in mind, this thesis will provide further brush

strokes in the portrayal of the use and integration of ICT in schooling in the new millennium.

The researcher's perspective

At the commencement of this study, the researcher was the Dean of Year 9 (Form 3) and had the responsibility for the overall academic programme of this group of 200 students. This gave the author regular contact with students, fellow staff members and parents, some of who were unfamiliar with the College notebook programme. The researcher is a committed notebook teacher and the majority of his teaching groups (Year 9 – 11) in 2001 were notebook classes and the study takes place within this setting.

For obvious reasons the researcher was keen to study this significant innovative educational development at the College. Unlike other studies this dual role provides a unique 'insiders' view on a student notebook programme. This is considered a strength of the current research study, as this position offers a deeper and richer understanding of the context and culture of a notebook programme.

Structure of the thesis

This thesis commences with a description of the literature relevant to the study in Chapter Two. In this chapter, a critique of the relevant ICT literature, together with the researcher's own experience of teaching within a notebook enhanced learning environment, leads to the development of the research objectives. Chapter Three provides a detailed account of the case study methodology undertaken, while Chapter Four reports the data. Interpretation and discussion of data and comparison with other studies is completed in Chapter Five. Chapter Six outlines a general discussion of notebook related issues, together with a critical evaluation of this research leading to questions and issues for further research. Finally, Chapter Seven concludes with a summary of the study, together with a series of recommendations for the future.

Chapter 2

Literature Review

Introduction

This literature review discusses the relevant notebook technology literature and aims to set the current research within the wider context of Information Communication Technology (ICT). The review addresses a number of general aspects of ICT in the New Zealand context and in chronological order it outlines the major research literature on notebook use in education. It highlights a gap in the research literature and establishes the research problem for this study. It concludes by presenting the objectives and the associated research questions to be investigated.

The terms 'notebook' and 'laptop' are both commonly used in the literature to describe portable computers and thus have been considered as synonymous terms. Throughout this thesis the term 'notebook' is used as the preferred descriptor.

There is debate as to precise definitions of Information Technology (IT) and Information Communication Technology (ICT). The New Zealand national ICT strategy for Schools (Ministry of Education, 1998) defines these 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 (MOE, 1998 : 5).

Others have offered differing definitions of IT and in particular ICT. Brown (1995) suggests a broader possible definition for ICT that focuses on the human use and interactions with the technology, with the possible utilisation of a wider range of equipment, be these electronic or not, to solve problems. Brown states that ICT could be considered as:

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

It is apparent that the terms hold different meanings to different individuals and groups. In the context of this research the term ICT will be used as a generic term to cover the broadest possible aspects of the use of computers and related equipment within a secondary school setting.

Notebook education in the broader context of ICT

There has been an emphasis on the role of ICT within the educational system over the past two decades. In part, this is due to the increased availability and reducing costs of IT equipment. Together with the evolution of an increasingly technology rich business environment, these factors have led to calls within the education system, the government and society for a so called 'knowledge economy' with ICT as one of the essential components.

The increased emphasis of ICT within education has been propelled by a number of complimentary and competing motivating forces. Some are based on; vocational, economic and commercial, marketing, cost-effectiveness and the educational pedagogical rationale for the use of effective ICT (Brown, 1997a).

The report of the Consultative Committee on IT in the School Curriculum (Sallis, 1990) was one of the first major documents in educational computing within New Zealand. It established the following two policy goals:

- All students should be given opportunities to increase the efficiency and effectiveness of their learning through the appropriate use of information technology.
- All students through access to appropriate information technologies will leave school with the necessary skills to take their place in an information society.

However due to changes to the political landscape related to the formation of a newly elected government that same year, few of the recommendations of the Sallis report were fully implemented (Hodson, 1992).

The next important step was the inclusion of Technology as one of the core learning areas within the New Zealand Curriculum Framework (Ministry of Education, 1993). This reaffirmed the Government's position that information and communication technology was a key aspect of education. It was identified as one of the seven technology strands within the National Curriculum Framework.

ICT and teaching philosophy

In 1993-94 Dowden (cited in Dowden and McMillan, 1996) completed a series of qualitative interviews using a small sample of Dunedin science teachers, to assess their perceptions and beliefs about ICT in secondary schools. The study concluded that teachers' beliefs about using technology in their science teaching was closely related to their beliefs and ideas about teaching and learning in general.

The recognition of the impact of teaching philosophy on the use of ICT was further developed by Brown (1998) who wrote a critical review the evolution of computer use in New Zealand schools from the early years of information technology in schools and asked what it meant to be a 'good' ICT-using teacher. The author stated a good ICT using teacher would be a thinker first and a competent ICT practitioner second, with a well developed philosophy of teaching based on a contemporary and critical

understanding of current educational theory. This raises the question of which theoretical perspective teachers should adopt to facilitate effective teaching and learning utilising notebook technology.

Theoretical perspectives

Many have linked the effective use of ICT with particular theoretical perspectives. The range of these is diverse and Kearsley (1992) has identified over fifty theories relevant to instructional innovations. It has been recommended that a blend of theoretical frameworks be used to ensure all learning styles are catered for within the notebook classroom environment (Newhouse, 1998). After an extensive review of the relevant literature Hill, Reeves and Heidemeier (2000) proposed that there were four major theoretical perspectives that could be used to guide the design, implementation and any evaluation of a notebook programme. These are:

- Constructionism as a pedagogical orientation (Papert, 1993)
- Learning environment models (Perkins, 1991; Wilson, 1996)
- Factors of school learning models (Carroll, 1963; 1989; Schank, 1995)
- Classroom technology integration models (Rieber and Welliver, 1989)

(cited in Hill, Reeves and Heidemeier, 2000)

Clearly there is a need to understand these different theoretical perspectives in terms of the influence and impact they bear on the teachers participating in a technological innovation such as the student notebook programme at SKC. Indeed, each of these theories has something to offer in the interpretation and evaluation of any innovation.

ICT in the classroom

There has in the literature been an identification of differing enduring forms of classroom computer use. Taylor (1980) proposed three modes for computer use; as a tutor, a tool and as a tutee. These broad conceptions have been used to describe and identify a diversity of differing pedagogical approaches and specific software applications that have been developed over the past twenty years. In the 1980s the 'tutor' mode was evident with emphasis on computer-assisted instruction (CAI) and

computer-assisted learning (CAL) as the prime use of ICT within the classroom, though in time the value of this form of computer use came into question (e.g. Miller and Olson, 1994). The tutee approach was personified by student use of computer software programmes such as LOGO, where students learn how to teach the computer (the tutee) using open-ended software programmes, to develop their own programmes and to reach solutions in problem solving situations.

The 1990s witnessed an increase in schools using technology as a tool to support student and teacher inquiry rather than as a substitute teacher or electronic workbook (Means, 1994). In recent years, there has been a trend in a number of schools to move from the more traditional teaching model of computer laboratories and stand alone desktop machines in classrooms to the introduction of individual notebook computers for students to be used actively within the students' own learning environment. The form of computer use tended to be more generalised and less emphasis was placed on the 'drill and kill' approach of CAL and some Independent Learning systems (ILS) (e.g. Hill et al., 2000; Newhouse, 1998).

By the mid 1990s the computer was no longer seen as the 'computer-as-teacher', and this was marked by a shift in emphasis to the view of the 'computer-as-learning tool' (Hodson, 1992). According to Bulter (1997) there has been a shift in information learning in society at large and this has begun to flow through into the schooling system. The introduction of student ownership of individual notebook computers can be seen as a logical consequence of this 'learning tools' approach and as a total infusion of enriched technology within classroom education (Stager, 1999). Thus notebook learning environments are arguably a unique and timely context in which to study the impact and integration of ICT into the lives of both students and staff.

It is apparent that accessibility is still a problem within New Zealand secondary schools. As outlined by Coogan (2001), the reality of many classroom teachers is that ICT accessibility is still a barrier to the integration of ICT by teachers, as seen in a survey of English teachers in New Zealand secondary schools. The issue of accessibility is perhaps not as significant as it has been (Ham, 1989) and the advent of portable computer technology may have a major impact on eliminating many of the common

practical problems associated with attempting to infuse ICT into the curriculum within the classroom environment (Ainley et al., 2000; Stevenson, 1999).

ICT lab or classroom use within schools

The problems of access are particularly evident in the ongoing debate over the use of ICT in laboratories or computer suites as distinct from the normal classroom environment. There has been considerable discussion on the use of computer laboratories within secondary schools and there is debate as to the effectiveness of this approach. There are justifications for both modes of ICT integration into the curriculum (Tiene and Ingram, 2001). Computer laboratories are considered to have some advantages, yet given the 1:1 ratio of computers to students obtained in a notebook programme the use of centralised computer laboratories is effectively redundant. It has been argued for quite some time that to be effective ICT must move from the IT laboratory into the classroom if it is to be truly integrated within the learning environment of schools (Salomon, 1990a). Morgan (1996 : 50) suggests that:

As long as computers reside in centralised laboratories, learning will continue to focus on the technology rather than on using the technology to enhance the learning of language, history and science.

The classroom use of notebook computers may be considered in a unique way to be the fulfilment of this statement. Now that computers are within the normal classroom environment, whether the emphasis is really on enhancing student learning of the curriculum or not remains a potent question and one which this research seeks to consider. Regardless of location, it is 'how' ICT is used that is the fundamental issue. There are alternatives to the laboratory approach and there is considerable support for ICT infusion within the classroom environment. One response to this has been the student use of notebook computer technology and this has been the path adopted by a number of schools including SKC in recent years.

School notebook programmes

There have been a number of initiatives that have brought about the development of learning cultures that utilise notebook technology within selected secondary schools. Notebook schemes have been implemented to varying degrees in many nations around the globe, for example, in the United States, Canada, United Kingdom, South Africa and Australia. Within New Zealand there are an increasing number of institutions with notebook programmes for students and/or staff. Burnside School, Corran School, Diocesan School, King's College, Kristin School, Saint Cuthbert's College, Tawa School, and Wellington Girls' College are examples. In 2001 the Notebook Valley project in four Hutt Valley secondary schools was initiated by the Ministry of Education in an attempt to address and research the digital opportunities within state secondary schools (Te Kete Ipurangi, 2002).

Overview of notebook use within educational institutions

In 1990 the Methodist Ladies' College (MLC) in Melbourne developed the first secondary school classroom notebook programme in Australia, and possibly the first in the world (Little and Dixon, 2000). At MLC the educational approach moved from instructional teaching towards a predominance of student-focused learning and constructive learning styles (Loader, 1993). Other schools, such as Penrhos College Perth, Trinity Grammar School Melbourne, John Paul College Brisbane and Coombabah State School in Queensland followed suit during the 1990s. It is noteworthy that largely because of the expense associated with providing individual notebook computers these student programmes in Australia, and those known to exist in New Zealand, have generally remained within the domain of independent educational institutions

In North America, the student use of portable computers had been introduced in some university departments during the late 1980s and early 1990s (The Node Learning Technologies Network, 1999). One of the school pioneers was Brewster Academy New Hampshire, which initiated the phase introduction of portable computer technology using Apple computers. The development of a new model of school culture at Brewster Academy was instigated by Alan Bain and has been described as the School Design Model (Bain, 1996). Students participating in the notebook programme were found to

have increased Standardised Achievement Test (SAT) scores, and ICT skills levels. The Brewster Academy also recorded higher than average student retention rates (Brown, 2000). These findings, however, need to be treated with caution in the light of the possible Hawthorn effects.

In 1996, Microsoft Corporation and Toshiba America Information Systems began a laptop computer pilot programme in 52 school sites across the United States. The 'Anytime, Anywhere Learning' (AAL) programme expanded to include over 800 schools and 125,000 students and teachers using notebook computers powered by Microsoft Office software (Microsoft, 2000). The aim of the programme was to provide students with access to 'real world' business tools to enhance student learning and performance (Rockman, Chessler and Walker, 1998). The AAL programme expanded and established a pilot programme of 28 schools in the United Kingdom and the State of Jersey between May 1998 and February 1999 (Passey, et al., 1999a). Despite the aforementioned initiatives, there remains a lack of independent systematically derived evidence as to their success.

The Copernicus Project in Washington State focused on the infusion of portable computers into a variety of components of the curriculum (Fouts and Stuen, 1997). The findings of a three year evaluation study indicated that word-processing, spreadsheets and presentation software being the most commonly used software. The results, however, suggested that up to half of the teaching time was spent on teaching computer skills. This data raises the concern over the emphasis of time and energy devoted to ICT skills and training as opposed to a more appropriate balance which addresses the wider teaching requirements of the curriculum found in educational institutions.

It is claimed that between 1996 and 2000 over 150,000 students and teachers worldwide have acquired access to individual notebook computers through educational programmes (Kids Technology Foundation, cited in Little and Dixon, 2000). These range from a single class notebook programme conducted at an international school in Beijing (Rysdale, 1997) to more than 1250 schools with pilot notebook programmes in the United Kingdom, Belgium and Canada by 2000 (Microsoft, 2000). Although these data are problematic, they show that the use of notebook technology is global. The term 'ubiquitous computing' has been used to describe the wide spread availability of

portable, networked technologies. These systems offer high levels of access to computing tools where students can be empowered to use technology at anytime and in any place and for any function (Hill, Reeves and Heidemeier, 2000).

In 1998, the Texas Board of Education went as far as to propose that the state replace all textbooks with CD-Roms and that a state funded leasing programme for portable computers for nearly 4 million students be instituted (Mendels, 1998). The proposal has not been adopted, but it serves to focus attention on 'how significant a role new communications technologies should play in the schools of the twenty-first century' (Tiene and Ingram, 2002 : 112).

The 'all or none' debate

The debate over 'voluntary' or 'compulsory' student participation in notebook programmes has been a thorny issue in the implementation of some school programmes (see Lightfoot, 2001). There is evidence that attempting to function with mixed classes of users and non-notebook users is a major barrier to the successful integration of notebook technology (Stevenson, 1999). Initially in the late 1990s SKC ran a pilot scheme whereby at the time of their enrolment at the College families could chose to join SNAP and the students were accordingly grouped into notebook or non-notebook classes on the basis of academic ability. The year 2000 saw compulsory usage of notebook computers by all Year 9 students and investigating the effects and consequences of this policy is one of the primary aims of this study. Similar investigations have been made overseas and the data suggests mixed student classes of notebook and non notebook users have been problematic and at times ineffectual (e.g. Newhouse and Rennie, 2001; Stevenson, 1999).

Thus far the literature review has considered the use of notebook technology as a standalone innovation. In the following section the broader issues related to notebook use in the context of general ICT research will be outlined.

Research related to ICT programmes

The implementation of technology rich learning environments has seen a rapid expansion in the past decade and documented research on the impact and value of this shift in classroom practice has only in the past decade begun to appear in the literature. In 1994, Herman suggested that research and evaluation of innovative and complex reform projects had failed to produce definitive evidence that ICT had in reality had an effect on student learning, teacher productivity and remarked that there had been no clear answer to the often asked question as to whether investment in ICT was cost effective and worthwhile. The following section provides an overview of selected ICT research at both the international and national level, and reviews the contribution of past ICT research in the context of notebook education.

International research

One of the earliest large scale educational computer studies was the Impact research undertaken in the United Kingdom. It was designed to investigate and make an assessment of longitudinal effects of IT within schools across a range of age groups and subject areas. It found that IT did make a contribution to student learning and their achievement, but the relative impact of this initiative was related to a range of factors. In particular, the positive influence of individual teachers was significant. Also it was observed that the contribution of IT was not consistent across curriculum areas or year groups (Johnson, Cox and Watson, 1994).

There have been a number of studies of the educational benefits and impact of ICT in schools. The research programme 'Apple Classrooms of Tomorrow' (ACOT) from 1985 to 1998 was sponsored by Apple Computers. It was a long-term open ended research programme into the use of personal computers within a range of educational institutions in the United States (Fisher, Dwyer and Yocam, 1996). It evolved into a sustained attempt to find useful ways to support student learning with a wide variety of digital tools. During the thirteen years of research, ACOT studied learning, assessment, teaching, teacher development, school design, the social aspects of education and the use of new technologies in more than 100 elementary and secondary classrooms. ACOT

also collaborated with schools internationally to explore constructivism mediated by technology, emphasizing collaboration over the Internet.

As the appropriate technology has developed, the ACOT programme moved to use portable notebook computers, rather than providing each student with access to two desktop machines, one in the classroom and another at home. Data produced in the technology enriched learning environments of the ACOT programme will be used for comparison with data to be collected in this thesis. The difference in the type of computer hardware used, whether it be a desktop or portable computer, is only one factor in a complex picture.

In a more recent UK study of ICT practitioners, the use of ICT was reported by teachers to make lessons more interesting, more motivating and enjoyable for students and more diverse. ICT usage was seen to improve the presentation of teaching materials and make teachers' administration more effective (Cox et al., 1999: cited in Mumtaz, 2000). Thus, from an international perspective it can be seen that there has been recorded a number of positive effects as computing technology has become more widely used within educational institutions.

New Zealand research

Within the New Zealand education system most of the published research relates to ICT in schools based on desktop and/or computer suite delivery of ICT. Clearly there is a gap in the research in relation to notebook technology. Any such research, nevertheless, must be conducted within the context of earlier works. The lesson is that it must avoid a technocratic emphasis and instead focus on developing an in-depth understanding of notebook use within an educational setting.

Most of the quantitative data found in some of the earlier New Zealand studies, such as that carried out by Nightingale and Chamberlain (1991) as part of an international study in 1989 under the auspices of the International Association for the Evaluation of Educational Achievement (IEA), offers a techno-centric perspective of ICT in schools. The study, although rich with baseline data on computers and related equipment in use in schools, took 'little account of the overall learning context' of computer use in the

classroom (Brown, 1998 : 5). However a case study of two secondary schools by Chamberlain and Kennedy (1991) did provide more contextual information regarding student and staff computer use. Indeed, this study is arguably the one of first of its kind to provide a more holistic perspective of computer use in a NZ secondary school.

Research completed in the Palmerston North region, admittedly with primary teachers, (Adams, Adams, Cheng and Sutherland, 1992) surveyed the attitudes and perceptions of teachers towards computer use. At that time, the majority of teachers expressed the view that word processing was the most desirable use of computers, as had been found in other overseas studies of that era (e.g. Woodrow, 1991). It is one of the intentions of this research to investigate similar research questions in the context of a notebook enhanced learning environment in a New Zealand secondary school. A decade later, it is timely to consider once again the attitudes and perceptions teachers' report in relation to ICT.

McKinnon (1995) and Nolan, Ayres, Dunn and McKinnon (1996) reported on a five year longitudinal case-study of the use of ICT for learning at Freyberg High School, Palmerston North. The study concluded that students within an integrated studies programme, with additional ICT components achieved significantly better School Certificate results in English, Mathematics and Science. However, one needs to question whether the improved performance was due in part to the special programme and additional focus given to this group of students, rather than to increased access to ICT within their learning environment? Moreover, the study raises some ethical concerns in today's context, in terms of equity of resourcing and input, that a specific group of students may receive. It was observed at Freyberg High School that the students involved in these programmes came to view computers as 'a normal part of their working environment' (Bulter, 1997 : 16) and appreciated them as a tool for enhancing their learning. This suggests that in a similar vein, one could expect notebooks to be quickly accepted by students within their regular classroom activities and learning environment.

As part of their obvious interest in the school sector, the Telecom Education Foundation (1996) surveyed schools on the availability and use of ICT hardware within schools. Their data showed an increasing availability of desktop computers within both primary

and secondary schools. Similar research undertaken by the Information Technology Advisory Group (ITAG) (1998) considered the issues of ICT funding, access to ICT equipment and telecommunications and professional development of teachers within schools. The ITAG survey did address the issue of principals' attitudes about the value and potential of ICT and concluded that as a group principals were persuaded of the value of ICT, with 82% of secondary principals strongly agreeing that it is important students leave school with basic computer skills.

In a recent report of randomly selected primary and secondary schools by the Learning Centre Trust (2001), it was concluded that the ratio of computers to students is now one computer for every six secondary students. This figure excludes computers used mainly for administrative functions. The survey also found that all the secondary schools had Internet access. Whether student use and/or access is either via desktop machines or notebook computers is not indicated, however it is clear that increasingly students have a wider range of ICT solutions to enhance their learning.

However, research undertaken by the Education Review Office (ERO) (2001) found that many state schools had not yet made the shift in their thinking from the practical implementation of ICT to focus on the successful use of ICT within the classroom. The report found that, in general, ICT was not well integrated into the curriculum, and there were few demonstrable ways in which it had improved teaching and learning. Like previous ERO reports on ICT (e.g. 1997 and 2000) the data was collected from a range of schools. The schools were broadly representative of all New Zealand schools in terms of type, size, socio-economic decile and geographic area. These reports collectively provide sound quantitative data from which to judge the use of ICT within educational institutions within a national context.

However, at the same time, these surveys provide a general snapshot only of ICT perceptions and practice; they lack a fine grain analysis of what is really happening in schools. This is why the study by Boyd (1997) on behalf of The New Zealand Council for Educational Research (NZCER) is noteworthy. Boyd's research was based on the study of Palmerston North Girls High School and presented more comprehensive qualitative and quantitative data. The scope of Boyd's study is impressive and it provides a sound foundation for a smaller study on the use of notebook technology

within a secondary school context. Aspects of that study readily apply to research on the use of notebook computers in New Zealand secondary schools

In 2000, from the observations of a study tour into the impact of ICT on a number of overseas schools, with a particular emphasis on classroom design and curriculum delivery, it was concluded that the nature of schooling would significantly change in the coming decades (Eadie, 2001). While recognising the technocentric and perhaps deterministic nature of Eadie's report, it could be suggested that the ubiquitous notebook usage by students may be one of the driving forces that will be instrumental in bringing about fundamental changes within education.

In another recent study, Halliday (2000) investigated the extent of the integration of ICT into the core secondary school curriculum areas. This study of 18 schools, together with an individual case study of a specific school, revealed that there is a complex and finely balanced relationship between many relevant contributing factors. These variables include: school policies, professional development, teachers' learning styles and level of enthusiasm and knowledge of ICT. This underscores the need for future research to take into account the entire context within which the technology is used rather than the technology innovation alone. The study also highlighted the need to overcome the common barrier of availability of computers and the ease of access to their location within the institution (Halliday, 2001).

It is likely that access and availability issues would be minimised in an independent school setting such as SKC. Within a notebook classroom environment, the availability and access barriers to the integration of ICT are eliminated by the student use of individual portable computer technology.

In summary, this section has illustrated the findings of a range of the more generalised research into ICT programmes and has considered some of the implications of these studies in relationship to an investigation into a student notebook programme. The next section focuses specifically on studies on notebook technology both overseas and within New Zealand.

Research specific to notebook technology

This section highlights the research directly related to the classroom use of notebook technology. The portable computer was the product of advances in technology during the late 1980s and 1990s. With each new development the processing power and numerous other specifications have been upgraded and expanded. When reviewing notebook research it is important to keep in mind that the 'impossible then is now the possible' and the findings of previous studies may not be completely relevant to the current situation in the 21st century classroom.

An international perspective

One of the earliest investigations based specifically on the use of portable computer enhanced learning was a study of 26 secondary school students using the Z88 portable computers developed by Cambridge Computers in the United Kingdom (Peacock and Breese, 1990). Despite the novelty factor, very few benefits were recorded and the study was limited as the students had only six months of classroom experience of portable computer technology.

The larger 1992 PLAIT (Pupils' Learning and Access to Information Technology) project undertaken in Northern Ireland, involved 235 students in nine schools each being given their own portable computers to use for one year (Gardner, Morrison, Jarman, Reilly and McNally, 1992; Gardner, Morrison and Jarman, 1993). The study found that IT related learning enhancement was easily demonstrated, however curriculum related learning enhancement was less apparent and difficult to measure. Using standardised pre and post tests in English, mathematics and science and comparing the performances of both experimental and control groups of students, they found that the use of notebook computers had no statistically significant effect on student achievement levels. However, an interpretation of the PLAIT study, concludes that 'portable computers were functionally capable of providing for all aspects of the curriculum' (Boyd, 1997 : 5). These sentiments are important in light of the more recent development of notebook programmes across a far wider range of educational establishments. The use of control groups in the study, which could have led the control

group students to be considered 'disadvantaged', would probably be considered an unethical methodology today.

At a similar time research undertaken across England for the National Council for Educational Technology (NCET) in over 100 primary, secondary and special schools, found that portable computers had potential educational benefits. The use of portable computers was viewed positively by participants in the study. Yet it was noted that student and teacher computer literacy was a barrier to effective classroom usage (Stradling, Sims and Jamison, 1994).

Following the introduction in 1996 in the United States of the 'Anytime, Anywhere Learning' (AAL) programme, this innovative student notebook programme was investigated over a four year period by Rockman et al., (1997, 1998, and 2000). The data based on student and teacher feedback explored 'when and how computers are used, their impact on teaching and learning, and the participants' assessments of their experiences' (Rockman et al., 1998 : 6). In addition, the research evaluated the use of ICT by notebook students with a control group of non-notebook students at the same and/or different schools. The comparative findings revealed that notebook using students spend more time collaborating with their peers and also directed their own learning and increased their creativity, in comparison with the non-notebook students. Notebook students showed greater evidence of applying higher-order-thinking skills (HOTS) to big picture, strategic issues rather than to information gathering and procedural issues (Rockman et al., 1998). However these findings must be viewed with a degree of caution as they are based largely on student and staff responses to survey questions, together with 'shadowing' classroom observations.

Similar research on a smaller scale was also conducted as part of the evaluation of the United Kingdom AAL pilot programme (Passey et al., 1999a). Both qualitative and quantitative evaluations of the student use of portable computers were undertaken. Compared to non-notebook users students at the Year 5 level participating in the study, notebook students showed improvements in the areas of reading, spelling, Mathematics and ICT capabilities. At the Year 8 level, nevertheless there was only a reported improvement in student ICT capabilities (Passey, Whytock and Davies, 2001).

A series of case studies of teachers who used portable multimedia computers in schools by Phillips, Bailey and Fisher (1999) found that as the notebooks became part of their regular work, nearly all teachers showed gains in their ICT skills. The authors believed that the portability of notebook computers, and hence the flexibility to move freely between school and home, led to improvements in staff ICT skills.

A study of 300 teachers in the United States found that notebook computers improved staff attitudes and increased their interpersonal communications. The use of notebooks also led to more cooperative learning and enabled teachers to improve their personal ICT skills (Gold, 1999). This appears to be a common theme evidenced within notebook classrooms from studies on both sides of the Atlantic.

Also in the United States, Stevenson (1999) carried out a longitudinal evaluation of the middle school notebook programme in the Beaufort County School District. The research in the third evaluation cycle found that in terms of the impact of the notebook project, students who had participated for three years were less positive than those with less experience of the programme. Similarly there was a drop off in the staff use of notebooks, and in particular, use of the notebooks for electronic learning activities and instructional delivery. However teachers had maintained a high level of class note-taking activities, with over 80% of staff indicating that their classes used the computers as least once a week for this role. This study raises important questions over the durability of the notebook innovation and indicates the need for further research of a longitudinal nature.

In the United States a further source of comparative data is a study at Athens Academy in Georgia USA (Hill et al., 2000 and 2001). At the time of the research, data from the Athens study were still emerging and it will no doubt provide valuable information for comparison with the SKC research.

While in Germany, a three year research project which commenced in 1999, involving 240 seventh grade students and their teachers is currently in progress and is being evaluated by the Centre for Media Research at Berlin University (Schaumburg, 2001).

In the Southern hemisphere, as a natural consequence of the growing popularity of notebook programmes in Australian schools, there have been a number of research studies. In 1991, the results of a questionnaire survey of 215 students at Methodist Ladies' College (MLC) (Loader, 1993) showed that students had a strong commitment to the notebook enhanced learning programme developed at MLC. The findings revealed that 95% of the students indicated that they liked using their computers, and 85% preferred using it to pen and paper, though this was conditional on the appropriateness of the task. Similarly over 80% felt that using a notebook had helped the organisation of their work. It is noteworthy that 98% of students perceived, that although learning was not easier, they had learned new skills (McDonald, 1993; cited in Stolarchuk and Fisher, 1999). These findings are hardly surprising given the novelty value of the notebook innovation and a longer time frame would be necessary to accurately reflect the true picture.

The SUNRISE project (Rowe, 1993) focused on the attitudes, knowledge, abilities and achievements of Grade 6 and 7 students in a Queensland primary school. The findings suggested students valued the use of laptops and that they could enhance social interaction between students (Stolarchuk and Fisher, 1999). Yet the small scale of the SUNRISE project suggest that in isolation these data should not be given too great an importance.

In 1995 a state wide project surveyed 176 Victorian schools regarding general computer use and also included narrative case studies of the notebook programmes within ten schools, comprising of seven independent and three state schools (Shears, 1995). The nature of the research, due to the small size of the samples used, with only 25 notebook computers in each school, and the short term duration of notebook usage, limits the study's usefulness and make detailed comparison with the SKC research problematic. However while recognising these factors, the Victorian survey did report that 'opportunities to use laptop computers, either at school or at home significantly improve students' attitudes to and perceptions of their work and their learning' (Narracott, 1995: 65 - 66).

The findings of the Victorian study indicate a number of positive outcomes related to the use of notebooks within the classroom. Despite this, the results have been

challenged as being inconclusive and lacking substance. They were challenged by Wild (1995) to be based on a questionable research methodology and thus of little meaningful value. This claim highlights a common methodological flaw in a number of the notebook studies and future research needs to take into consideration these criticisms in order to ensure a valid and authentic investigation is completed.

A further Australian study on the effect of notebook enhanced learning and science performance and student attitude was also completed in 1995. Data were collected across nine independent schools, using attitude and achievement scales adapted from earlier work by Fraser (1979, and 1981). A comparative approach involving both notebook and non-notebook groups was used during the study. The quantitative data was analysed and no statistically significant conclusions could be made. The study found that 'there were only negligible differences between the cognitive achievement outcomes of science laptop students and their non-laptop counterparts' (Stolarchuk and Fisher, 1999 : 43).

In 1998 and 1999 a small sample of the Year 9 students involved in the notebook programme at St Michaels' Grammar School in St Kilda Melbourne was surveyed to evaluate what difference the notebook enhanced learning environment had made. The results showed students perceived they were better organised, and able to draft their work more easily using notebook technology. Of interest were gender differences between the responses of students, with more boys than girls stating they believed that computers had helped them to better present their work and to be more organised (Nettelbeck, 2000).

Although limited in terms of sample size, the informal research at St Michael's Grammar also surveyed the perceptions and classroom practices of teachers at the school, with a large number of staff indicating that the notebook programme had brought about changes in their classroom teaching. However the study did not address the issue of how the teaching had changed. In addition, a few parents of notebook students were surveyed and many were pleased with the investment they had made on their children's behalf to purchase notebook computers (Nettelbeck, 2000). The study is evidence however that while the statistical significance of the changes were unresolved,

there is strong evidence that the perceptions of the participants had changed. This is an important feature, given the role of perceptions in shaping our actions.

Similarly at Trinity Grammar School (Melbourne) research has been undertaken and according to the past Headmaster, the research had been of a qualitative nature, using classroom observations as the means of data collection (Crawley, Headmaster of Trinity Grammar School, personal communication, September 2000). The shortcomings of these Australian 'in-house' school surveys have been their informal and unsystematic nature and limited scale of the research. It is apparent that a more formal academic study of a secondary school notebook programme is still required

Also in Australia, the Balwyn High School (Ainley et al., 2000) and the Penrhos studies (Kessell, 2001) have recorded similar observations of student notebook programmes. These single site studies provide valuable information as a foundation for further research.

In summary, despite a lack of clear evidence and while recognising concerns over the quality of some of previous notebook research, the researcher would agree with the view expressed by Owen and Lambert (1998), who conclude, on the basis of a review of the literature that:

The evidence suggests that a fully implemented notebook curriculum has considerable potential for enriching the quality of the learning environment (1998 : 30).

New Zealand research

This section shifts our attention to the New Zealand context and briefly describes a number of exploratory studies involving notebook computer use in a limited number of New Zealand schools.

At King's College Auckland there have been a number of studies undertaken. The earliest involved the pilot notebook programme in 1991 where two classes of Year 9 students and staff used notebook computers (Parr and Bairstow, 1992). The evaluation

of this programme revealed that 'students enjoyed using the computer; they find it a useful tool and its motivating effect is widespread and lasting' (Parr and Bairstow, 1992 : 39). Despite this conclusion, the King's College year long study was not able to demonstrate whether student notebook use had enhanced classroom learning. In addition the report insightfully noted that there were many moderating variables which may impact on the ability of researchers to assess and assign specific characteristics and trends which were a direct consequence of student notebook use. This point has implications for future notebook related research in New Zealand and beyond.

At the same time, an evaluation of the staff response to participation in the notebook programme was also completed. Staff were equipped with notebook computers (Apple Macintosh Powerbook 100) and their attitudes and experiences were documented over the course of the year by pre and post questionnaires and follow up teacher interviews (Parr, 1994). The level of integration and use of this ICT innovation by staff was influenced by a number of factors:

- The personality of teachers
- The availability of appropriate software
- The adherence of King's College to a rigid exam based curriculum
- The use a traditional delivery mode of instruction.

(Parr, 1994)

This shows how the innovation must be understood within the context of the overall school culture. A later case study evaluation by Johnston (1996) at King's College centred on the staff response to the implementation of a notebook programme in Year 12 (Form 6). It found that the staff viewed the programme in a positive light and felt it had been 'beneficial to their teaching and to their students learning' (Johnston, 1996 : 47). The study was restricted to only staff and did not consider the input of other key stakeholder groups such as students and parents. It did observe that students responded very positively to the introduction of notebook computers. Many of the issues related to the notebook programme and the views of teachers have potential for comparison with similar New Zealand studies.

The evaluation of a pilot notebook programme at St Cuthbert's Junior School, an independent girls school in Auckland has also been undertaken (Selby, Elgar and Ryba, 2001). The focus of the St Cuthbert's Junior School study was on two Year 5 classes using a wide range of research instruments. The study concluded that 'Teachers, students and parents were enthusiastic and positive in their approach to the laptop project' (2001 : 38). The study also recognises that the introduction of portable ubiquitous computer technology in isolation would have limited impact on the teaching and learning, rather that it is the way it which the technology is utilised in the interface between the students, staff, and the curriculum that is more important factor.

A common trend has been the number of unpublished 'in house' surveys of notebook students, such as a limited one term study of a small notebook pilot programme at Diocesan School for Girls (Auckland) undertaken in 1999 by Judy Parr (Cooper, ICT curriculum manager Diocesan School, personal communication, September 2000). This type of informal research again highlights the need for more systematic studies in this field.

In summary, this section has briefly covered the research specifically related to educational notebook programmes, both within New Zealand and abroad. It has shown that while in many cases there have been some positive impact on the teaching and learning within a notebook environment, there are still many aspects of the innovation of a technology enriched classroom that need to be investigated. The next section outlines a summary of the perceived benefits and success factors associated with successful student notebook programmes.

The case for classroom use of notebook technology

From a synthesis of the literature on notebook technology a number of positive factors are apparent. These are perhaps best summarised in a recent United Kingdom study (Hennessy, 2000) on the use of portable technology, which presents a list of the advantages and benefits of portable computers as perceived by students.

The **advantages** in rank order were:

- Flexibility of usage - the 'anytime, anywhere' availability factor,
- Personal ownership,
- Preference of students to type rather than to handwrite work,
- No dominance of the machine, and greater computer access,
- Gave students the ability to work independently,
- Portables were more interesting than desktop computers,
- Portables made the subject more interesting

The **benefits** of student use of portable computers were:

- immediate access to computer technology,
- increased student motivation and confidence,
- improved attitudes,
- greater productivity and better quality of work produced,
- greater opportunity for independent work and investigative learning across the curriculum.

(Hennessy, 2000 : 251)

Despite these advantages and benefits, most studies have not clearly identified the success factors that have had a major impact on student notebook programmes. The United Kingdom AAL study found that the most influential things that the pilot notebook schools had done was to provide staff with ongoing access to individual notebook computers. In addition it noted that the provision of time and opportunities for regular in-school support for staff, students and perhaps even parents, were necessary if the outcomes were to be of any lasting importance (Passey et al., 1999a).

Other success factors to emerge from the literature include the ease of access to resources, and the quality of software and hardware available. The quality of facilities, technical back-up and financial resourcing are also important factors. There is a need also to provide incentives both at a school and national level to encourage greater use of ICT within the classroom.

These factors together with a commitment to professional development and a personal desire on the part of teachers to professional learning will ultimately be the basis on which the successful integration of ICT within the classroom will be founded (Mumtaz, 2000). According to Herman (1994), ICT is a tool which in the hands of good teachers, and if effectively infused into a sound curriculum, will enhance the learning of students. But despite such optimism there remains a lack of clear evidence and further detailed research into whether the use of notebook technology is justified.

The need for further research

The literature review has shown a paucity of good quality research, specifically related to the ubiquitous use of notebook computers within a normal classroom environment. This gap in the literature is the basis and a key motivating factor on which this current study has been founded and developed. As one commentator has remarked, ‘it remains to be seen what additional research will reveal about the long-term impact of laptops on student achievement and outcomes’ (Belanger, 2000 : 3).

This view is shared by Oglan and Rothenberg (1999) and reveals a general questioning of the educational benefits of enhanced classroom use of technology. The complexity of the learning environment means that many apparently ‘simple’ questions such as: Is the use of ICT cost effective? What impact does it have on student learning? are in fact, ‘essentially unanswerable in many innovative projects’ (Herman, 1994 : 134). Thus while recognising the potential that some research objectives may turn out to be irresolvable there is still a need for context enriched and in depth research related to student portable computer programmes.

Having identified there is a need for such research to be undertaken and together with a desire to develop a clearer understanding of the impact of the notebook programme within the context of the SKC environment this research was formulated. After all, it has been stated:

Research needs to continue into the provision of high-access to computers learning environments... it must be long term and must

consider teacher perceptions, attitudes and beliefs concerning learning, schooling and computers (Newhouse and Rennie, 2001 : 243).

And as other scholars have suggested:

Are they just the same old wine in new wine bottles? Do they add anything new and effective? Are they cost-effective? The research is difficult to do well and sometimes seems to support the preconceptions of whoever is paying for it. However, over time, these answers will become central to the debate (Tiene and Ingram, 2001 : 113).

Research problem

The review of the literature has shown the potential of notebook technology within an educational setting. However, this potential has yet to be realised or at least fully documented and there remains considerable gaps in the literature. Therefore, it is timely for a New Zealand based study that undertakes to investigate a student computer notebook programme that reports on the impact of the notebook programme on those stakeholders directly and/or indirectly associated with it, namely, the students, staff and parents. This has been a major shortcoming of earlier research, and this study will provide an 'inclusive perspective' with representation from each of the key stakeholder groups. In addition this current study addresses the attitudes and perceptions of stakeholders to a specific ICT innovation and these will be reviewed against the backdrop of the relevant ICT research literature.

Research into the attitudes and perceptions of the major stakeholder groups is considered very important, as attitudes influence personal action choices (Good and Brophy, 1990; cited in Adams, Adams, Cheng and Sutherland, 1992). One of the aims of this research is to examine the attitudes and perceptions of the participants in a notebook programme within a New Zealand secondary school context

Objectives

The overriding objective of the research is to undertake an evaluation of the student notebook programme at SKC. The study will be a 'descriptive' research project, with the primary aim to acquire further knowledge and understanding of the notebook programme at a specific institution (Anderson, 1998).

The specific objectives of this research are to:

1. Gather student, staff and parent perceptions regarding the use of a computer notebook within the context of a New Zealand secondary school.
2. Describe the perceptions of the participants' with regard to the notebook enhanced learning programme.
3. Identify key issues and concerns of different stakeholders.
4. Draw some considered conclusions and recommendations regarding the notebook programme at the college.

Research questions associated with each objective

The use of research questions can help identify the route that the research will take to reach its intended or expected destination (Wagemaker, 1992). Thus the following questions were proposed in accord with each of the specific objectives.

Objective 1

- How frequently do students use their notebooks, in class and out of class?
- What subjects do students use their notebooks in and to what extent is use made of this tool?
- What types of software applications are used by students and what is their relative importance in terms of frequency of usage?
- How do staff view the use of notebooks in the classroom and its impacts on their instructional process?
- How do parents view the use of notebook technology by their child at the College?

Objective 2

- How worthwhile do those participating in the notebook programme feel it has been, in terms of student education and learning?
- What are the student and staff attitudes towards the programme after the completion of a year of the notebook enhanced 'technology rich' learning environment?
- Do the views and attitudes held by students, staff and parents differ according to the academic ability of students?

Objective 3

- What problems have students encountered using notebooks regularly in class?
- What have been the benefits and how could these be developed to further enhance student learning?

Objective 4

- While aware that a precise definition of effectiveness is problematic given the full array of variables acting within the College setting; Do the students, staff and parents believe the notebook programme has been effective?
- How do the results of this study compare with similar research conducted in New Zealand and overseas?
- What issues can be identified regarding future developments of the notebook programme at the College?

Summary

This chapter has reviewed both the international and local literature relevant to the proposed study. It has examined a range of studies, involving both desktop and portable computers and has sought to provide an understanding of the strength and weaknesses of previous research. The diversity found in previous studies has been highlighted and the findings and conclusions of these studies have been presented. The advantages and benefits of student notebook use as summarised by Hennessy (2000) have been recorded, and a number of key success factors, as such staff professional training and provision of time for lesson preparation, have been noted.

Thus having identified from the literature the opportunities, some would suggest a need, for further research in this area of ICT, the selected research objectives for this study are stated and detailed research questions provided as a foundation on which to structure this investigation.

The following chapter addresses the methodological approach adopted in this study, and details the research design utilised in the SKC study.

Chapter 3

Methodology

Introduction

This chapter contains the rationale for the adoption of a case study approach to this research and it discusses the assumptions associated with this methodology. It describes the pre-testing (pilot study) phase of the research process and considers the trustworthiness and validity of data and covers ethical issues associated with the research. The chapter explains in full the selection of the sample during each phase of the study, the process of instrument development and data collection procedures.

Educational research methodology

This section considers the theoretical and philosophical issues associated with the case study approach. It outlines the assumptions on which this research method is based and reflects of the case study research design, citing some relevant New Zealand examples and highlighting a definition of case study research. Justification for the selection of this methodology is also provided.

Theoretical and philosophical issues

It is difficult to define case study research in a precise or concise manner as it has many differing forms. It is not specific and rather is a way of organising data gathered within a social context so as to maintain the unity of the character of the social group being studied (Stake, 1980). There are particular situations or conditions when case study research should be considered as the most effective form of research method, and should be employed in preference to other research designs, such as used in experimental studies (Yin, 1994).

The concept of 'bounded systems' is often associated with the case study design (Stake, 1994). That is, the study of a complex, dynamic system in its totality; be it a single individual, a group of students or an institution. The case study aims to tell a story; it

seeks to observe, describe, investigate and understand. This is one of the distinctive features of the case study research approach. The holistic nature of a case study has as its goal the understanding and explanation of a particular case accounting for its idiosyncrasies and complexities.

Case studies contribute more to naturalistic generalization than to scientific generalization (Stake, 1980). It is a way of knowing based on experience rather than through the traditional empirical methods of experimental research. The research seeks patterns of meaning rather than statistically replicable data. It has been described as:

The preferred strategy when seeking answers to the 'how' and 'why' questions, and when the investigator has little or no control over events and when the focus is on a contemporary phenomenon within some real-life context (Yin, 1994 : 1).

Case study research can have many similarities to the 'illuminative evaluation' approach described by Parlett and Hamilton (1972). It is the intention of this study to use this form of case study approach, as it will concentrate on the information-gathering rather than the decision-making component of evaluation.

The task of the researcher is to provide a comprehensive understanding of the research topic within a particular context, recognising all its complexities. As Merriam has suggested case studies are chosen and carried out because they are "intrinsically interesting" (Merriam, 1998 : 27) and the personal interest of the author is certainly a motivating factor in the selection of this research topic.

As the researcher is a member of staff at Saint Kentigern College (SKC), there are recognised advantages of this 'insiders' perspective in this form of case study evaluation. The researcher is able to offer a deeper and richer understanding of the culture and context of the notebook programme at the College than that possible by many external researchers of previous notebook studies (e.g. Rockman et al., 1997; Passey et al., 1999a). However, recognition of the relative objectivity of the researcher is an issue that must be taken into consideration.

Philosophical considerations

In general, case study research is considered to be within an interpretive / subjective perspective (Denzin and Lincoln, 1994). There are those who question the motivation of case study researchers and the philosophical framework upon which the case study approach is based. Atkinson and Delamont (1985) raise several concerns regarding the political and ideological undercurrent and motivations of those opposing traditional empirical quantitative educational research. They argue that in an attempt to oppose positivistic research methods too little attention has been devoted to establishing a firm theoretical and methodological foundation for case study research itself. With an awareness of these criticisms it was important that this study was based on a firm methodological foundation.

Guba and Lincoln (1989; cited in Mertens, 1998) state that one cannot interpret a person's paradigm simply by the research method they select and argue that a person's worldview will influence their choice of methods. Indeed the author's background as an empirically trained scientist is supportive of this, as the adoption of the naturalistic case study research method could be considered as an example of a cross fertilisation of methodological approaches. Thus a hybrid design may well be considered the 'best fit' in the context of the stated research objectives.

Assumptions of case study research

In terms of the theoretical and philosophical assumptions associated with case study research, these are common to the naturalistic and interpretative perspectives.

The **ontological assumption** is that reality is subjective. Thus there are multiple perspectives as experienced by the participants in the notebook study. Any research is socially constructed, with the potential for conflicting mental constructions and the researcher perceptions of reality may change throughout the research process (Mertens, 1998). The view of the constructivist Stake (1980) is that knowledge is socially constructed and thus case study researchers assist readers in the construction of knowledge. As noted previously, the present researcher's personal views and perceptions of the reality of notebook learning must be recognised, however the data

collected is as far as is possible independent of these views and the discussion and conclusions of this study will be founded on a trustworthy database of evidence.

The **epistemological assumption** maintains that the researcher interacts with those participants being studied. In the context of this study, methods such as the use of direct observational techniques, questionnaires and focus group discussions will be utilised, recognising however that there is always an element of interaction between the participants and the researcher (Yin, 1994).

The **axiological assumption** is that data collected is value-laden and that the values free position of an objective positivistic approach is rejected. There is, however, recognition that any evaluative statement does contain empirical content (Clark, 1997). In case study research the values of the researcher are to be made clear. Hence in the context of this thesis the researcher remains undecided regarding the value of notebook enhanced learning programmes, as from personal experience he detects some areas of weaknesses in the practical application of the College notebook programme, while recognising and supporting the validity of the SKC vision for this ICT innovation.

The **methodology assumptions** of case study research are the adoption of an inductive process, where the emergence of context bound information may lead to patterns of theories that help explain a phenomenon, and from which generalizations may be developed within the context of the specific case study. This differs from the *a priori* cause and effect hypothesis testing used in positivistic experimental research (Creswell, 1994). The emphasis of the case study approach is on an hermeneutical and dialectical understandings of the specific case.

The concept of objectivity is replaced by confirmability (Guba and Lincoln, 1989; cited in Mertens, 1998). The data collected and its interpretation are rooted within the context of the case study, and information can be tracked to its sources and the logic used to develop the analysis is made explicit in the written record. The case study researcher needs to provide evidence for validating both the observations and generalizations (Stake, 1994). Indeed Wild's (1995) criticism of Shears' (1995) notebook study in Victorian schools is an example of generalisations proposed without the necessary valid

and well documented evidence. This study seeks to avoid such limitations and accepts that the findings of the research are uniquely site specific.

Case study research design

In a general sense educational case study research has developed on two foundations, that reflect differing geographical regions. The 'British school' was initially focused on the implementation of curriculum or pedagogical developments within the educational system in the United Kingdom in the 1960s and 1970s. The 'American school' has a strong ethnographic tradition founded on sociology and anthropology (Vidich and Lyman, 1994).

Case study has its roots in sociological research, and has been employed within a wide range of disciplines, such as clinical medicine, urban planning, political and social sciences. Case studies have also been used for a range of purposes, for example; teaching devices, record keeping and as a research tool (Yin, 1994). This makes case study ideally suited to the study of a technological innovation drawing on elements of psychology, sociology, and an empirical scientific approach.

The development of case study research has also been influenced by such diverse fields as anthropology, sociology, psychology, and human geography. Indeed one of the strengths of case study research is its wide application in a number of disciplines. The evolution of case study research could also be seen as a reaction by researchers to the perceived sterility of positivism, yet as Kemmis (1980) argued, case study research is scientific because it seeking to discover truth and reality within a real world context.

One could argue that the case study as a research design falls within the 'psuedo chasm' of the quantitative / qualitative divide and that this traditional dichotomy founded on the contrasting paradigms of positivistic empirical research and interpretative and/or narrative understanding, is a reflection of the differing views of the traditional research establishment.

The issues of considering qualitative and quantitative options arise at each phase of the research process, and the researcher must make the decision as to which is the most

appropriate option. As Bouma (1996) states, 'it is possible to collect qualitative data but to subject them to quantitative analyses and vice versa' (170). Other authors have expressed a similar view (e.g. Salomon, 1991) and it has been suggested that drawing an absolute line between qualitative and quantitative research is never a satisfactory solution (Bouma, 1996). Case studies may be either purely qualitative, or quantitative or a combination of both. Using a variety of data collection techniques may beneficially provide different perspectives with regard to the investigation.

Case studies are usually associated with singular instances and as such the question of generalizability is an important issue that needs to be recognised and addressed. Case studies are by definition focused on unique situations and circumstances, and the degree to which the results or conclusions can be generalised to or representative of other situations is questionable. However whether this is an issue depends in some degree on the purpose of the case study. Some, such as this research, are undertaken with the aim to illuminate a local situation and thus there is no essential need for it to be representative or generalizable (Stake, 1980).

It is possible however that the unique nature of the detailed case study may enable the research to make broader generalizations, to similar environments or situations, though some such as Stake would dispute the validity of this claim, and emphasize the importance of optimising the understanding of the particular case rather than generalization beyond (Stake, 1994). However as Wild (1995) recommends, the reporting of case study data must be well presented:

The reporting of case study research, investigating computer use in education, has limited value for a wider audience unless the results of the research can be synthesised and projected as meaningful to those who are likely to read it (1995: 105).

There has been considerable debate as to whether there should be a distinction between quantitative and qualitative research at the philosophical level, rather than at the level at which the sampling techniques are used. Some believe these philosophical systems are irreconcilable, while others see them as essentially complementary (Bouma, 1996; Yin,

1994). In this study the view is adopted that the two approaches are complimentary and a 'hybrid' research design will be used to gather data.

The application of case study in New Zealand educational research

Within New Zealand, case study research methodology has been increasingly adopted in educational research. In the literature it has been in the form of both quantitative and qualitative research and such studies provide a better understanding of the workings of educational institutions and also more general educational issues and concerns.

Nolan, Ayres, Dunn and McKinnon (1996) use a case study approach in their reporting of the implementation of integrated computerised systems in school administrations. Other examples of quantitative case study research within the context of New Zealand secondary schools, were studies completed by Parr (1997) and Halliday (2000). Parr's study was focused on the Integrated Learning System (ILS) computer programme marketed as 'Successmaker' and as the author acknowledges 'to study the introduction of an innovation into a secondary school is to study a complex phenomenon' (Parr, 1997 : 40). Likewise the case study methodology was utilised to good effect in a more recent investigation into the integration of ICT within New Zealand secondary schools (Halliday, 2000). In short, case study is an accepted and well established method for use in research with objectives such as those of the SKC study.

Definition of case study

A concise statement of case study research is found outside of the field of educational research. The U.S General Accounting Office (GAO) provided a workable definition of the case study research approach:

A case study is a method for learning about a complex instance, based on a comprehensive understanding of that instance obtained by extensive descriptions and analysis of that instance taken as a whole and in its context (GAO, 1990; cited in Mertens, 1998 : 166).

The challenge for the research process is to relate theory and research in such a manner that questions are answered and problems identified, addressed and resolved. Case study as a tool can contribute greatly to these ends and ‘the end result of the research process is neither theory nor data but knowledge’ (Bouma, 1996 : 18).

Case studies contribute more to naturalistic generalization than to scientific generalization (Stake, 1980). It is a way of knowing based on experience rather than through the traditional empirical methods of experimental research. It is particularly appropriate to study human phenomena (Gillham, 2000). Case study research can have many similarities to the illuminative evaluation approach described by Parlett and Hamilton (1972). The research seeks patterns of meaning rather than statistically replicable data. It is:

The preferred strategy when seeking answers to the ‘how’ and ‘why’ questions, and when the investigator has little or no control over events and when the focus is on a contemporary phenomenon within some real-life context (Yin, 1994 : 1).

It is the intention of the researcher to use the case study approach as it will concentrate on the information-gathering rather than the decision-making component of evaluation. The task of the researcher then is to provide a comprehensive understanding of the research topic, recognising all its complexities. From such case studies we can learn both propositional and experiential knowledge (Stake, 1994).

Justification of the use of case study methodology

In summary, it is apparent from the previous section that there is no stereotypical case study research style and various sampling techniques can be equally valid in their application. The choice and decision must be about the ‘best fit’ to meet the case study objectives and research questions. Thus the adoption of a case study approach was viewed as the most appropriate methodology for this research as it offers a sound approach which permits a range of both qualitative and quantitative data collection and analysis. This is in keeping with many other notebook programme research studies. As Boyd (2002) recognised in a recent review of the literature which found that ‘the

majority of laptop school studies... include a longitudinal multi-method case study of a single site' (20). Though a precise definition of the length of any 'longitudinal' study is impossible to determine and is always context bound.

Schofield (1995) emphasises the importance of the context on the decision to adopt a case study research approach, drawing on her experience based on a study which focused on the effect of computer use on students and on classroom social processes. Schofield believed that a single site study offered the opportunity to study computer use in rich detail using an intensive qualitative approach. This research builds on this view but in addition recognises the value of quantitative data in assisting in the creation of a broad and meaningful understanding of the notebook programme at SKC.

It has been suggested the preferred methodology for assessing the educational benefits of ICT would be a longitudinal study over a number of years (Bulter, 1997). It is therefore important to note that by its very nature this case study research cannot legitimately be expected to assess the long term consequences of a 'technology rich' notebook classroom learning environment. It is similar in duration to a number of other notebook research studies (e.g. Parr, 1993; Robertson, Calder, Fung, Jones and O'Shea, 1997; Shears, 1995), but will only ever provide a 'snapshot' of the College notebook programme at a given time. The 'illumination' of the context of the notebook programme at SKC will go some way to identifying relevant variables that may be seen as valuable within a longitudinal study.

Technology using projects, such as the SKC notebook programme, will 'require sensitive assessment strategies and expanded evaluation paradigms combining qualitative and quantitative methodologies' (Herman, 1994 : 160). The notebook programme presents a complex picture and thus a complex assessment is required to do justice to research of this nature.

The research design

Introduction

The following sections outline the research process used during this study. It provides background information on the College, while the main focus of the section is on the development of the study research design. It presents the techniques employed to collect data, together with consideration of the ethical issues and the reliability and validity of data. It justifies the development of site-specific research instruments for this particular study. Practical issues, such as the peer review process and pre-testing of the survey instruments, are reported as are the methods utilised for the selection of the sample.

Background information

Saint Kentigern College (SKC) is an independent boys school with a roll of approximate 1100 students in Years 7 to 13 (Form one to Form seven). It has a Presbyterian foundation and the Christian character of the College is reflected in its mission statement.

The reader is referred to the SKC website for further demographic information and details of the College mission statement.

<http://www.saintkentigern.com/college/index.htm>

The 2001 Year 10 cohort is divided into two distinct groups of students, with four streamed and four un-streamed class groups determined on the basis of past academic grades. Within the structures of the College the streamed classes would traditionally be described as 'higher ability' groups while the un-streamed classes comprised students with 'mixed' to 'lower ability' in terms of their previously assessed academic performance. This total year group is considered to be a 'bounded system' in the context of the research.

Research design

The research was designed to realise the specific aims of the study as outlined in the literature review. It involved both qualitative and quantitative methods of data

collection. It was considered important to use both forms of data collection. This approach is in keeping with the views expressed by Salomon (1990a) and Levine (1990), who recommend that research into the use of computers in education needs to be more holistic and use systemic case study and ethnographic approaches.

The first phase of the study was based on a survey technique using written questionnaires to gather information. Phase Two utilised focus group discussions to gather more specific and personal data. In addition, these groups provided a reflective opportunity for participants to consider their own views and understanding of the notebook programme and also to follow up on issues identified during Phase One.

Research sample

This section provides background information on the specific research sampling techniques to be used in the study.

Data collection techniques employed

There are a range of sampling techniques that have been successfully employed in case study research. These can be either qualitative, quantitative or a mix of both. Indeed as it has been suggested 'often the best and most innovative research uses both qualitative and quantitative approaches' (Bouma, 1996 : 172). What is most important is the appropriate use of any particular method of sampling to the declared aims and objectives of the research project.

Yin (1994) clearly outlines the strengths and weaknesses of the common techniques usually associated with case study research and states that 'no single source has a complete advantage over all the others' (80). It is the appropriate application of one or more of these, which will enable the researcher to fulfil their research objectives (Bouma, 1996).

One of the advantages of the more qualitative approach is that this form of research does permit more continuous reflection on the research in progress, and more interaction with the participants, and hence will have greater flexibility for ongoing alteration and improvement (Bouma, 1996).

The use of written questionnaires afforded the opportunity for the collection of both quantitative and qualitative data. For it has been stated:

A well-constructed survey enables us to gather a wide range of information on a topic and to measure or quantify our results. Surveys can be used to describe, to explain, to explore, to predict and to evaluate (Jenkins, 1999 : 1).

This research uses questionnaires in conjunction with semi-structured focus groups with individuals involved in the notebook programme at the College (e.g. the relevant student, staff and parents groups). The goal of the focus group discussions was to engender participant feedback regarding the quantitative data collected in the questionnaires and to reflect and record general observations. This additional sampling method assisted in establishing the validation and reliability of the questionnaire data.

This mix of techniques provides both quantitative and qualitative data and were considered appropriate to collect individual responses and viewpoints. These particular techniques are recommended by Cohen and Manion (1994) as being among the preferred forms of data collection for case study research. A variety of sources of data are in fact highly complementary, and the best case studies rely on a range of sampling techniques (Yin, 1994). The convergence of this range of sampling methods increases the reliability and validity of the study's conclusions.

Triangulation may be achieved in different ways as outlined by Denzin (1970). The purpose of triangulation is to ensure that the information collected is not simply artefacts of one specific method of collection. Triangulation is particularly recommended as a useful technique in case study research, where the case study needs to represent fairly the differing and potentially conflicting perspectives of those participating in the research (Adelman, Jenkins, and Kemmis, 1980). It also helps overcome the problem of 'method boundness' which is a criticism levelled against single technique methodologists (Cohen and Manion, 1994). Thus in this research two distinct data collection techniques were employed, namely; written questionnaires and focus groups.

In addition informal interviews were undertaken throughout the research period with the College Director of Information Technology. The function of these discussions was to reflect on the data collected and to gather insights from another stakeholder perspective.

Development of research instruments

This section describes the process by which the research instruments were created. In developing the instruments to be used in this study a range of survey instruments were examined but were considered to be too generalised for the context of this research (e.g. Christensen and Knezek, 2000). For a further comprehensive list of computer attitude instruments the reader is also directed to Proctor and Burnett (1998).

There are a wide range of research instruments available, such as those developed jointly by Christensen and Knezek (1998). These include the Teachers' Attitudes towards Computers (TAC) and the Teachers' Attitude towards Information Technology Questionnaire (TAT) which were designed to specifically address issues related to teachers' attitudes to ICT. Given the parameters of this study they were not considered appropriate for use within this particular context.

Another example of an evaluation tool used to look at programme implementation and analyse the effects of specific interventions is the Concerns Based Adoption Model (CBAM) (Hall and Loucks, 1981). The CBAM enabled the researcher to categorise the practitioners into six levels of innovation usage, from non-use to renewal level. While recognising the usefulness of this instrument, and bearing in mind the specific research objectives of this thesis, the use of CBAM was deemed inappropriate.

Elsewhere, for example, in the research in a number of Australian independent schools by Stolarchuk and Fisher (2001a) on the impact of notebook use in science classrooms, the researchers have used non specific instruments such as the Test of Enquiry Skills (TOES) (Fraser, 1979) and the Individualised Classroom Environment Instrument (ICEQ) also developed by Fraser (1990).

There are some instruments that have been used within a notebook computer environment, such as the 'New Classroom Environment Instrument' (NCEI) (Newhouse, 2001) however this instrument focused on different aspects of the integration of ICT within the classroom and used only a three point Likert scale. As Adams et al., (1992) in an earlier New Zealand study recognised, the use of a four choice Likert scale was considered unwise as it limits the opportunity for participants to express a truly neutral response. Thus in keeping with other research the use of five or seven point Likert scales were constructed for use in the sampling instruments developed for this thesis.

A Northern Ireland portable computer study used a questionnaire with a mixture of semantic differential and five point Likert instruments. A number of the issues identified in these instruments address similar ideas to the survey instruments developed for this study (Morrison, Gardner, Reilly and McNally, 1993).

Nettelbeck (personal communication, July 2001) at St Michael's Grammar School in Australia, did develop a less rigorous set of survey instruments that specifically addressed notebook computer use in a school setting. The questionnaires were open ended and consisted primarily of short written responses. The function of these instruments were to obtain information and feedback for an internal college review and thus were not considered to be of a trustworthy standard for adoption in this study. The questions were designed to help the school assess the effectiveness of the new notebook computer policy and its impact on student learning.

The Balwym High School study (Ainley et al., 2000) used a number of data collection techniques. One of which was a short questionnaire that included a set of items to measure attitudes to computers and questions asking students about their use of a range of learning resources and specific software. These attitudes were a mixture of positive and negative statements, and did not make available a list of neutral statements for which students could make a full range of possible responses.

As Kessell summarised:

There is no standardised data collection instrument specifically designed to evaluate the impacts of networked multimedia or ubiquitous computing across the curriculum (2001 : Chapter 2 : 4).

In a similar vein, Herman found that:

The insensitivity of standard measures in assessing the outcomes of innovative uses of educational technology is another challenging problem (1994 : 150).

The ongoing American research conducted in conjunction with the Microsoft AAL programme (Rockman et al., 1997, 1998, and 2000) has used a wide range of data collection techniques. Staff and student questionnaires were one form of the research instruments used in the study. Several of the issues investigated and questions used in the Rockman et al., studies have been adapted and integrated into the survey instruments developed for this study. The inclusion of these questions has permitted direct comparison between the data collected in the two different learning environments of the American and New Zealand sites.

The inclusion of open ended sections of blank lines within many questionnaires gave opportunity for participants to give expression to their own thoughts. Open-ended questions and statements can provide a different perspective and also enlighten the quantitative responses selected by participants (Yin, 1994).

In light of these concerns, and having determined that none of the instruments considered were specifically designed to be used to study individual student notebook computer programmes, the use of a standard and recognised questionnaire instrument was deemed inappropriate. Thus, after an exhaustive review of prior ICT studies the researcher concluded that no published instrument would be able to fulfil the objectives of the present study effectively. Nevertheless, the research was informed by and adapted some aspects of these instruments for use in the SKC study.

Subsequent to the completion of the development of the questionnaire instruments for this thesis the publication of the Penrhos Laptop Program report by Kessell (2001) has presented similar five point Likert and short statement questionnaires to be used in staff, parent and student surveys. The questionnaires developed in the Penrhos study although containing a greater number of Likert questions covered the same issues and concerns addressed in this study. However one could question whether a sense of 'overkill' may raise concerns over the validity of this technique in collecting such data. The similarities of the form of the Penrhos questionnaires to those developed in the course of this study add further confirmation that the survey instruments developed for this research are in keeping with common practice within the ICT research community.

Peer review of research questionnaires

All three questionnaire instruments were peer reviewed as they were developed in the period of April to June 2001. The peer review was undertaken by members of the college staff who included; The Director of ICT, one of the Associate Principals, the Teacher in Charge of Journalism and the Director of Music.

Further review and critical feedback was completed by the researcher's university supervisor, Mark Brown and also an independent retired Principal Lecturer (Auckland College of Education) Peter McQueen. The feedback and advice provided during the peer review stage enhanced the structure, format and language used in the survey instruments prior to the pre-testing phase. Details of the time frame of the pre-test and research data collection are provided in Appendix J.

Pre-test sampling of the questionnaires

The pre-testing (pilot study) of the survey instruments was carried out during May and June 2001. This was a valuable exercise as it enabled further refinement of the questions and gave a good indication of the time required to complete the written questionnaires. Trial participant feedback was collected using a specifically designed pre-test feedback form (Appendix F). Individuals of similar age to the three research groups were asked to complete the draft questionnaires and an attached feedback form.

The information collected was studied and resulted in beneficial improvements in the clarity and layout of the three survey instruments. The format and pre-testing of the questionnaires was in accordance with accepted practice (Jenkins,1999; Statistics New Zealand,1995).

Data collection procedures

Staff survey sample

All SKC staff who had taught Year 9 classes in 2000 were invited to participate in the notebook study. The invitation letter included the general information sheet (Appendix B) and clearly stated that they could chose to decline or to participate in the study. Further information outlining the purpose of the study was given to staff during the regular weekly staff meeting and was also made available on the College Intranet.

The selection of staff was deliberately non random. This non-random sampling was deemed appropriate given the relative small potential pool of teaching staff that had taught the Year 9 cohort. It also ensured that the full range of subject areas were included within the staff sample.

In June 2001, numbered staff questionnaires (Appendix F) were distributed to appropriate staff pigeonholes with a covering information letter and the participant consent form (Appendix C). The staff were asked to complete the survey within two weeks. Follow up reminders were distributed after one week either in person or by email.

The staff questionnaire was completed by 26 teachers out of a total number of 29 questionnaires distributed. This equates to approximately a 90% response rate. The sample represents over 78% of all the staff either current or no longer at the College that had taught Year 9 classes in 2000. The staff sample was approximately 31 % of the total staff population, given that at the start of 2001 academic year there were 84 full and part time academic staff at the College. While this figure is in part unrelated, it is of interest to note that the present research represents the views of approximately a third of the College staff.

Of the 26 staff sampled 16 (62%) were male and 10 (38%) were female. All teaching departments within the College were represented. As would be expected staff from the English (23%), Science (19%) and Mathematics (15%) departments constituted a higher proportion of the total sample recorded. It is recognised that Social Studies was under-represented, as two members of this department who taught Year 9 classes left the College at the end of 2000 and hence did not participate in the study.

Parent survey sample

The use of the term 'parents' is the accepted practice within the College environment and thus through out this thesis it is used in the broad sense to represent all parents, caregivers and legal guardians of the student population connected with the research.

A sample of 65 parents of Year 10 students were randomly selected by a computer programme. This sample was selected from of the total possible population of 185 families. A comparatively large sample size was deemed necessary as there was an expectation based on previous studies (e.g. Newhouse, 1998) and past experience at the College that the participation rate could be quite low.

The use of random sampling was considered the best method of ensuring there was no bias in the selection of the sample. As Jenkins (1999) remarks, 'Despite their many advantages, surveys also have their drawbacks. The most obvious is the risk of bias, in that the people selected for the survey may not be representative of the population as a whole' (3). Thus random stratified sampling was used to ensure a representative sample of the total population.

The random samples were obtained using random numbers generated by computer using a spreadsheet programme (Microsoft Excel). All family/students in each class within the population of Year 10 students (excluding students new to the College in 2001) were listed alphabetically and assigned a number. The samples were randomly selected from within each class population on a proportional basis according to the total number of students in each class. This was done to ensure the sample selected was representative of the whole year group.

With the permission of the College a mailer was posted to the homes of potential participants containing a general covering letter outlining the invitation for parents and their son to participate in the notebook study. In the case of four families, this information was distributed to separate addresses for the parents to ensure that all caregivers were informed.

In July 2001, a mailer was posted to all the selected families, containing the general information sheet (Appendix B), participant consent form (Appendix C) and a numbered copy of the parent questionnaire (Appendix I) and a covering letter (Appendix K). In addition an addressed pre-paid envelope was enclosed for the return of completed consent and questionnaire forms.

The participants were requested to return of forms within two weeks. A general reminder and letter of appreciation and thanks were posted after two weeks. A small number of second reminder letters (5) were posted a week later (Appendices L and M). These included a replacement copy of the parent survey (identifiable by a replacement 'R' coding) for those who may have misplaced the original survey form.

The parent survey was completed by 49 families, out of a sample of 65. This is a 75% return rate. The sample represents 27 % of all the families whose sons were members of the notebook programme in 2000 and were in the current Year 10 cohort (excluding families of students new to the College in 2001).

Student survey sample

The selection of the student sample was linked directly to the process adopted for the selection of the parent sample. The students of the randomly selected parents were invited to participate in the study. This simplified and enhanced the process of gathering the collection of informed consent from the participating students, as both groups of stakeholders were members of the same family. In the four families where there were two legal caregivers with separate addresses, as mentioned previously, both parties were invited to participate in the study; however, in only one case did both parents take part in the study.

The survey of randomly selected students from the Year 10 classes was administered on three consecutive days in September 2001. A total of 34 students completed the student questionnaire (Appendix G) along with the student participant consent form (Appendix C). This was administered on Monday 3 September, in the College Library during roll check/study time to minimise disruption to student learning. Due to prior commitments, some students (14) were unable to attend and these students completed the questionnaire on Tuesday and Wednesday of that week in the Careers room at a similar time. Both these venues were considered as neutral non-threatening environments for students.

One family who participated in the parent survey declined to permit their son to take part in the student survey, on the basis that they wished their son to focus his attention on his academic studies. All students participated with prior written consent obtained from parents or legal guardians. Therefore the total student sample was 48. This sample represented approximately 27% of the total Year 10 student population. Thus, this was considered to be a representative sample of the student population who participated in the Year 9 notebook programme. A total of 13 students left the College during the course of 2000 or subsequently and hence were excluded from the study.

Focus group samples

In addition to the research questionnaires, three semi-structured focus group discussions were held, comprising of individuals participating in the notebook programme at the College. These involved members of the relevant student and staff groups. A focus group is essentially a formalised version of the spontaneous group interview, where the goal is to have the participants do most of the talking, using when appropriate probing questions to keep the discussions on task (Tolich and Davidson, 1999). The role of the researcher within the context of the focus group was to ensure full participation of group members and direct discussions to consider a range of pre prepared open-ended questions.

The purpose of the group discussions was to engender participant feedback regarding the quantitative data collected in the questionnaires and to reflect and record general observations. This additional research technique assisted in establishing the validation

and reliability of the previously collected questionnaire data and enabled exploration of possible reasons for some of the quantitative findings. The careful probing of participants for explanation of views and to check their understanding of terminology was a real strength of this research.

A number of staff and students were invited in writing to participate in the focus groups. Each of the potential participants had previously indicated on their original consent form (Appendix C) that they would be agreeable to participate in a group discussion, and hence the membership selection of these focus groups was a non random process. The views expressed in the focus groups, therefore, may not have been totally representative, as a willingness to participate in the focus group may indicate a more positive attitude regarding the notebook programme. In hindsight the researcher does not consider this to be an issue, as it was observed that during the focus group discussions a number of participants were more than willing to express negative views.

The focus groups were held in the College Careers room during lunchtime for approximately 50 minutes and food and drink was provided. All participants were given a further copy of the general information sheet (Appendix B) to read over and all signed the group discussion consent form (Appendix D). With permission of all participants the discussions were audio-tape recorded for later referral. The objective of these semi-structured focus groups was to discuss the quantitative data previously collected using the various survey instruments. There was also opportunity for general comments and interaction between group members during the discussions, using commonly recommended techniques to engender further related information and feedback (Tolich and Davidson, 1999).

Three focus groups were completed in October and early November 2001. A total of seven staff participated in two groups and twelve students participated in one larger student group. General interview schedules were used for both the staff and student focus groups. These provided a flexible guideline to ensure there was some structure to the discussions (see Appendix N and O).

Data analysis process

The research was undertaken with the aim to provide an ‘in depth’ case study of the SKC notebook programme and as such was primarily qualitative in nature. The questionnaire data was collected in three separate groups, and analysis of participant responses, both quantitative and qualitative, was undertaken. The numerical data for all questions was double checked, using tally tables, while the qualitative participant responses were typed up in full by the researcher for later reference. All data was securely stored and although numbered (for identification and recording uses only) no personal details were recorded on the actual participants written questionnaires. In the case of the focus groups, in addition to the notes recorded by the researcher during the interviews, the audio tapes were reviewed and key points, if not previously noted, were transcribed to give a full and accurate record of the discussions.

As the sample was relatively small ($n < 50$), only limited statistical analysis was undertaken. For selected quantitative questions the arithmetic mean (average) was calculated. This was generally for comparison between the pooled responses of different stakeholder groups and occasionally to enable comparison with previous research.

Ethical considerations

A number of ethical principles were addressed and consideration of these was intended to guide the behaviour of the researcher and offer security and protection to the participants. Clear procedures were put into place to ensure that the study did not contravene the rights of individuals and/or the institution where the study was undertaken (Anderson, 1998; Tolich and Davidson, 1999).

Simons (1989) states that a set of specific procedures are needed to guide the conduct of any study and that it is insufficient to rely on the trust, integrity of the researcher and their respect for the participants of the study alone. Clark (1997) outlines five key principles that this study sought to emulate in its methodology. These principles are that:

- The study promotes good and minimises the possibility for harm
- The participants are recognised as individuals and treated with dignity

- The study is just and equitable to all involved
- The pursuit of truth is maintained at all times
- The rights and freedoms of the individuals may be upheld

(summarised from Clark, 1997).

In accord with the Massey University Human Ethics Committee (MUHEC) requirements, this research was approved without change on 30/05/01 (Appendix Q), by the College of Education Ethics Committee. It adhered to the five major principles outlines in the MUHEC code, namely: Informed consent, confidentiality, minimisation of harm, truthfulness and social sensitivity. The research was, furthermore, undertaken with the written approval of the Executive Headmaster and the College Trust Board (Appendix A).

As the College is easily identifiable within the context of the New Zealand secondary education system no attempt has been made to hide the identity of the research site. A further strength of the research was the formation of an internal SKC peer review group, of willing colleagues, who reviewed the questionnaires and provided a sounding board for the research procedures, thus ensuring that these would be consistent with accepted practice at the College.

All study participants were informed of their individual rights and the purpose of the research was clearly explained using an information sheet that had been developed in accordance with normal practice (Tolich and Davidson, 1999) (Appendix B). Anderson (1998) outlines the six basic elements that must be respected when seeking permission from potential study participants, and these were adopted in this research. Voluntary written informed consent of all parties stating their agreement to participate in the study was obtained (Appendix C).

This informed consent was specifically reaffirmed when permission was sought to audio-tape participants involved in the focus group discussion (Appendix D). The tapes were used to aid the field notes recorded during the focus groups and were not fully transcribed. It was the intention to have all tapes erased following the completion of the research and this was stated to the participants at the time.

All individual data collected remained confidential and any personal responses cited in the research are, as far as the researcher could guarantee, anonymous. However no absolute guarantee of anonymity was given to participants. All records were stored securely and in due course will be destroyed following the successful submission and completion of the research. This study was based on 'the principle of confidentiality will operate to protect private and personal data from unnegotiated dissemination' (Simons, 1989 : 126). In the interests of participant confidentiality and to protect a degree of anonymity the raw data has not been included within the thesis.

The dissemination of data collected is another key ethical issue. In consultation with the Executive Headmaster of the College and thesis supervisor there has been further discussion as to who should be entitled to view the full set of completed research. The question of control of the information has also been addressed, as the research is technically owned by Massey University. This consultation was undertaken to avoid any conflict as to who has the right to control and responsibility to disseminate the completed report and who should be the intended audience(s).

However it is evident that one of the functions of this case study will be to provide information and feedback to the College administration related to the notebook programme. There is a recognised risk that the case study evaluation of the notebook programme may be 'used for legitimisation and advocacy rather than critique and enrichment in the system' (Simons, 1989 : 132). This was not the intention of this research. The researcher was aware of this from the outset of the study and has attempted to minimise such use of the findings.

Looking ahead to the next decade the role and significance that ICT will play seems certain to increase. Thus a specific site based case study will generate information that will have great benefits for future developments and refinements of the notebook programme at the College. It may also have broader applications to other educational institutions considering implementing similar technology rich learning programmes.

There is a potential for a conflict of interests arising from the dual nature of the researcher's role and his responsibilities within the College. Clearly a totally independent researcher would not be influenced in any way by the College, its

leadership and/or administration. While recognising the possible subtle influence associated with the researcher being a member of the SKC community, the researcher does not believe this has had any negative impact on the trustworthiness of data and its analysis. Indeed an 'insider view' is more likely to be able to identify both the strengths and weaknesses of the College notebook programme.

Reliability and validity

The reliability and validity or 'trustworthiness' of case study research is achieved by internal and external verification and by triangulation by the use of a range of research techniques. Unlike traditional empirical research, the outcomes of case study research are not likely to be replicable in other situations. By definition a case study is just that, it is unique to a particular time and place. What can be discovered by case study research is not sweeping generalizations but rather contextual findings (Maykut and Morehouse, 1994). In part external verification will be established by comparison of aspects of the data collected with research in other studies, both in New Zealand and overseas.

In this study, the questionnaire information was confirmed by follow up discussion groups with participants. During these discussions the questionnaire data was presented and opportunities given for critical feedback and reflection on the 'truthfulness' and validity of the information collected.

The internal consistency of the questionnaire data was not formally assessed as has been done previously for a range of teacher computer attitude scales (Christensen and Knezek, 2000). The magnitude of such an exercise would have been beyond the scope of this research. However, questions that would be expected to illicit similar responses from the participants were used in the student and staff instruments and an internal comparison was made of the individual's responses to these specific questions. The data examined was homogenous, and the informal comparison of responses suggest a good degree of internal consistency.

Summary

This chapter has outlined the theoretical and philosophical issues related to the chosen methodological approach. It has considered case study research in detail. It has described in depth aspects of the study related to the development of the study instruments, sampling procedures and data analysis. These have been supported by justification from and comparison with the relevant ICT literature. The ethical considerations have been addressed and issues of reliability and validity considered.

The following chapter details an integrated presentation the results of both phases of the research, that is, the questionnaire data and focus group responses.

Chapter 4

Results

Introduction

This chapter presents the results of the quantitative (Phase 1) and qualitative (Phase 2) data collection. The three stakeholder groups are considered in the following order: staff, students and parents. While some brief explanatory commentary is provided on the findings, the interpretation and discussion of data is presented in the Chapter Five.

Staff information

This section presents the results collected from the teachers of notebook classes. It considers staff use of ICT and their perceptions and attitudes regarding the notebook programme for Year 9 students. Data are presented in a sequence similar to the order of questions in the written questionnaire and where appropriate information from the focus group discussions has been integrated into the results. Unless otherwise stated, all percentages are based on the total staff sample (n = 26).

Application software used by staff

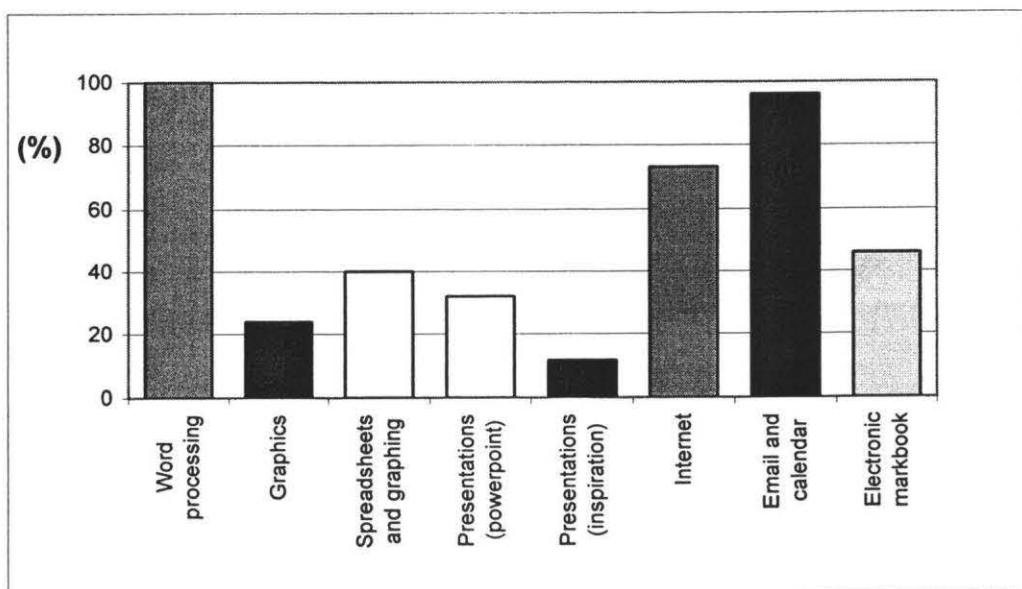


Figure 4-1 - Percentage of staff using specific ICT software

It is evident in Figure 4.1 that all staff regularly use word processing software and over 95% use email and/or calendar. The Internet is used by over 70% of teachers and spreadsheet programmes and electronic markbook software are used by a high proportion of staff.

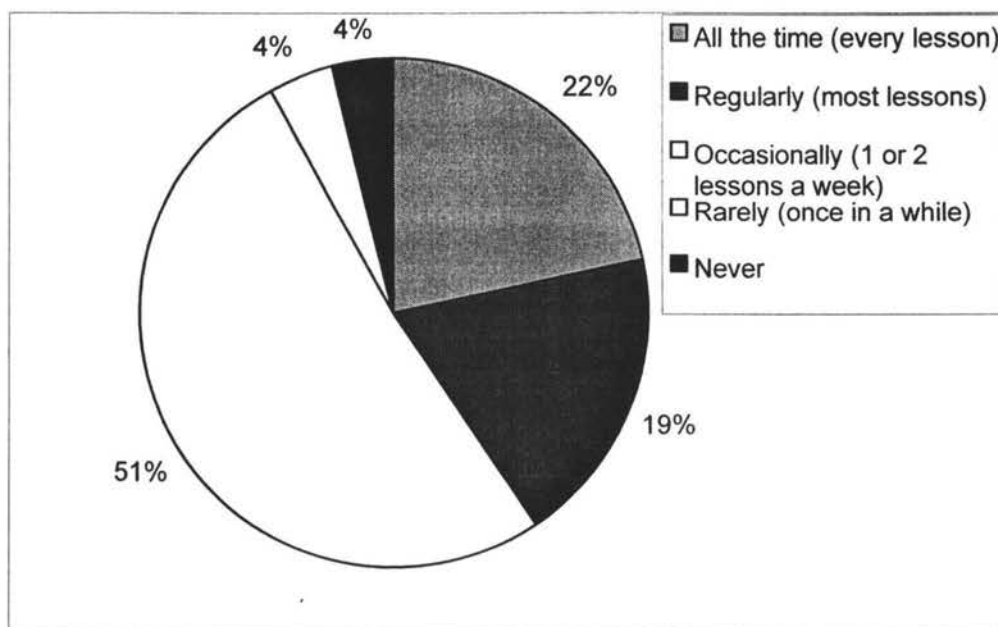


Figure 4-2 - Level of student use of notebooks during lessons

Figure 4.2 shows the level of classroom usage where just over 40% of teachers recorded that students in their classes use notebook computers during either all or most lessons. When questioned if they were using notebook computers more in class during 2001, 52% of staff responded positively, 40% stated there was no change, while 8% stated they had decreased the level of student notebook use.

Usage levels of notebooks by Year 9 students for class work and homework

As a means of assessing internal validity of the questionnaire a similar question asked staff to indicate the percentage of lesson time where students used notebook computers.

The homework values shown in Table 4.1 report the proportion of work students were expected to use their notebook computer to complete classwork or homework. The percentage levels of usage were based on a 0% (no usage) to 100% (used all the time) scale with 10% incremental divisions (see Appendix G, Question 8).

Table 4-1 Frequency of student notebook use in class and for homework

	Mean percentage usage	Standard Deviation
Notebook use in Class	48 %	28.1
Notebook use for homework	51 %	33.9

Table 4.1 suggests that approximately half the students' class work and homework was completed using their notebook computers. The class work mean value is similar to the level recorded in Figure 4.2, suggesting that the 'actual' level of classroom usage has been reliably determined. It should be noted that a mathematical mean tends to hide the wide variation in usage, as some staff and subject areas require most or all work by students is completed using their notebook computers. While some other staff, admittedly a smaller minority, make little or no use of notebook technology in their classes.

The effect of the notebook programme on staff teaching styles

Approximately two thirds (68%) of staff responded that the notebook programme had effected their teaching style, while 32% indicated it had no impact. The written comments indicate that staff teaching within a notebook environment, may move around the classroom more to monitor student work and they may position their own desk at the back of the room. Others had changed the classroom configuration to allow them to see the screens of student notebooks more easily. As one staff member wrote:

*Back of the room teaching has increased, I walk around a lot more,
less chalk and talk.*

Five staff commented that they had become more in the way of facilitators and that there was less formal instruction during classroom lessons. An increase in peer support and instructional behaviour between students was also noted.

A negative concern expressed by some staff was having to adapt to dealing with student notebook failure and related software problems. At times there was a sense of

frustration with the technology and staff were constantly developing techniques to address these situations, such as having paper and pens on hand in case of notebook failure, and/or getting students to work in pairs. As a number of teachers commented:

I get far more frustrated as notebooks fail.

More time spent in process & presentation rather than on content.

Student notebook use and the changing role of the teacher

The teachers' responses to a number of aspects related to class dynamics were investigated. The results are presented in Table 4.2. The question considered how student notebook use had changed the role of the teacher in the following ways.

Table 4-2 The changing nature of the notebook classroom learning environment

The table uses a five point scale where 1 = strongly disagree, 3 = neutral and 5 = strongly agree. In addition the mean value was calculated for each the following statements.

	1	2	3	4	5
<i>(a) The teacher becomes more of a facilitator rather than director of learning.</i>					
n	2	5	8	8	2
%	8	19	31	31	8
Mean value = 3.12					
<i>(b) The teacher spends less time 'lecturing' (less teacher centred instruction).</i>					
n	1	4	4	13	4
%	4	15	15	50	1
Mean value = 3.58					
<i>(c) The students spend more time collaborating with each other.</i>					
n	3	1	9	9	4
%	12	4	35	35	15
Mean value = 3.38					
<i>(d) The students use their Notebooks for greater independent work and learning.</i>					
n	2	2	5	13	3
%	8	8	19	50	12
Mean value = 3.38					

While acknowledging that no statistical analysis or control group comparison has been made, and within the limits of the Likert scale used to generate the above data, there would appear, as a broad generalisation, to be more student collaboration and greater independence of student work (i.e. less teacher centred) when using notebooks. As 39% of respondents (Table 4.2(a)) agreed that their teaching role had changed within a notebook classroom and just over 50% of staff reported that they spent less time ‘lecturing’ (Table 4.2 (b)). These data appear to suggest within a notebook learning environment the role of the teacher is moving towards that of a facilitator rather than a director of learning.

The impact of the notebook programme on the thinking and learning processes of higher and mixed ability students

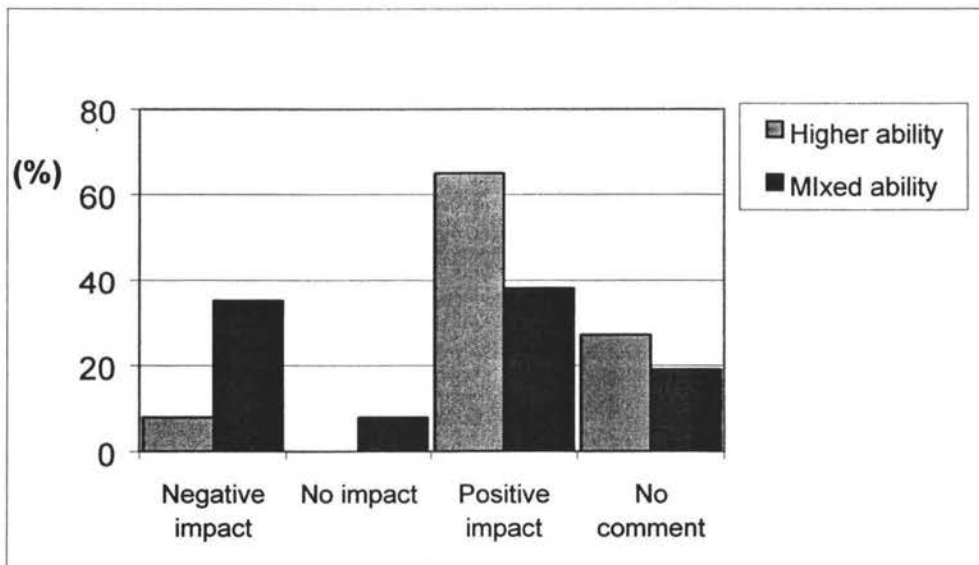


Figure 4-3 - Staff views on the impact of notebook use for students of different academic ability

Figure 4.3 indicates that staff perceive that the notebook programme has had a positive affect (65%) on the thinking and learning processes of higher ability classes; however, a proportion of teachers (38%) perceive the use of notebooks have had a negative affect with mixed ability classes.

The high percentage of 'no comments' can be attributed to the fact that a number of staff taught either streamed or mixed ability classes, and hence did not feel qualified to comment on the effect of notebook usage with regard to the other group of students.

These findings are expanded and supported by the range of staff comments presented below.

Notebook usage with mixed ability classes

As a class my mixed ability students cannot retain info on how to use their notebooks for anything but basic functions (this applied to most of the class) and they cannot maintain good records of work. They also find it hard to work through interaction with, reading from or writing notes on a screen. They prefer paper handouts to read and fill in, and like to write notes in an exercise book.

With the 'special needs' class I found that so much time was wasted setting up, coping with problems etc relating to each boy's notebook that I began to only use the notebook for homework related activities. Even then, assignments were not given in on time due to printer problems etc at home.

Mixed ability students will get better but they take longer to 'catch on'

'Weaker' students with organisational problems find Notebook learning difficult e.g. loss of files, broken machines, unsaved work.

Notebook usage with higher ability classes

I have not taught mixed ability classes using notebooks, however my students (in a streamed class) have done considerably more work.

Higher ability students cope better than lower ability students.

General comments

For any ability level, if the student is lazy or unmotivated the notebook programme encourages this trait.

Notebooks demand that kids be better organised in terms of files etc. They are great for correcting work, amending notes etc.

Within a class group, some benefit, some don't.

I think it has been a positive impact, but will be more so in the future as teachers and students get better using them (notebooks) and as I develop more and more material. I'm still a 'beginner' after four years.

In the future the effect will be much greater and positive.

Confidence builds on confidence ... the weaker academic (but ICT literate) student is seen to be capable and this can be a positive foundation.

The influence of notebook use on student performance and behaviour

Staff responses in the following figures relate to student performance and behaviour in notebook classes. The percentage frequencies of responses for each category have been calculated.

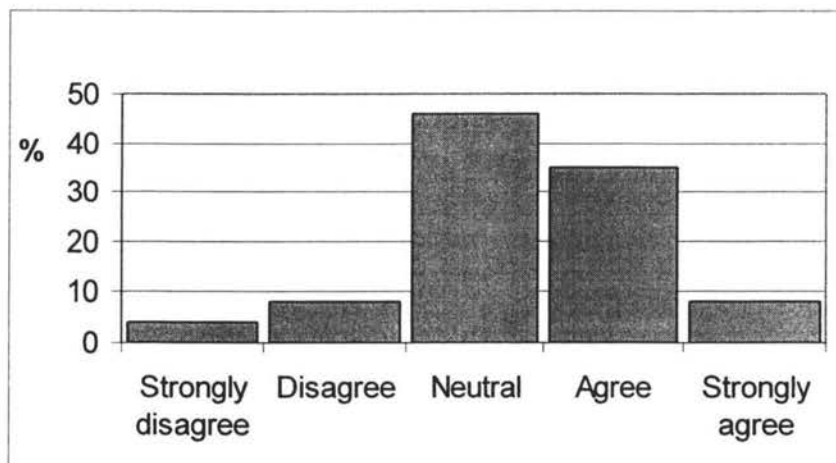


Figure 4-4 - Notebook use has helped students to organise their work more effectively

Figure 4.4 illustrates that most participants (46%) held a neutral position in terms of their view as to the impact of notebook use on student's organisational skills. However, 43% indicated a positive response suggesting a number of staff perceive notebook usage has beneficial effects on the organisation of students school work.

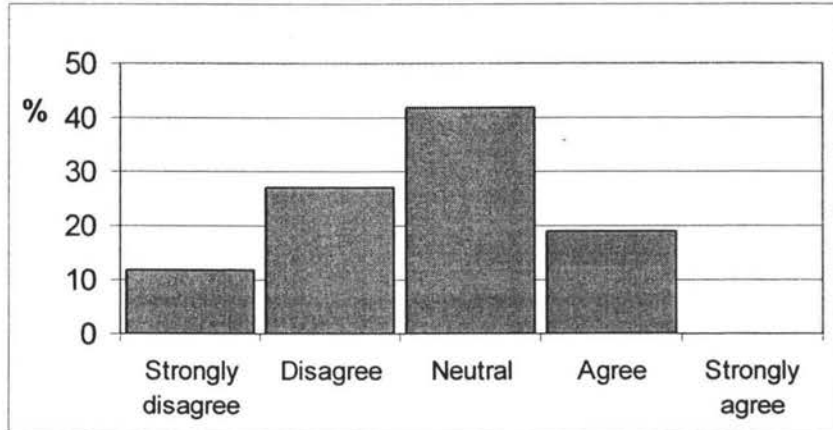


Figure 4-5 - Notebook use has helped students to increase their productivity

While the majority of staff indicated that notebook use had made students more organised, it is noteworthy, as Figure 4.5 reveals, that in contrast many staff (39%) perceived that notebook use has decreased student productivity. Overall the most common response of staff was a neutral view on this issue (42%).

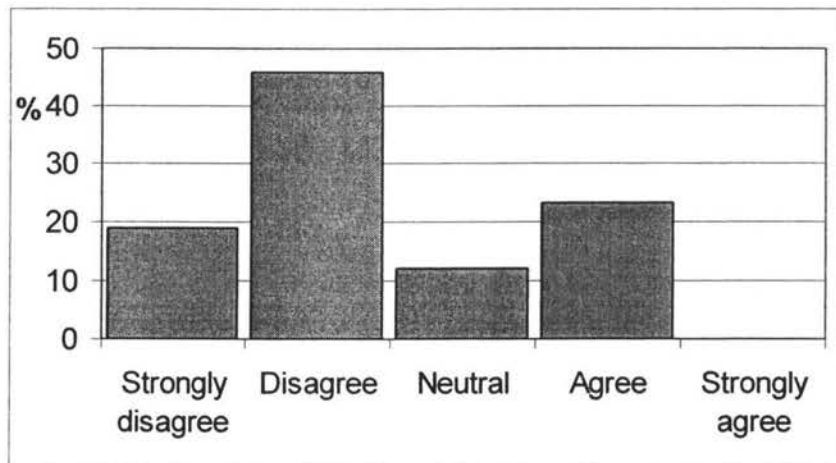


Figure 4-6 - Notebook use has saved students time in the classroom

Figure 4.6 shows that the majority of teachers (65%) believed that notebook usage did not save students time during lessons. Whether notebook use actually slowed students work rate was not explicitly examined. Certainly some teachers expressed this view:

Notebook have slowed things down, and(we) get through less work.

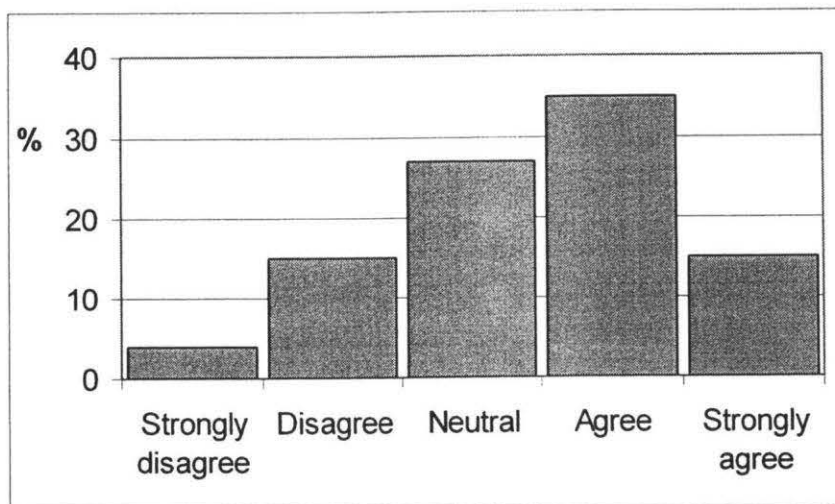


Figure 4-7 - Notebook use has improved the quality of student work

Figure 4.7 shows that in general the quality of student work has improved using notebook technology. It is noteworthy that 50% of staff indicated a positive response, while only 19% disagreed. However, as with other the statements, a fair proportion of staff expressed a neutral view in terms of the impact of notebook usage on student work.

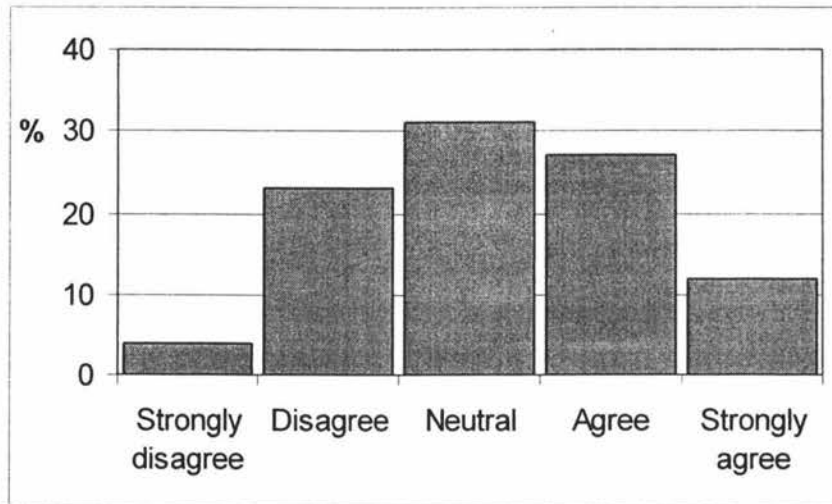


Figure 4-8 - Notebook use has increased student motivation and interest in learning

In a similar vein, Figure 4.8 shows a full range of views have been expressed by staff, in terms of the influence of notebook technology on student motivation and interest in learning. Again the most common staff response was a 'neutral' one, and there is no pattern either positive or negative.

These findings were supported by the following written staff comments:

Students enjoy research more and search more widely with computers, but class activities are often slowed by slow boot up, crashed computers and lost files.

Unless the teacher inspires the students, just as in the past, the students will lose interest.

The computer cannot manipulate the student to learn, it is, after all, just a computer.

Notebooks have increased motivation and interest but not always on worthwhile academic matters.

For some students the notebook has helped them to organise their work and has helped build self-esteem of some very slow students who find writing and presentation difficult.

For some students it does enable them to be more organised. I don't think it saves time in the classroom. We seem to get through less work than we did.

The software/hardware available is not useful across the entire (maths) curriculum and I only use it where I think it fits well. In these areas it enables us to do things we were never able to do. It's wonderful.

With the less able students the 'novelty' wears off fairly quickly. Less so with the more able students.

For some students computer use does improve quality, quantity, and efficiency of work. However there are those adversely affected by it (either distracted by it or unable to manage) it seems worse than the old methods.

We are only on the 'verge' of the revolution.

In summary, these comments suggest that it is ultimately the interaction of students and staff, the relevance of the subject material and perhaps, as some of the above comments would suggest, more importantly the personalities of the participants, that determines the effectiveness or otherwise of their notebook use in the classroom learning environment.

Preferred classroom environment

Figure 4.9 indicates the teachers' preferred level of student notebook usage within the classroom environment. Data suggests that a clear majority (84%) of staff are keen to see notebook computers used either regularly or at least occasionally within lessons.

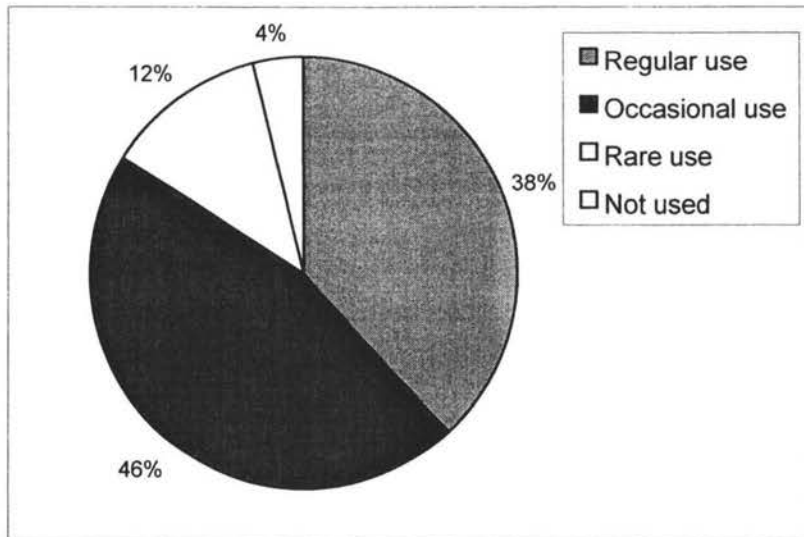


Figure 4-9 - Staff preferred level of student notebook use during lessons

Staff views on the College notebook programme

The staff were asked to indicate their personal responses to a range of attitudinal questions pertaining to the College notebook programme. It is noteworthy that the wording of the attitudinal questions and the seven point Likert scale used in this study, were identical to those in the AAL study (Rockwell et al., 1998). The staff responses are presented in the following section.

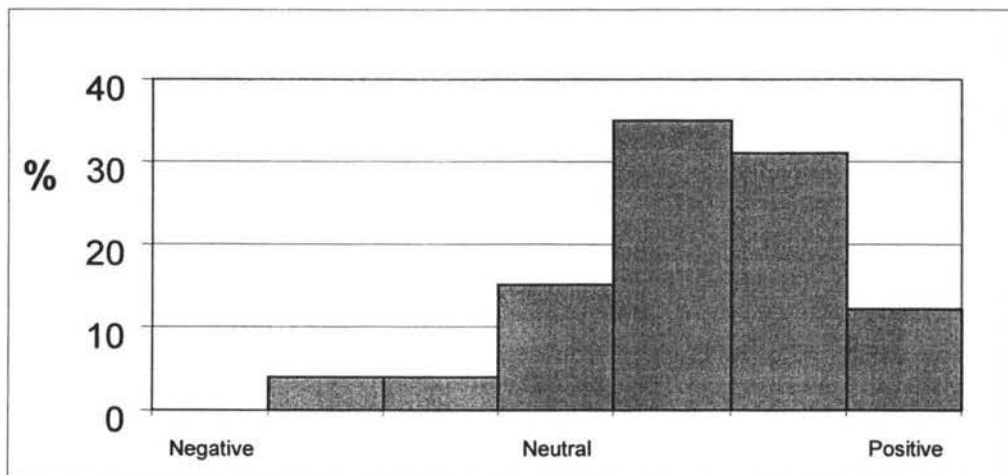


Figure 4-10 - Level of staff enthusiasm for notebook use in classes

Figure 4.10 reports the generally positive level of enthusiasm for the College notebook programme amongst the teachers participating in the study.

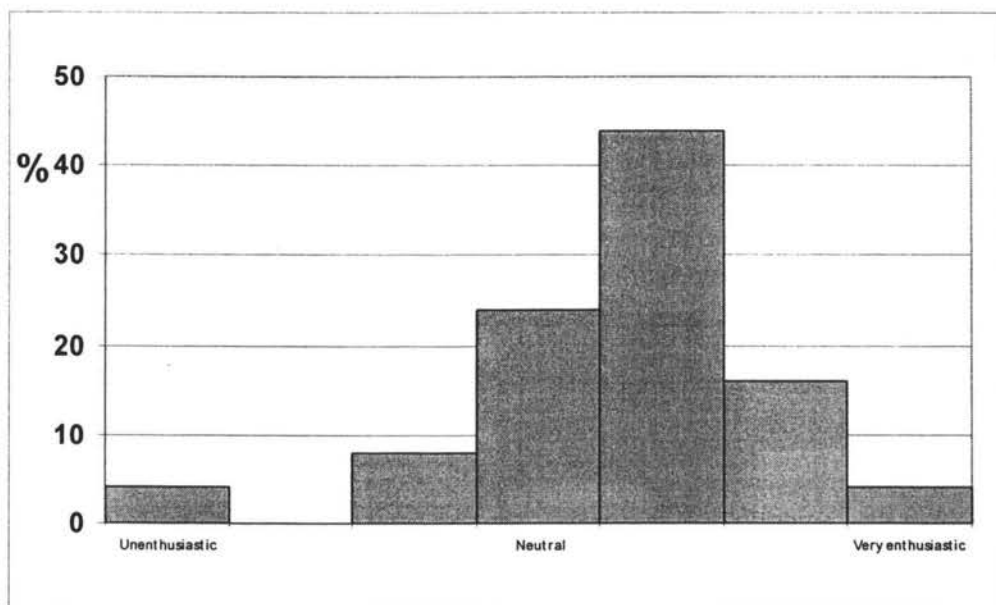


Figure 4-11 - Staff support for the notebook programme

Likewise, Figure 4.11 indicates a high level of support from teachers for the notebook programme at SKC, with over 75% of staff expressing a positive response.

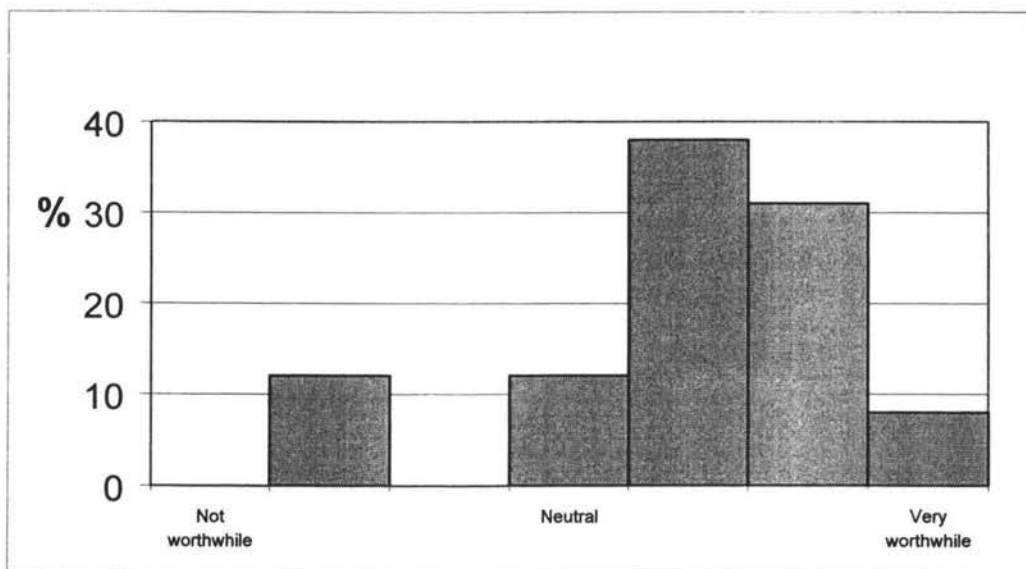


Figure 4-12 - Staff perceptions of the value of the notebook programme

While clearly, as Figure 4.12 shows, most staff perceive value in the College notebook programme, a few (12%) expressed the opinion that it has not been a worthwhile initiative for Year 9 students.

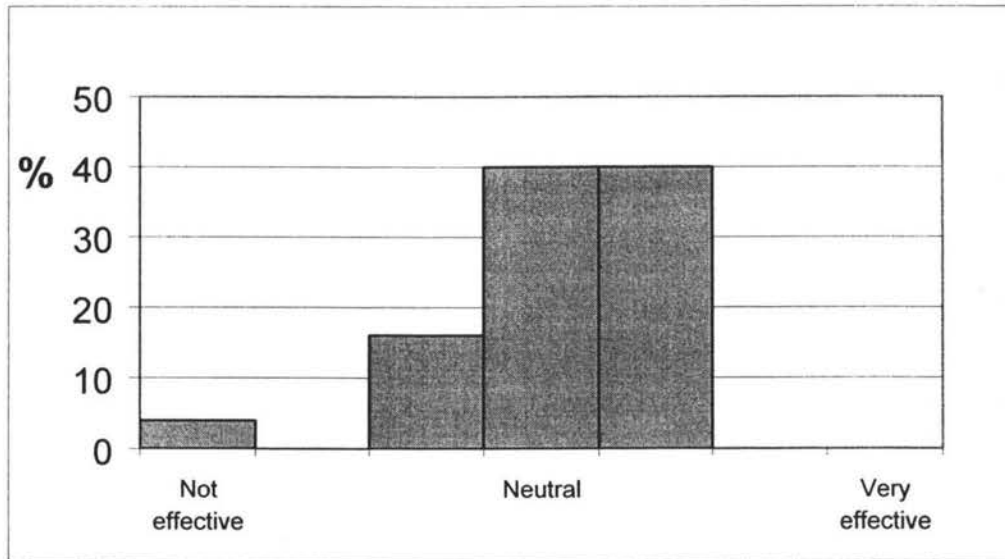


Figure 4-13 - Staff perceptions of the effectiveness of the notebook programme

As Figure 4.13 highlights, staff participating in the study were generally neutral or mildly positive in terms of the effectiveness of the notebook programme at the College. Only one teacher expressed the view that the programme was totally ineffective.

In summary, the majority of staff viewed that the College notebook programme was worthwhile and indicated good levels of enthusiasm and support for the programme, however, fewer perceived it had been effective. The written comments suggested a number of reasons for staff holding these views as evident below:

Put the essential operating structures in place to a functional level before expecting high usage from staff.

Always need more training, but I would appreciate training in curriculum areas.

I strongly support computer use, but our environment and structures are at odds with our Notebook system.

Place more emphasis on quality learning and the Notebooks being the tool, rather than the basis of learning.

Staff perceptions of the benefit to student learning with notebooks

This section reports findings on the impact on students' learning with notebooks on the basis of their academic ability. The survey design permitted the separation of student responses according to their previous academic performance. These two categories were established by their class groupings e.g. streamed (higher ability) and mixed ability classes.

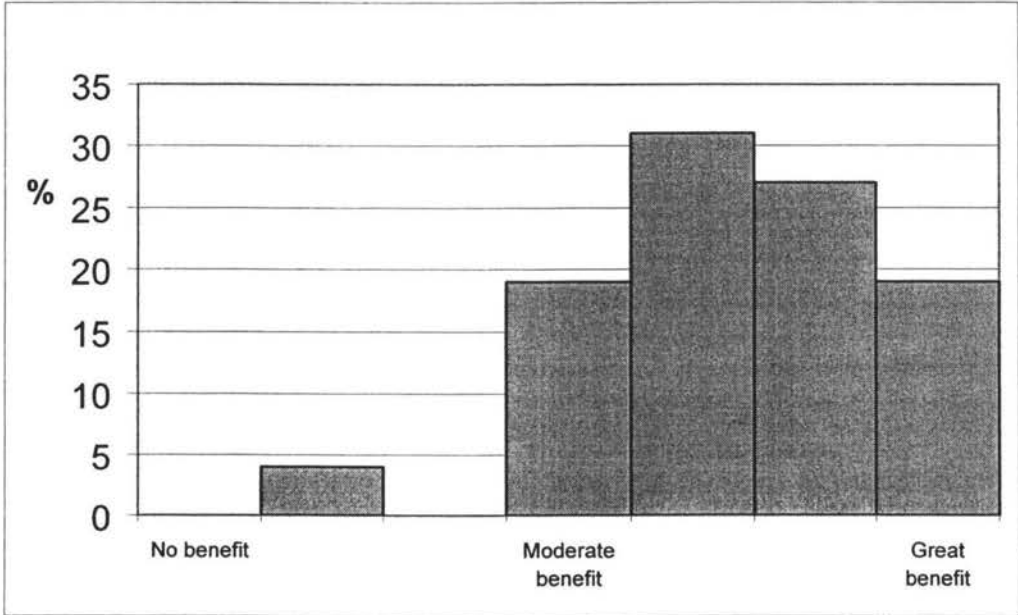


Figure 4-14 - The benefit of the notebook programme for higher ability students

Figure 4.14 indicates that staff perceive notebook usage has greater benefits for higher ability students, with only a small minority (4%) expressing a negative view.

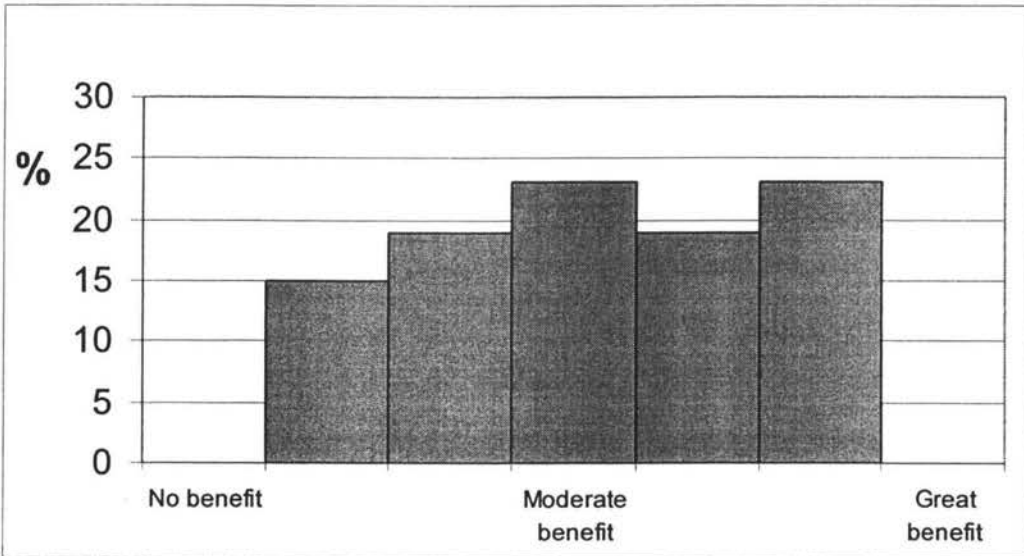


Figure 4-15 - The benefit of the notebook programme for mixed ability students

However, it is evident in Figure 4.15, that there was a far greater diversity of opinions expressed by teachers as to the benefit of notebook usage for mixed ability student groups.

Staff ICT self-assessment

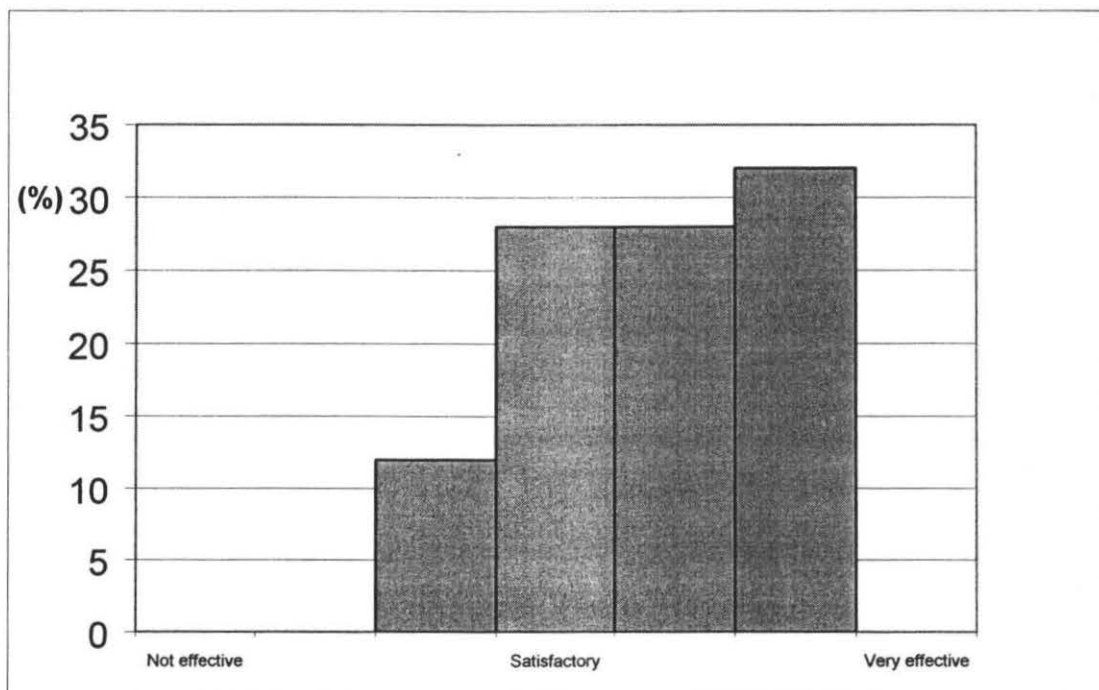


Figure 4-16 - Teachers self-assessment of their ability to teach effectively in a notebook class

Figure 4.16 reveals that most staff participants at the College believe they have a reasonable to good level of understanding and ability to teach effectively within a notebook classroom environment. For example, 78% of teachers considered themselves 'satisfactory' or better.

Staff recognised that there is always a need to improve their skills. The availability of time dedicated for ICT professional development was perceived as a key factor to improved levels of classroom use of ICT. As the following extracts from the focus group discussions reveal there was a diversity of staff responses to the question of effective use of notebook computers in lessons:

I have increasingly becoming more effective, it's taken me a few years to up-skill myself.

I'm still learning... it's another tool that I have got to bring into my teaching... another six months and I am out of date.

(the later comment refers to the problem of keeping up with the pace of ICT innovations)

If I don't know (how to use it) I just ask the students.

It's just a tool, it's not helping me to teach more effectively.

As it can be seen, these comments range from positive to non-committal and highlight the need for staff professional development and support.

Detailed analysis and interpretation of the staff data is considered in chapter five. The next section presents the student data.

Student information

This section presents the findings of the student questionnaire and focus group interview. In this section the student data is considered as a whole. Unless otherwise stated, all percentages expressed are based on the total student sample ($n = 48$). Detailed analysis of data on the basis of student academic ability is undertaken in Chapter Five.

Commencement of notebook use

Most students (88%) participating in the study commenced using their notebook computer in class lessons in 2000, that is, at the start of Year 9. A small proportion of the student sample (12%) had commenced notebook use in Year 8 or earlier. Given the small number of students with prior notebook experience no distinction in the student responses has been made on this basis.

Home usage of notebooks

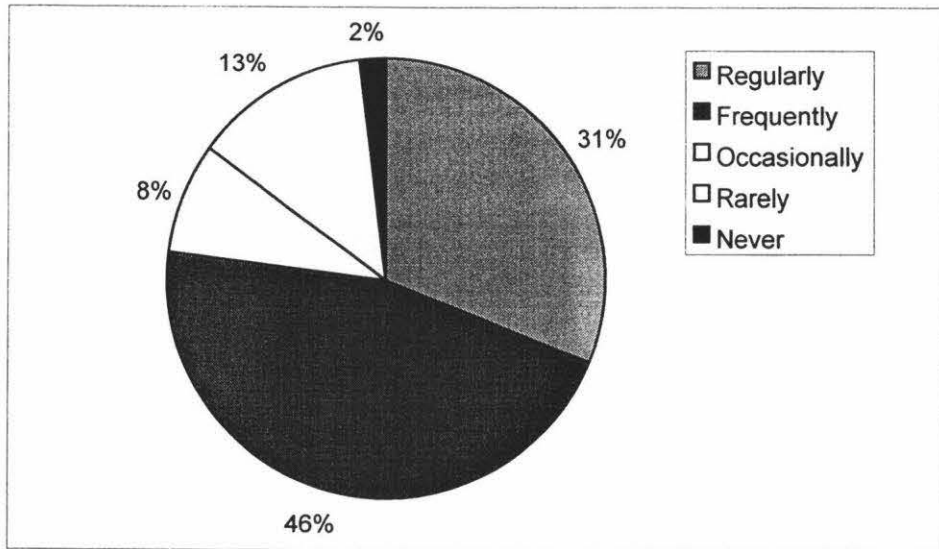


Figure 4-17 - Student home usage of notebook

As Figure 4.17 reveals, the majority of students make use of their notebook computer at home (77% either regularly or frequently).

The impact of notebook use on student work

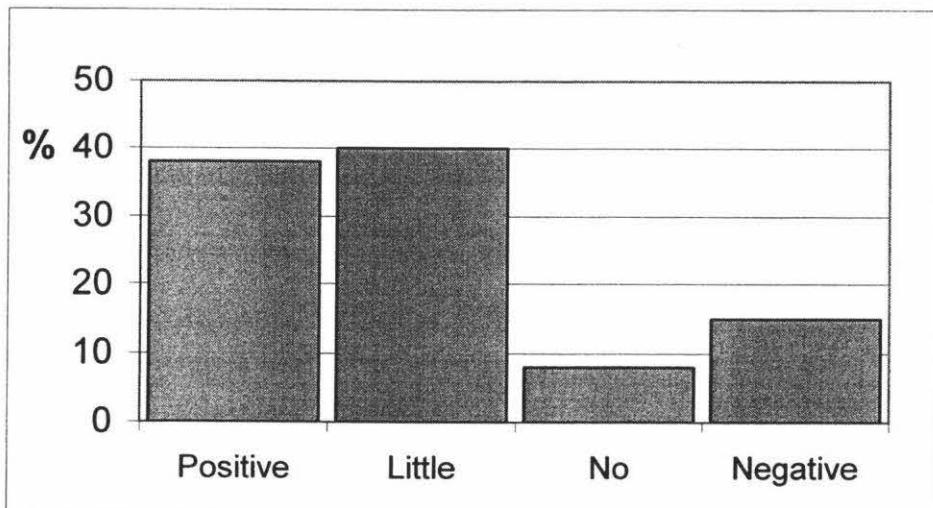


Figure 4-18 - The effect of notebook use on the standard of student work

Figure 4.18 shows the effect of notebook use on the standard of student work. The minority of the students (38%) perceived that the use of the notebook computer has had a positive effect on their work. While nearly 50% believe it has had either little or no

effect, a smaller proportion (15%) regard the use of the notebook computer as having a negative effect on their school work.

It should be noted the term 'standard of school work' is a broad expression and students may have interpreted it differently, however it does give a general idea of the perceptions of the student regarding their use of notebooks.

Some student written comments were positive and generally focused on the physical benefits of computer generated work, as such:

It has made my work neater and more presentable.

Using a notebook makes work not so hard to write and also saves time.

I am bad at spelling so the notebook helped me.

Whereas, others expressed negative views, focused on concerns as such:

My spelling has declined since using a notebook.

Games and other things take over and you never get around to doing the work set.

It seemed to sidetrack me.

The feedback from the focus group discussions was similar, with some additional insights, such as:

I have learned how to research better using a computer.

You forget how to handwrite for tests.

Everyone's presentation is similar.

Class use of notebooks in core subjects

Figure 4.19 shows that these results must be taken in context. Student use of their notebook is in part determined by curriculum appropriateness (e.g. students indicated little use in Mathematics) and perhaps by greater staff adoption and integration of the technology within lessons. For example, in Science 50% of students indicated that they used their computer ‘all the time’ in lessons.

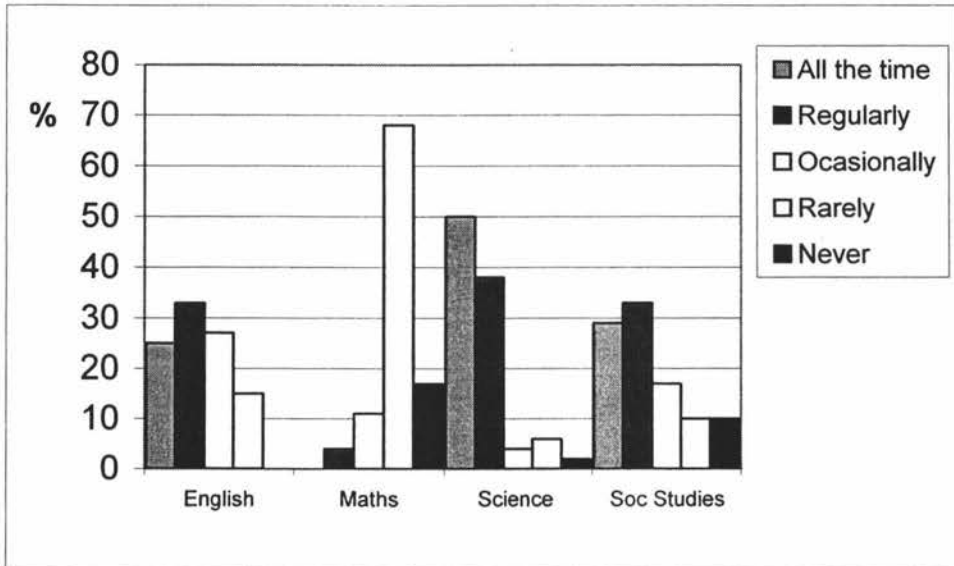


Figure 4-19 - Frequency of notebook use in core subject lessons

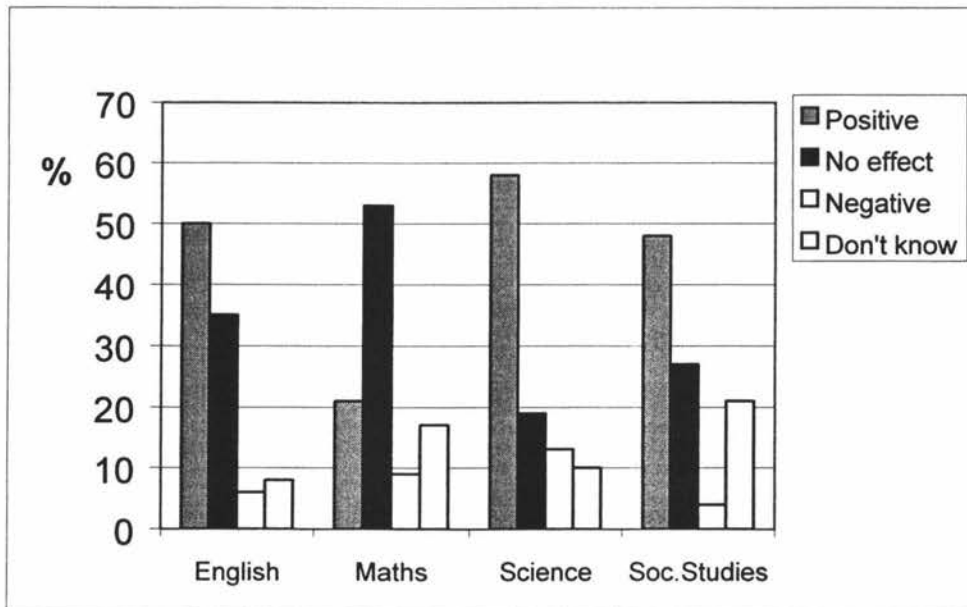


Figure 4-20 - The effect of notebook use in the core subjects

Figure 4.20 shows that in the core subjects of Science (58%), English (50%) and Social Studies (48%), students indicated that notebook use had a positive effect. While in Mathematics the majority (53%) perceived it had no effect and this may be related to limited appropriate curriculum usage of ICT in Mathematics at the time of this study.

These results are in keeping with data from other sections of the questionnaire (e.g. Question 4, see Appendix H) and therefore indicate a degree of internal validity within the survey instrument.

What are students using the notebooks for in lessons?

Table 4.3 presents the most common forms of notebook use by students and reveals that ‘note taking’ was the most common use students made of their computers in class, followed by ‘information gathering’ and ‘information sorting’. It was noteworthy that ‘subject specific software’ was lower than these other activities, yet overall it was ranked fourth.

Table 4-3 - Ranking of the common forms of notebook use by students in class

Ranking (% of sample)	Graphics & drawing	Info gathering	Info sorting	Note taking	Spread sheets	Subject Specific software
First	0	4	0	94	2	0
Second	4	60	19	2	6	8
Third	6	17	42	0	17	19

The student focus group members agreed with the rank order of the common classroom uses of notebook computers determined by the written questionnaire. As one student stated:

We use them in most lessons but always for word processing.

Another student asked why activities such as ‘games’ and ‘listening to music’ had been excluded. It was subsequently explained that these activities had been deliberately excluded as options in the survey instrument as they were not considered to be school or learning related activities.

Student ICT self-assessment

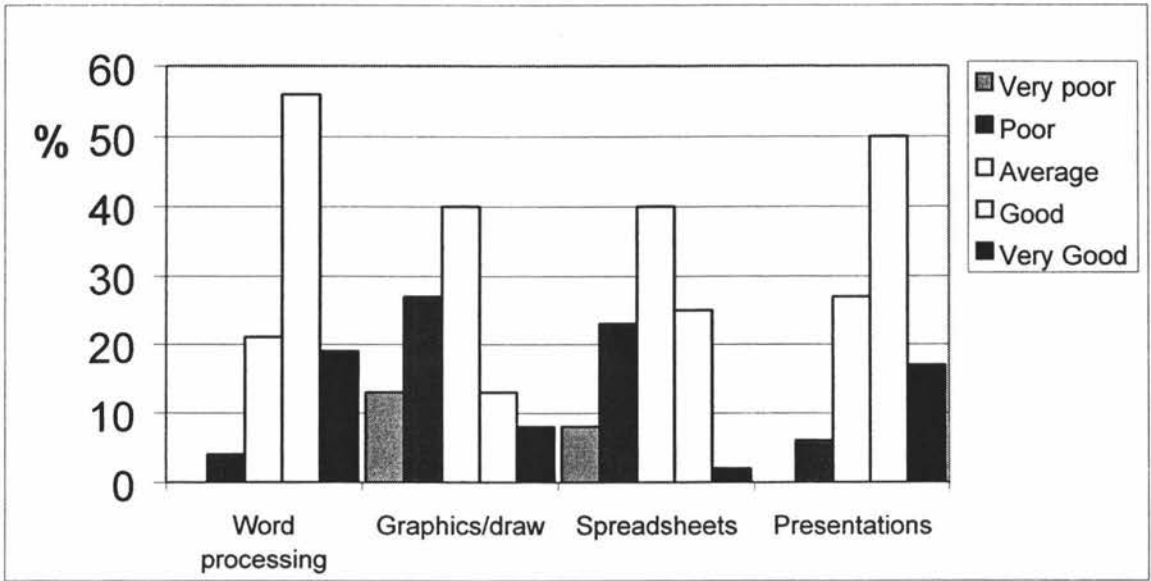


Figure 4-21 - Students self-assessment of their ability levels using common software

Figure 4.21 shows that the majority of students indicated that they have a good understanding and skill levels for the word processing and presentation software programs (e.g. Microsoft Word and Power-point). Fewer students felt confident with the use of Graphic and Spreadsheet programs (e.g. Microsoft Paint and Excel). Whether this is purely a consequence of the frequency of use of these particular programs and/or the curriculum relevance of specific software could not be determined.

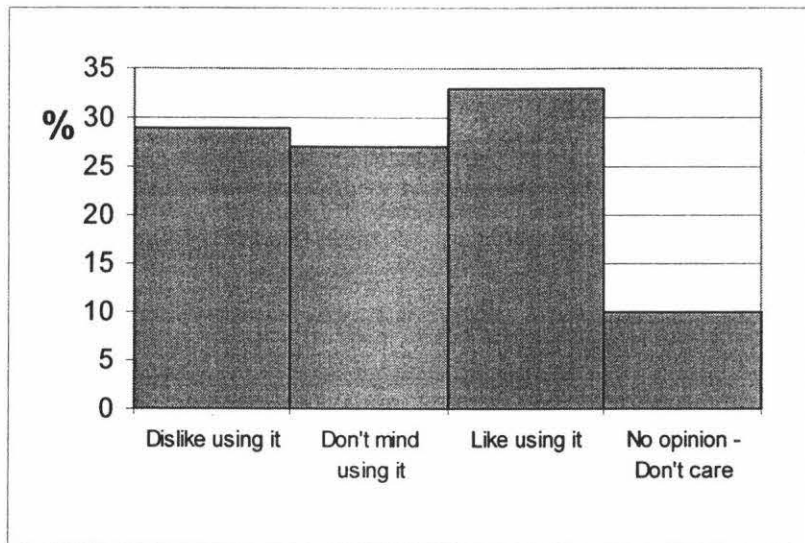


Figure 4-22 - Student views about classroom notebook use

In Figure 4.22 there appears to be no clear preference towards classroom notebook usage, as the students surveyed were nearly equally divided between the three suggested categories (ignoring the 10% who indicated they had no opinion). The high percentage (27%) who did not mind, perhaps who could be described as the ‘non-committed notebook users’, suggests that the College still has further work to do to ‘convert’ this group of the students.

Very similar results were obtained from another question, which considered the advice a student would give to another pupil joining the notebook programme. There was an equal division between the suggested responses, e.g. 29% of students expressed a negative view, that is, ‘don’t join the programme’; while 33% were uncommitted; and 29% of students were positive and recommended a fellow student ‘should join the notebook programme’. The similarity of data for both questions are a positive indicator of the internal validity of the survey instrument.

Student attitudes to computer use

Table 4.4 shows the student responses to the six computer attitudinal statements.

Table 4-4 Student Attitudes to Computer Use

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<i>(a) I enjoy playing games on computers.</i>					
N	1	5	17	13	12
%	2	10	35	27	25
<i>(b) I prefer to use computers to do school work</i>					
N	6	5	19	13	5
%	13	10	40	27	10
<i>(c) Computers make schoolwork more fun/interesting</i>					
N	6	3	14	19	6
%	13	6	29	40	13
<i>(d) Computers make schoolwork easier to do. (Note : N = 47)</i>					
N	5	7	11	17	7
%	11	15	23	36	15
<i>(e) Computers help me to improve the quality of my school work.</i>					
N	4	3	8	21	12
%	8	6	17	44	25
<i>(f) Computers help me understand my classes better.</i>					
N	9	9	19	9	2
%	19	19	40	19	4

Summarising these data it is suggested that students:

- Enjoy playing computer games and they do not mind using their computer for school work.
- Generally they find computers make school work more fun and interesting.

- Computers have improved the quality of their school work.
- However they have not helped them to understand their classes any better than in the traditional class environment.

As the students themselves reported:

Using computers helped me more because I enjoyed using them.

I was more interested in doing classwork than in previous years.

It made a positive effect on my presentation mainly.

The effect of notebook usage on student skills and work

Tables 4.5 below reports the positive effects of notebook usage as perceived by students, across a range of nominated categories.

Table 4-5 - The positive effects of notebook usage on student skills and work

Positive effects	% of sample
Neat presentation of my work	90
Correct spelling of my work	83
Researching information	79
Keeping my work organised	67
Note taking/recording in class	65
Doing homework	54
Note making on my own	46
Other skills *	4

* (e.g. typing skills and game playing!)

In a similar vein, Tables 4.6 reports the negative effects of notebook usage as perceived by students.

Table 4-6 - The negative effects of notebook usage on student skills and work

Negative effects	% of sample
Doing homework	42
Keeping my work organised	27
Note making on my own	25
Note taking/recording in class	23
Researching information	15
Correct spelling of my work	10
Neat presentation of my work	8
Other skills*	6

** (e.g. spelling, handwriting, design drawing skills)*

The data reveal that for a number of students, the category ‘doing homework’ appears to have had both a positive and a negative effect on their work. This suggests that in some subject areas and/or at some times using the notebook has been beneficial, while at other times its use has had a negative effect on their homework. In general the data shows there was a greater frequency of ‘positive’ skills responses from the students than ‘negative’ responses. As 90% of the sample identified ‘neat presentation’ as a factor, it ranks as the most obvious positive effect of student notebook use. Also a comparison of data reveals some students have found that notebook computers have assisted them in the organisation of their school work, whereas equally others have found the same technology a hindrance.

Student learning styles and notebook computers

Figure 4.23 illustrates that nearly half the student sample (48%) believed that using the notebook computer had changed the way they learnt. However, this is a crude response and the findings here need to be treated with caution. There is a question over the meaning of the adopted categories as ‘not sure’ and ‘maybe’ were not clearly defined, though ‘not sure’ is assumed to be a slightly negative response, while ‘maybe’ a slightly positive response, as both were positioned between ‘no’ and ‘yes’ responses.

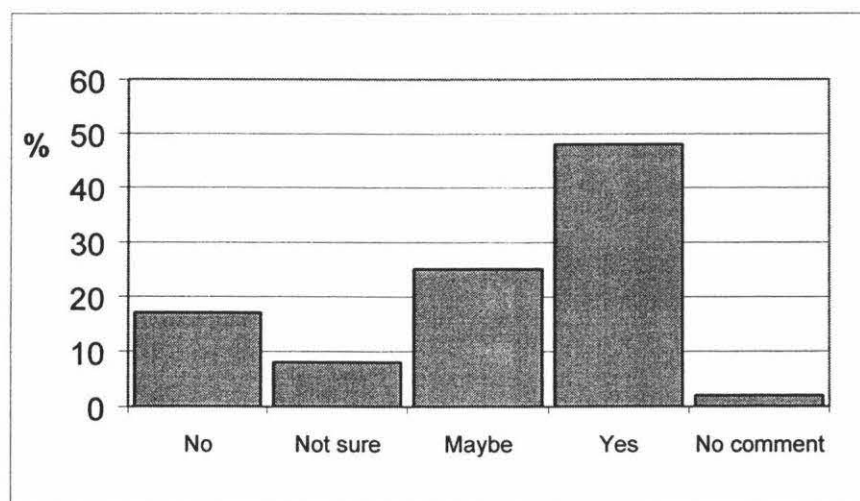


Figure 4.23 - Students views as to whether using a notebook changed their learning style

The student responses during the focus group gave further insight. A number of students expressed views that notebook usage had little or no effect on their learning, while others commented:

It's a different way of learning, but you learn the same material.

It's more negative effect because with computers you just see it on the board and you can type without thinking, when you write it down you think more about it.

If you can get to be able to touch type means you can think even less.

These comments suggest that some student perceive the passive nature of keyboard written notes resulted in less cognitive thought on the part of students during lessons. It is noteworthy to recognise that some students interviewed were not able to explain just how their learning had changed, although they perceived it had changed.

Notebook technological issues

The students experienced a considerable range of problems and 'software malfunction' and 'hard drive' problems were significant, with over half the students recording that they had experienced these problems with their own notebook computers. Lost

documents and battery related problems were other major problem areas, as shown in Table 4.7.

Table 4-7 - Notebook computer problems

Notebook computer problems	Percentage frequency
Hard drive failure / faults	56
Software malfunction / problems	54
Battery failure / fault	48
Lost files / folders	46
Mains adaptor failure / fault	33
Screen failure or damage	31
Virus infections / damage	27
No faults or problems during the year	10

The members of the focus group had experienced the full range of notebook problems, some more than others. As one student stated:

I had lots of problems, not all of them are on there.

Students also identified a range of notebook related concerns, which are presented in Table 4.8.

Table 4-8 - Notebook related problems

Notebook related problems	Percentage frequency
Carrying weight during school	88
Printing off my work	67
Revising for tests/exams	44
Storage problems at school	40
Transport problems (e.g. on bus)	38
Using the notebook keyboard	10
No real problems for me	4

The issue of the notebook weight was clearly the dominant concern for students as evident in Table 4.8. Problems associated with printing off their work were also a major concern. There was little disquiet about the actual use of the notebook keyboard, as the keyboard size is similar in size to a normal desktop keyboard.

The focus group participants felt a sense of frustration, having to carry their notebook computer to and from school, yet not using it regularly in class. As one student complained:

I carry it to school every day but only use it for two periods.

Another issue raised in discussion was that of security and size and location of student lockers. Several students indicated that having a notebook had also altered their behaviour outside of the classroom. They reported:

At lunchtime you have to go and lock it away before playing sports.

It's a hassle going to toilets, can't exactly take it in and have it on your lap!

Level of notebook use in class

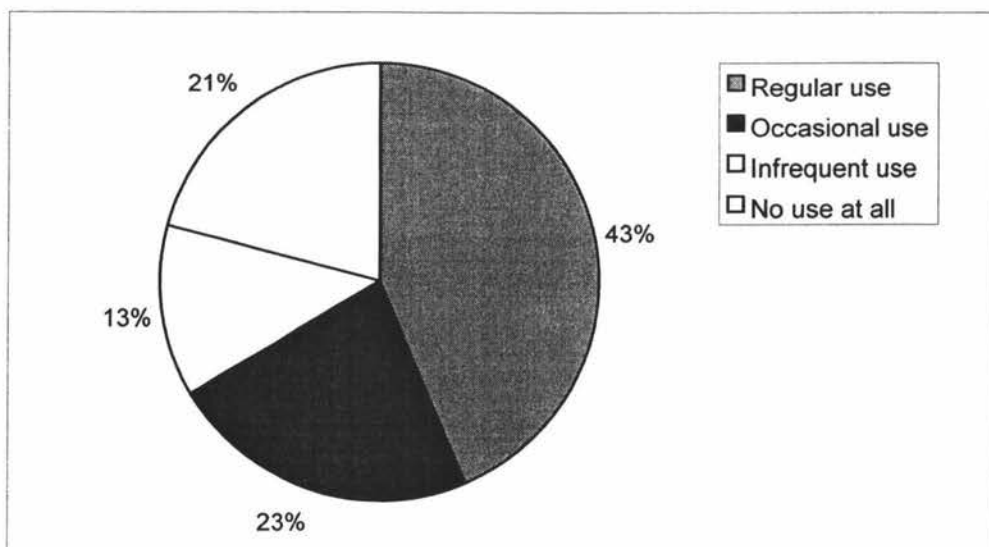


Figure 4.24 - Student preferred frequency of class usage of notebooks

As Figure 4.24 shows, a small group of students (21%) would prefer not to use notebook technology within the classroom. However clearly most students would wish to work within a learning environment where notebook technology is used to a large extent.

The student responses in the focus group did not reflect those reported in the questionnaire. None of the twelve participants wanted 'regular' use of notebooks within the classroom, while six (50%) expressed a preference for 'occasional' use, four for 'infrequent' and two students opting for 'no use at all'. These figures are in contrast with data from Phase one, which indicated over 40% of students would prefer 'regular' classroom use of notebooks.

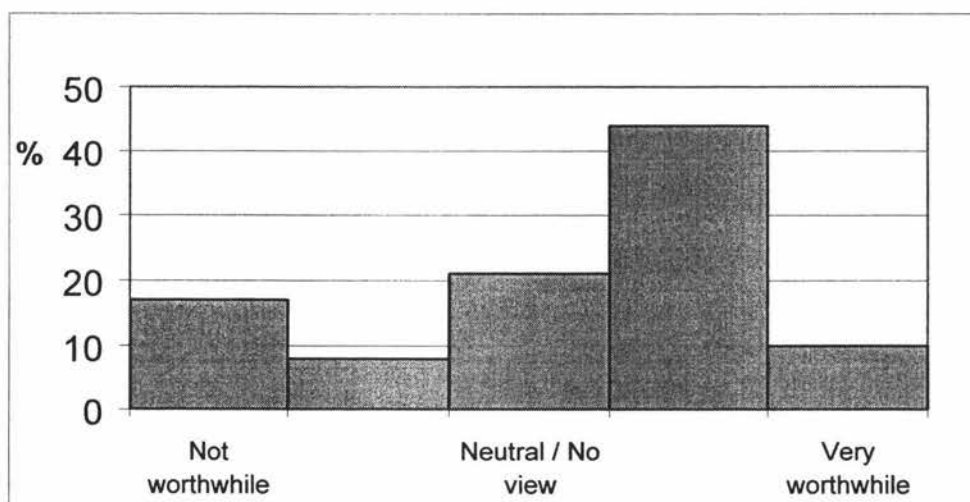


Figure 4.25 - Student views on the value of the notebook programme

As Figure 4.25 shows, there is a small (25%) but important group of students who expressed the view that the notebook programme had not been worthwhile, while in general the majority of students (54%) expressed a positive response.

Student work skills

The following section presents the data related to four specific areas:

- (a) Notebooks and student organisation
- (b) Notebooks and student productivity
- (c) Time management – Inside the classroom
- (d) Time management – Outside the classroom

The student responses were elicited using trigger statements, which for ease of understanding have been included in each figure. In addition, in keeping with the objectives of the study, a separate analysis of the student responses based on their academic ability has been completed (see chapter five).

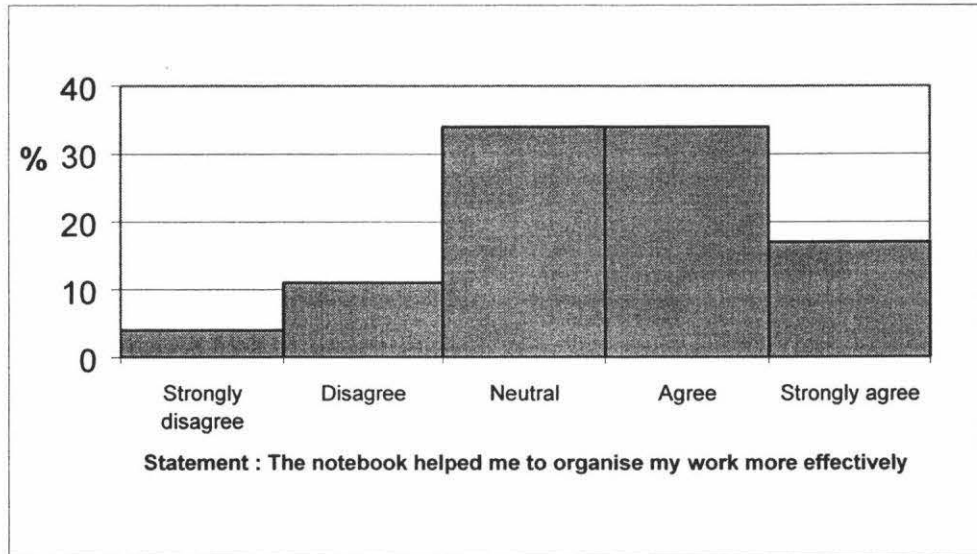


Figure 4.26 –Student responses as to the organisational effectiveness of notebook use

Figure 4.26 shows just over half of students (51%) expressed that their usage of a notebook computer had helped them to organise their work more effectively. Conversely, 15% of the students felt that the organisation of their work had suffered and had been less effective as a result of notebook use. A high number of students expressed a neutral viewpoint (34%).

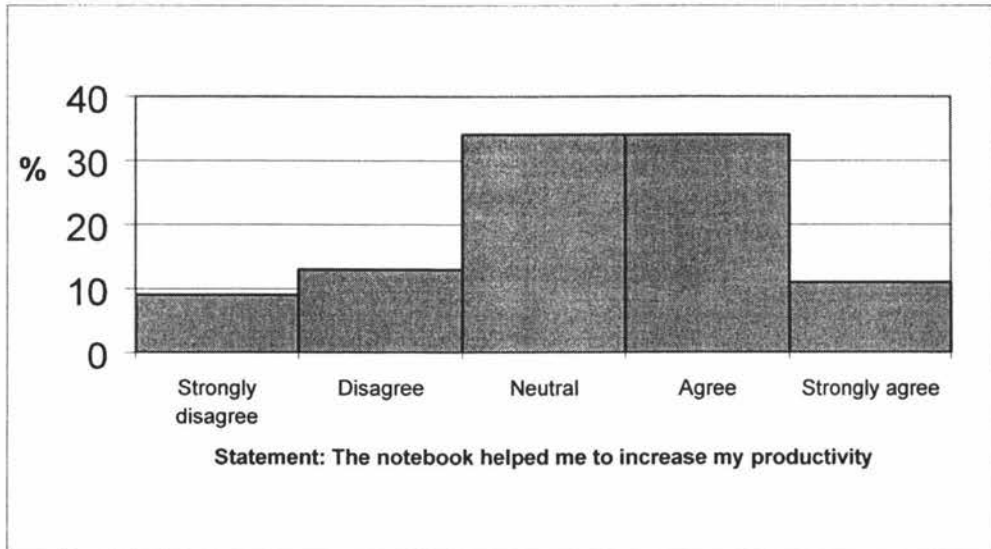


Figure 4.27 - Student responses as to the impact of notebook use on their productivity

Figure 4.27 indicates that around 20% of students believed that they were producing less work as a result of using a notebook computer. On the other hand 45% of students perceived that their work productivity had increased. The volume of work produced by the students was not quantified so these figures relate to their own perceptions of the work they generally produced in 2001. Whether any increase or decrease can be directly attributed to student notebook use was not measured.

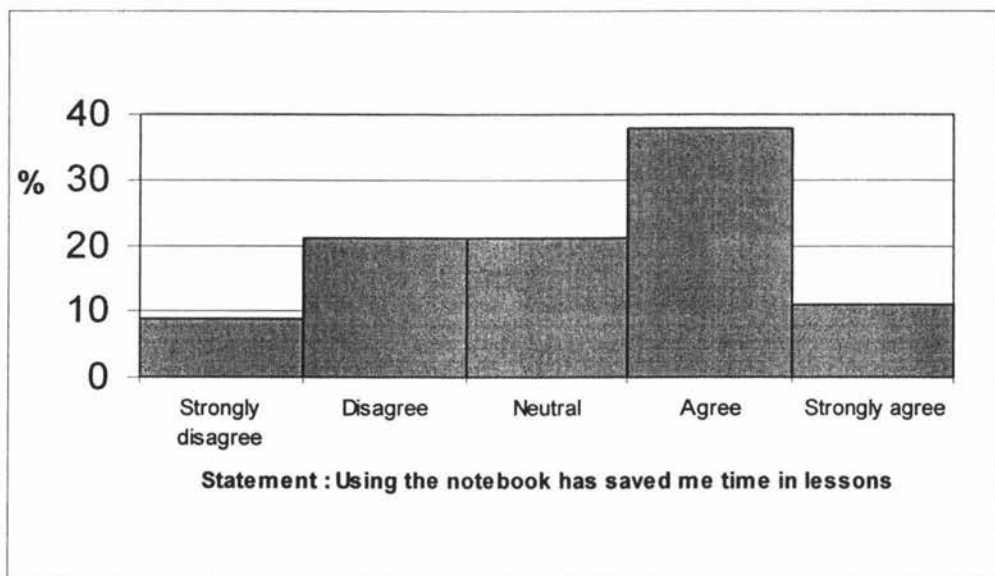


Figure 4.28 – The impact of notebook use on student time management in class

Nearly half the students (49%) expressed the view that notebook use had saved them time during class lessons as shown in Figure 4.28. Despite this, there were numerous written and focus group comments that the computers were too slow and time wasting. The level of students (30%) who felt that notebook use had effectively wasted time is reflected in the following two comments. In the words of the students:

One of the most frequent problems is frustration and this is due to slowness.

Starting up the computer takes too long.

In the focus group discussions one student stated, ‘Our computers are not fast enough’ and another suggested that teachers should move between classes rather than students, thus reducing the start up/shut down time wastage between lessons.

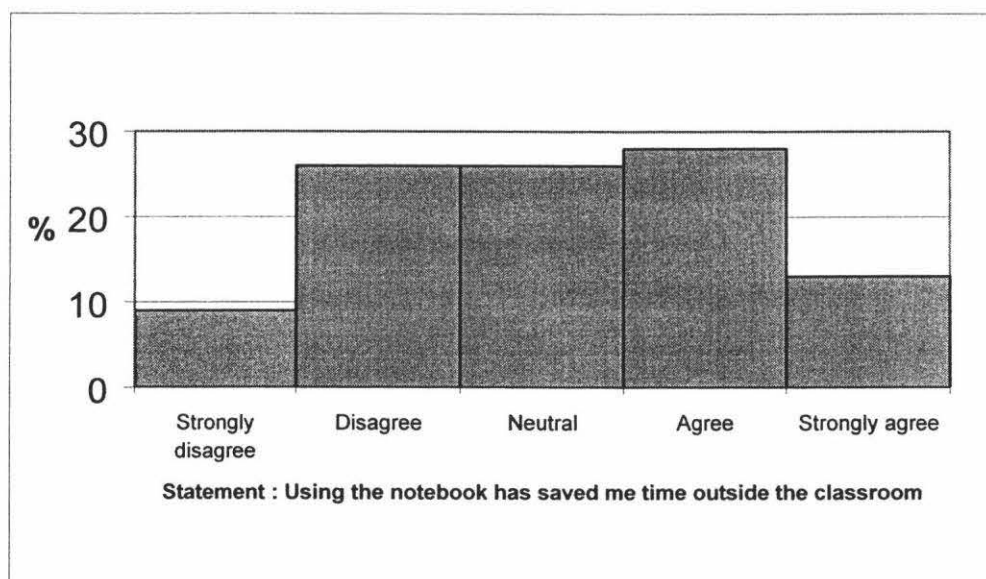


Figure 4.29 – The impact of notebook use on student time management outside of class

Figure 4.29 shows the effect of notebook use on the students’ time management outside of lessons. There was a near equal distribution of student responses, with only slightly more students indicating that using a notebook computer had been beneficial in terms of time management of work outside of the classroom. i.e. for homework.

Teaching subjects and student notebook use

Two thirds of the students surveyed indicated that some subjects and/or teachers made better use of the notebook technology than others, as indicated in Figure 4.30. The students were asked to list the subjects where they felt better use was made (from the

student's point of view) of their notebook computers. Students chose to list only a limited number of subjects from the range offered. Science (48% of the total sample), along with to a lesser degree the other core subjects, were recognised as having made better classroom use of notebook technology.

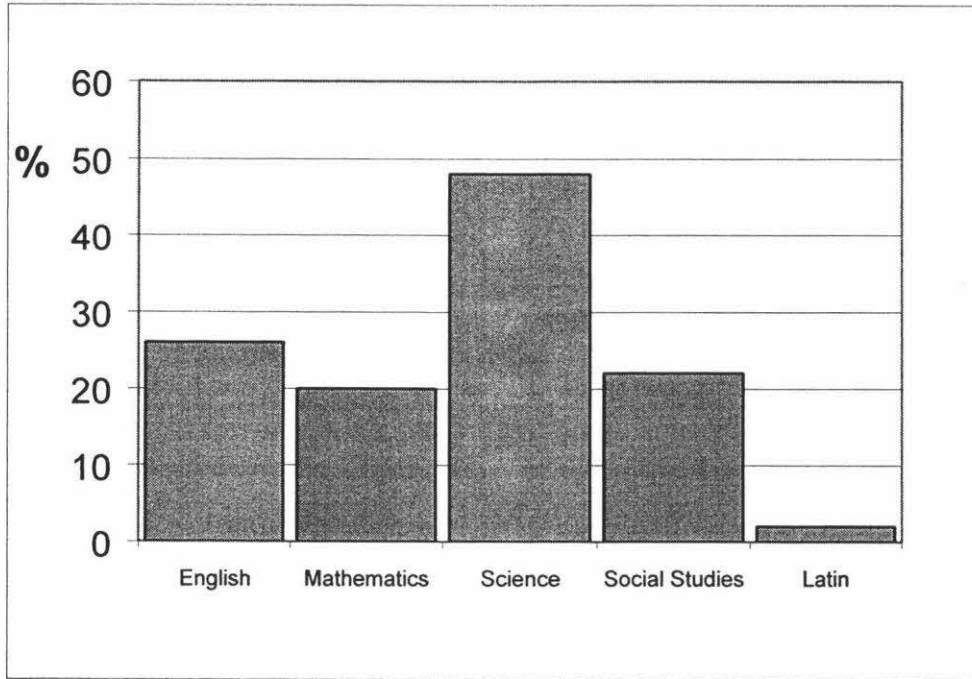


Figure 4.30 - Subjects identified by students as having made better use of notebook technology

Ultimately the level of classroom usage of the notebooks was determined by the combination of the software appropriateness and the individual staff members teaching style. Comments made in the student focus group suggest the latter was perceived by the students to have the greater impact on the level of classroom notebook usage. As the following students stated:

We never used it, probably about once a week.

We used it a lot in maths (in 2000)... but this year we have had two notebook lessons (with a different teacher).

It depends on the teacher.

Parent information

This section reports the findings of the parent questionnaire. It describes a range of issues related to the College student notebook programme. These include: (a) the level of home usage; (b) influence on student enrolment; (c) the educational and vocational benefits of notebook use; (d) the impact on student work, and finally; (e) examines parent perceptions and attitudes towards the SKC notebook programme. Unless otherwise stated all percentages expressed are based on the total parent survey sample (n = 49).

Home use of notebooks

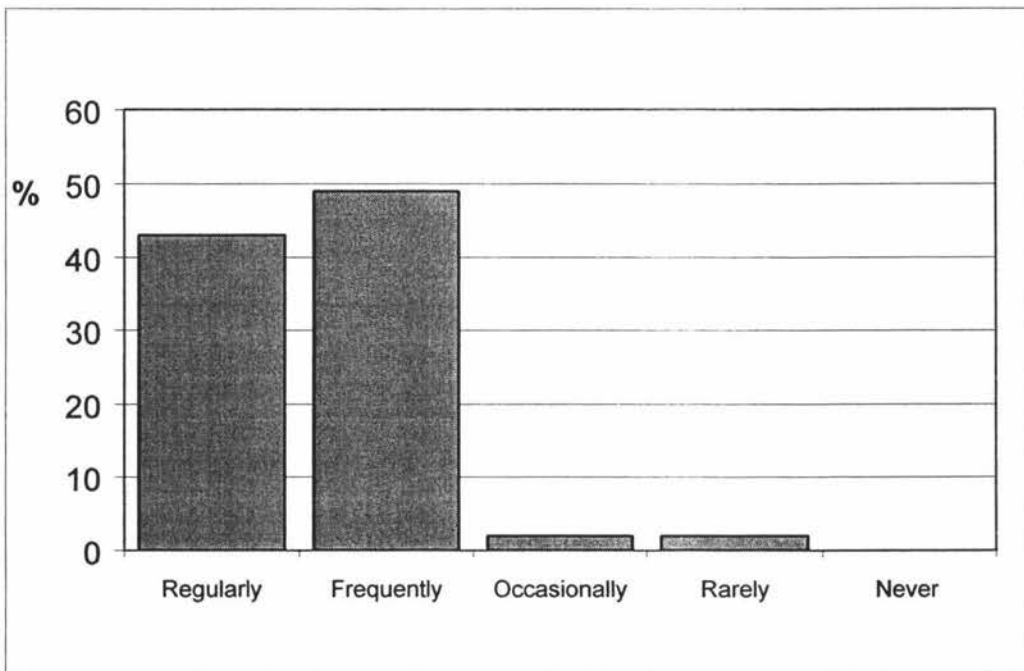


Figure 4.31 - Home use of the notebook computer by students

Figure 4.31 shows the high level of home use of notebook computer by students as reported by parents. Two families recorded on their survey form that their sons were full time boarders and indicated that their sons 'rarely' used their notebooks at their actual home. The results appear to be consistent with the level of student use of notebooks as indicated in the student questionnaire (see Figure 4.17). It is noteworthy that some students indicated they use their notebook at home rarely (13%), yet fewer parents (4%) selected the corresponding low level of use. The survey question did not specify the type of use, so possibly the students were using their computers for non-school related

activities, e.g. playing games. It is also noteworthy that only 27% of the respondents reported that their sons make significant use of another computer in the home (i.e. a desk top machine) to complete their school work.

The influence of the notebook programme on enrolment in 2000

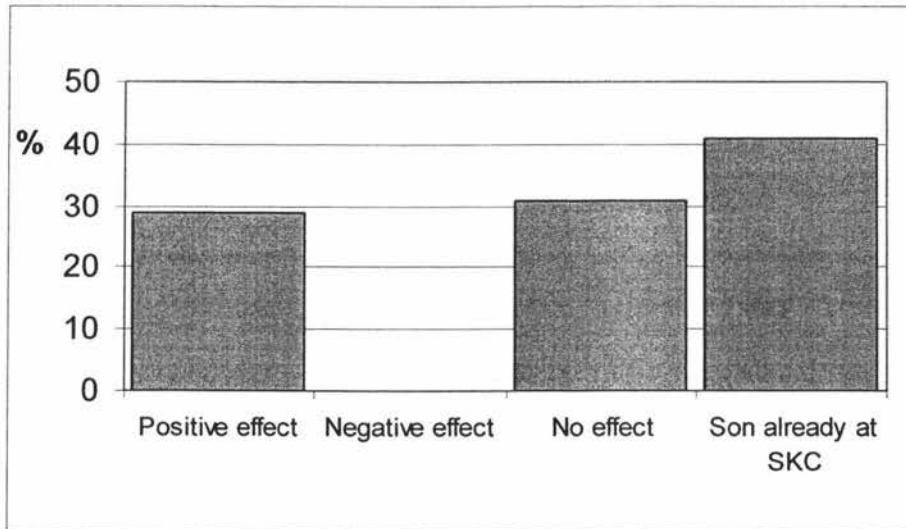


Figure 4.32 - Parents views as to the influence of the notebook programme on student enrolment

Figure 4.32 reveals that in most cases the implementation of the compulsory notebook programme in Year 9 had only a limited influence on the decision of families to enrol their son/s at the College. As a large proportion of students (41%) were already attending the Intermediate Department of the College as Year 8 students, the notebook programme may have had only a minor influence on their decision making process, except perhaps in terms of financial expense.

However it is recognised that this study considered only families whose son/s currently attend the College and for an undetermined number of families who decided not to enrol their child at SKC the notebook programme may well have been a significant factor in their decision.

The following sample of written comments reflect the diversity of the parents' views:

The notebook programme wouldn't have influenced our decision to send our sons to the College.

My initial views of the programme were positive and I was disappointed when my son didn't get into the Form 2 (Year 8) notebook class.

We did not want our son to use a notebook as an option in Form 2 and we are still fairly ambivalent about computer usage in forms 3 and 4 (Years 9 and 10).

It sounds wonderful but I don't think the actual experience has been as positive as we thought it would be.

We were forced to buy a computer if our son was to continue at the College. No other options given.

Even given the cost the notebook programme was seen as a big advantage given the role computers play today.

I felt that the College was at the cutting edge of educating boys with computer technology.

*At the time of enrolment we were not aware of the notebook programme.
(This last comment was repeated by three other respondents).*

The educational and vocational benefits of the notebook programme

The following section reports the parents' perceptions regarding the educational and vocational benefits of student notebook use.

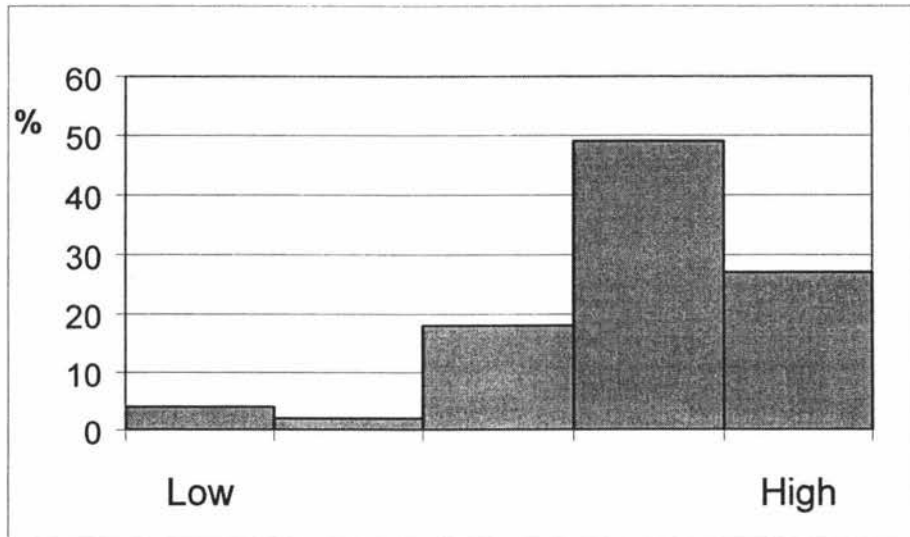


Figure 4.33 - Parents perceptions of the vocational benefits of the notebook programme

Clearly, as Figure 4.33 shows, most parents report that they perceive there are good vocational benefits associated with the student notebook programme.

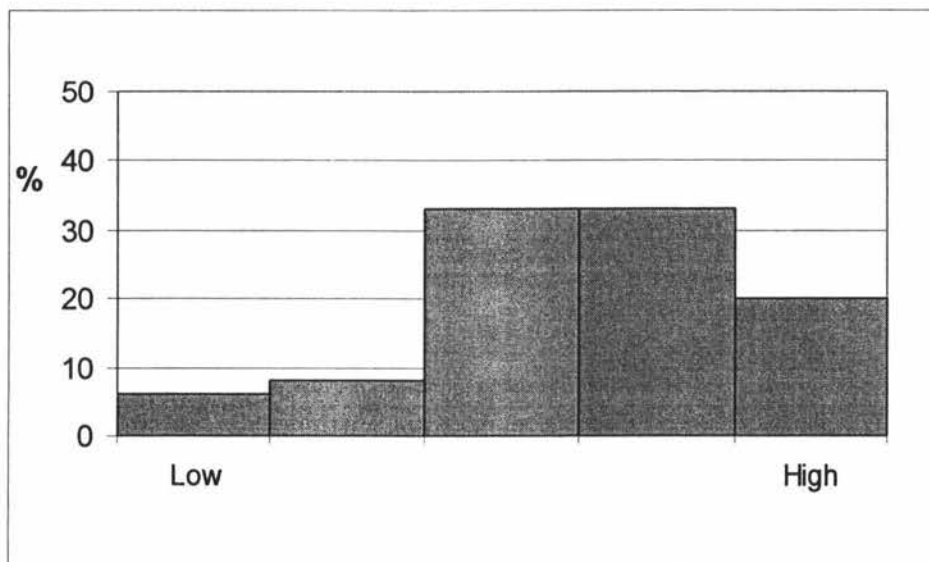


Figure 4.34 - Parents perceptions of the educational benefits of the notebook programme

Figure 4.34 shows that, to a somewhat lesser extent, parents appear to be convinced of the educational benefits of notebook use by students. The written comments made by

respondents indicated that most were supportive and believed that notebook usage had significant advantages in terms of career development. In contrast, a few parents expressed the opinion that there was a downside to notebook usage by their sons.

The following positive parent comments highlight the vocational benefits:

We can probably survive educationally without notebooks in the classroom and at home, however they are a definite advantage in most managerial positions our son may aspire to.

Feel it is necessary for students to learn use of computers in order to be more employable when they leave school.

Excellent preparation for the commercial world.

While other parents, for a variety of reasons, expressed reservations primarily about the educational benefits of the notebook programme. The following comments reflect these more critical views:

It is a tool and not an end in itself. The biggest drawback is carrying it around in addition to books.

Less distractions with non-computer learning in the classroom. There is no more educational benefit in learning by computer than conventional methods.

Educational benefit is still debatable, it's early days with many technical hitches etc.

At this stage I believe they are fully under utilised and see that increased use would increase the educational benefit.

Being parents of the older generation we still have concerns about the use of computers to the detriment of the basic learning principles, in particular writing/reading.

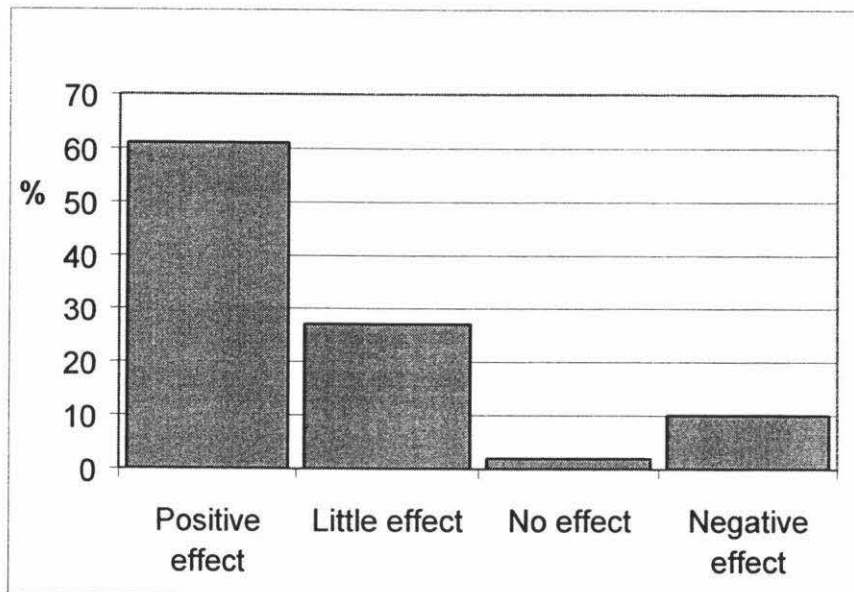


Figure 4.35 - The effect of notebook use on student school work

Figure 4.35 illustrates the majority of parents perceive that the use of the notebook computer has had a positive effect on the quality of student work. However, the definition of ‘quality’ was not specified and although not confirmed, ‘quality’ is likely to have been interpreted in terms of the presentation of work, rather than the intellectual standard of the work.

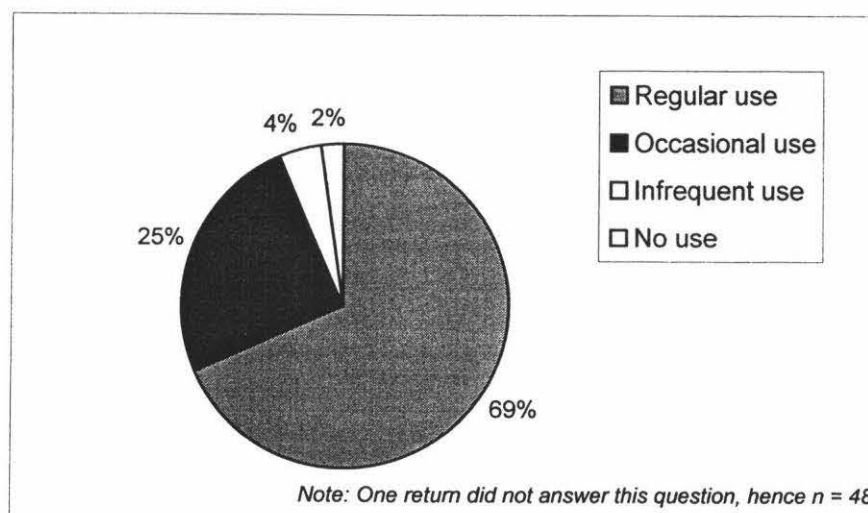


Figure 4.36 - Parents preference of the level of student notebook usage in the classroom

Figure 4.36 indicates that parents support the student use of notebook technology within the classroom, with 89% preferring either regular or occasional use. Only one

respondent (2%) indicated they would prefer no notebook use. However, this may be considered as a skewed response, as all the current parents have already committed a financial expense to purchase a notebook computer for their son and hence the desire to see it utilised to the full is a logical consequence of this investment.

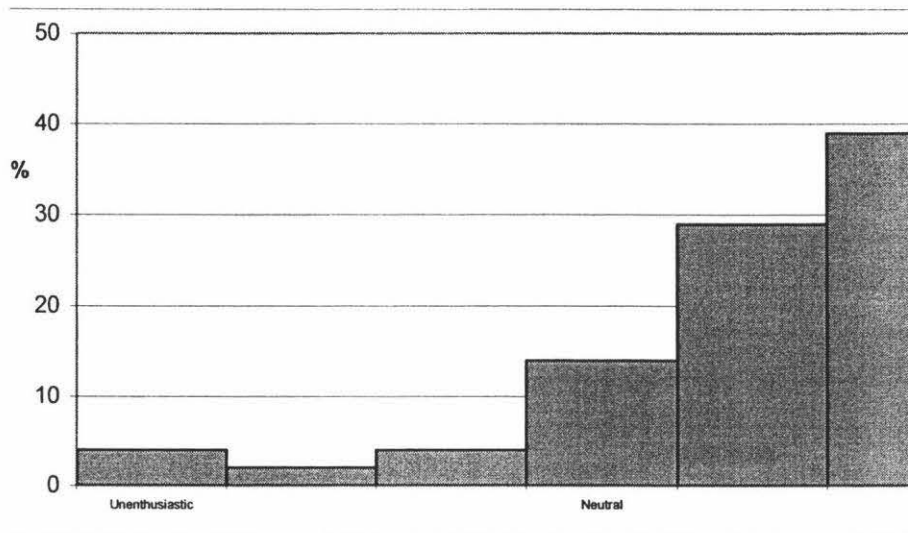


Figure 4.37 - Parental enthusiasm for the use of notebook computers in classes

As shown in Figure 4.37, there is generally a good level of enthusiasm by the parents for the use of notebook in College, with 68% of parents expressing more than just 'neutral' response.

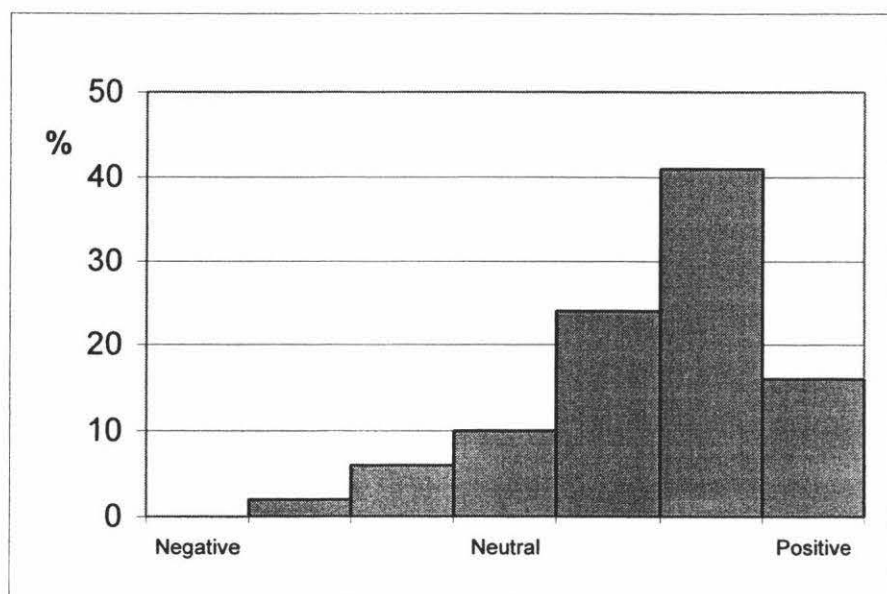


Figure 4-38 Level of parental support for the notebook programme

Figure 4.38 illustrates that there appears to be overwhelming positive support for student notebook usage at the College, with 71% of parent responses in support of the programme.

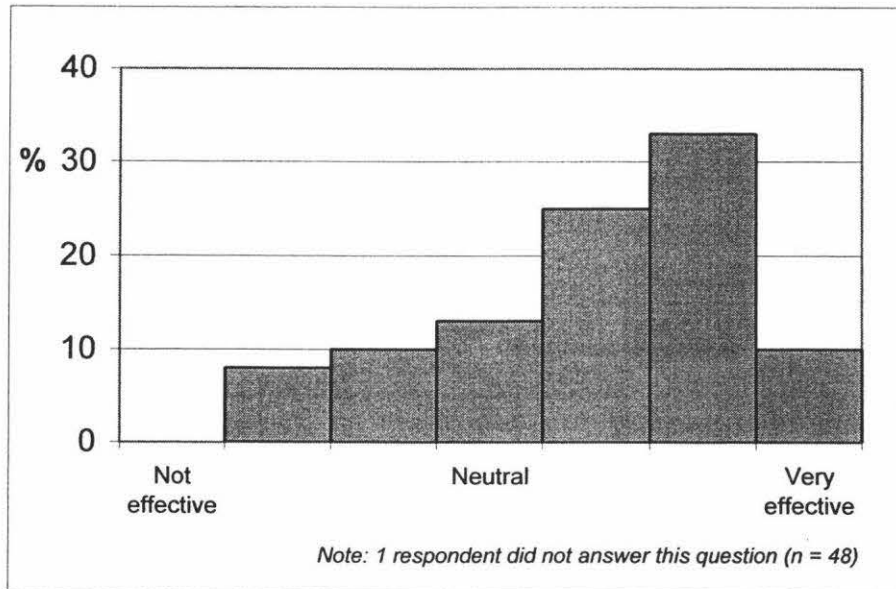


Figure 4.39 - Parental perceptions of the effectiveness of the notebook programme

Figure 4.39 would indicate that, as observers ‘at a distance’, parents generally perceived the College notebook programme to be effective.

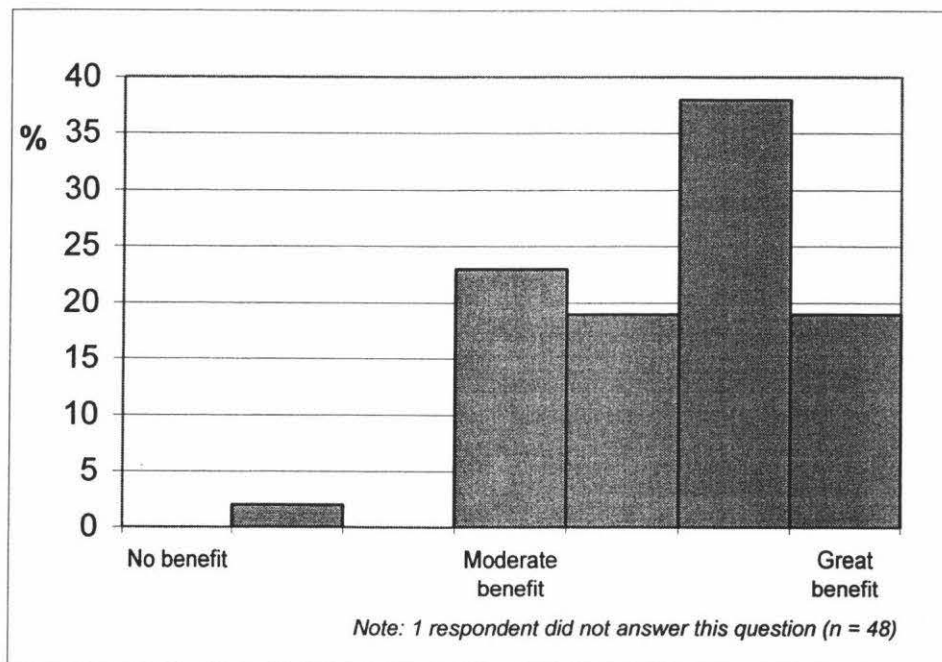


Figure 4-40 Parental perceptions of the beneficial nature of notebook technology in learning

Figure 4.40 indicates that a majority of the parent sample believe that student use of notebook technology is beneficial to their sons' learning. On exactly what basis this judgement has been made by the parents was not evident. However, the individual written responses to the question that asked about this issue illustrate a diversity of positive and negative effects of the notebook programme, as perceived by the parents of the student participants.

The following parent comments reflect their perceptions of the **positive effects on student learning** of notebook use:

He takes more interest in study because of the notebook, because it is the first time for him and he wants to show it to his parents.

Skill and knowledge level of computer use enhanced.

My son is always up to date with work or has opportunity to catch up on work missed due to music or other commitments within school. Students are responsible for ensuring work is completed. No excuses for missing any class work as everything is listed on notebook.

Layout and presentation improved, mainly because he didn't have to hand write things. (similar remarks about the presentation of work were made by other parents).

He can collect reference material more easily. He enjoys doing his work, especially the projects because he can use different software. He does not have to waste time to recopy his exercises again when he makes mistakes.

He is very proficient in the use of computers. He is able to access a wide range of useful information through internet etc.

He is more inclined to do homework on the computer. As most work is on the computer there is less mess with papers being left everywhere and his chance of work being left at home or at school.

He is keen to do homework. The quality and quantity of work has greatly improved. Speed of processing for him is enormous. More independence to work on his own. Attitude and confidence is fantastic.

He has learnt how to use the computer very effectively and quickly. When he has a problem he has usually been able to work it out himself and has even helped me when I have a problem on the computer.

The following parent comments reflect their perceptions of the **negative effects on student learning** of notebook use:

Without notebook, normally every student writes their notes and homework and also improve their hand writing, but with the notebook hardly any hand written home work.

*He says his spelling has deteriorated.
Too many distractions ie; playing of games.*

Difficult for parents to check on homework or any work being done or not done. We moved our home computer into the living room so we can monitor usage, but the Notebook can be used anywhere, so much harder to monitor.

Although breakdowns did not happen often, a real hassle when it did. Access to work for study etc hard to obtain.

His handwriting has deteriorated. He is reluctant to carry the laptop to and from school. Posture poor due to all the gear being carried. Gets distracted by access to internet, music and games.

Over dependence on word processor – can't work with pen and paper !

If the notebook breaks down, work is lost, study is difficult, some files not printed, some lost. Heavy to lug to and from school. I believe the notebook may have added a complication to learning rather than aiding it.

Being not a particularly organised boy, the notebook allowed him to waste still more time.

Our son has not used the notebook well due to his learning strengths. He would be better suited to be taught in a way that his attributes and abilities could be focused on.

It has restricted his reading and writing growth. These are in our opinion still an integral part of the learning process.

I was initially very ambivalent about laptop usage. However as a parent, I can now see some advantages. Still a 'real problem' with the boys not having the maturity level to use computers effectively.

These comments, both positive and negative, reflect a wide range of concerns and thus a thematic analysis approach has been undertaken to identify key concerns and issues.

Thematic analysis of parent comments

This section provides a presentation of the written parent responses using a thematic approach. Based on a coding of parent comments around a series of self-evident common themes, the following perceived effects of the notebook programme have been identified.

Positive effects

A review of the questionnaire responses revealed that 42 out of the 49 respondents (86%) chose to write a personal comment in relation to the benefits of notebook usage. The written comments were coded into four distinct themes in relation to the positive effects of student notebook usage. Some parents mentioned more than one benefit in their response.

Table 4-9 Positive response frequency

Themes	Frequency	%
Improved Information Technology skills and understanding	20	41
Improved presentation of work	17	35
Improved student motivation	5	10
Improved appropriate Information Communication Technology usage	4	8

Clearly as Table 4.9 indicates, the most significant benefits for student learning as perceived by the parents were related to improvements in the students' computer literacy (41%) and in the physical presentation of their academic work (35%).

Negative effects

Likewise, it was observed that 39 out of the 49 respondents (80%) chose to write one or more negative comments about notebook usage. Given the number of positive respondents stated previously this indicates that many parents expressed both positive and negative opinions on various aspects of their child's notebook usage. Using a similar format to that of the positive categories, the written comments have been coded according to six distinct themes in relation to the perceived negative effects of student notebook usage. Some parents mentioned more than one negative aspect in their response.

Table 4-10 Negative response frequency

Themes	Frequency	%
Handwriting and spelling	14	29
Distraction from learning, time wasting	12	24
Monitoring their son's work / productivity / activities	7	14
Physical concerns e.g. Carrying weight of the notebook	4	8
Computer faults/failures problems	3	6
The effect on reading	3	6

As Table 4.10 shows, the frequency of the major negative concerns expressed are generally lower than the level of support for the positive effects. However, it is evident that a number (29%) of the parents are concerned that their sons' written skills have either not developed as would be expected or have deteriorated since their participation in the notebook programme. Likewise parents expressed concern that the students were relatively easily distracted from their academic work by either a range of computer games and/or dealing with IT software related concerns rather than focusing of their studies.

In contrast to the high levels of notebook problems and failures recorded by students in their questionnaire responses, the parents have not reflected these software and hardware concerns in their responses.

Parents perceptions of their child's enthusiasm for notebook use

Figure 4.41 indicates the parents perceptions of their child's level of enthusiasm for notebook usage. The trend is positive with 61% of respondents reporting a degree of enthusiasm by their child in relation to the use of notebook technology. Only 18% of the parent sample indicated that their son was unenthusiastic to any degree at all.

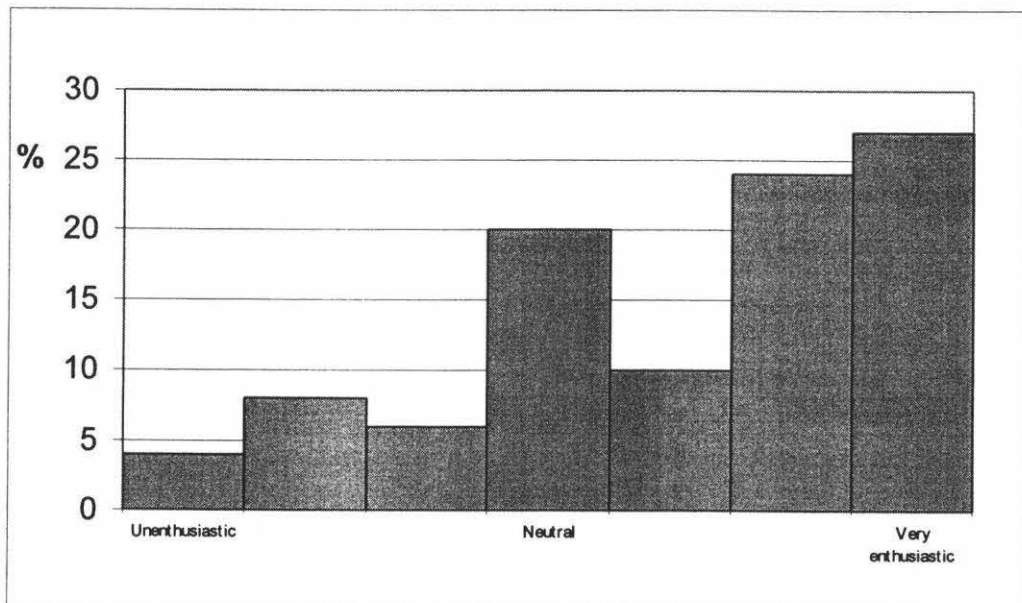


Figure 4.41 - Parents rating of their child's enthusiasm for the use of notebook technology

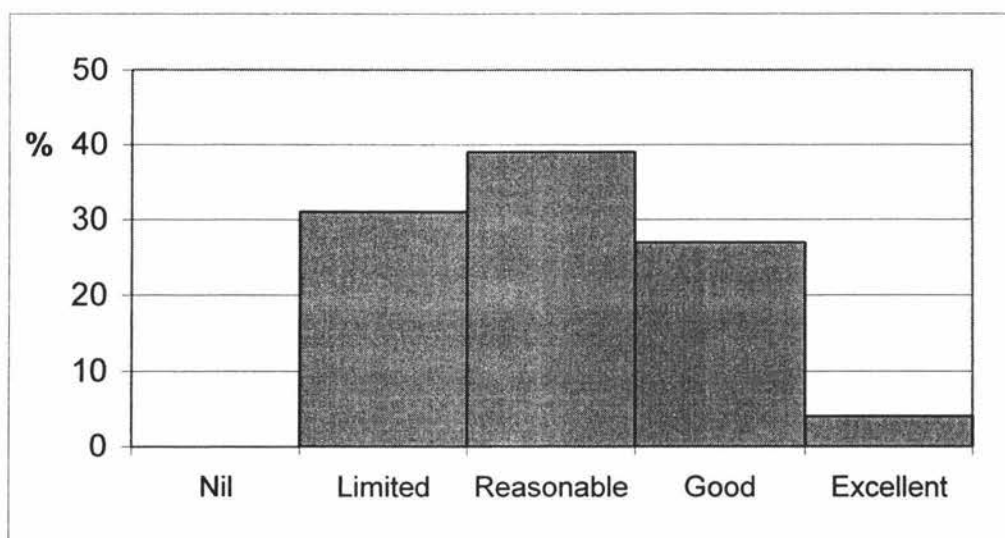


Figure 4.42 - Parents self-assessment of their own ICT understanding and knowledge

Figure 4.42 shows the self assessment by each parent of their ICT understanding and knowledge. Less than one third of the parent sample indicated they had only limited ICT knowledge and understanding. The majority of parents reported they had a reasonable or good level of knowledge and understanding. Given the higher than average socio-economic status of the parent community, these findings are not unexpected as many of the parents are likely to have significant exposure to computer technology in their homes and workplaces.

Parental suggestions for improving the notebook programme

Parents made a number of valuable suggestions as to how they perceive the notebook programme could be improved. A sample of these suggestions is presented:

Keep notebooks free of games and clutter. More hard copy kept.

I hope the school can ask the students to print out the notes/reference material and the exercises in a regular basis. By doing this they can put their work in files and revise more easily.

College staff check laptops every term to see what software etc has been downloaded and provide feedback to parents. Integrate the use of the computer into more mainstream studies.

Have 'notebook' free days. Knowing when and which classes they will be required so they can go into lockers if there are several classes/subjects in succession when they won't be used.

I'm sure that over time the programme will become more refined – there are teething problems with any new concept.

These comments reflect a well considered level of understanding of the student notebook programme and may offer some ideas for consideration by the College administration.

Summary

This chapter has presented the quantitative and qualitative findings for the three sample groups, staff, students and parents. A summary of the key findings for each stakeholder group is presented below.

1. Staff

It is clear most staff are utilising notebook technology within their classrooms. The student notebook programme appears to have had a small impact on the style of teaching and the role of the teacher within an ICT enhanced learning environment. The use of notebook computers by students has improved the presentation of their work, but it has not increased their productivity. The staff, in the main, report that the notebook programme is of greater benefit and value for the more able students at SKC.

For the most part, staff perceive a number of benefits of the programme, while also acknowledging areas of difficulty and weakness. They are mildly enthusiastic and supportive of the College notebook programme. Most staff consider themselves able to teach effectively using notebook technology.

2. Students

The use of notebook computers has assisted a sizeable proportion of students, enabling them to be more organised and produce work of a better physical quality. The most common classroom use of the technology is for note taking (e.g. word processing). The students are confident users of key software, such as word processing and presentation programs. Notebook usage has enabled students to present their work more neatly and correctly, and the technology has assisted them in researching information. Many students reported experiencing technical notebook problems/faults during the course of the year, and the carrying weight of the notebook in its bag was the most frequently identified concern.

Students generally wished to use their notebook computers regularly or at least occasionally in class. There was, however a reasonable proportion of student (around 25%) who disliked using the notebook in class. The impact of notebook technology on

student productivity was minor, and it generally had little influence on student time management issues, however the slowness of 'start-up' and computer processing time was a concern for a number of students. It appears, according to the student data, that some core subjects, as such science, made better use of the technology than other areas. Students by and large found computers had made school work more interesting, however the technology had not necessarily helped them to understand what was taught any better than in their past, perhaps more 'traditional' classroom experiences.

3. Parents

The parents are in general supportive of the notebook programme at the College. They perceive there are good vocational benefits for students in the use of the technology, while the educational benefits are less apparent, most recognise that notebook use has had a positive effect on the quality of their son's work. The majority of parents would prefer regular usage of notebook computers in class, and are generally very enthusiastic for this to occur. The positive benefits of the programme, as reported by parents, are largely ICT related and/or the motivational influence of notebook use, while there are some concerns regarding the impact of notebook use on students' handwriting, spelling and the potential distractive nature of computer games etc.

Closing observation

However, as one would expect, seldom is data unanimous for any specific aspect investigated and broad generalisations run the risk of misrepresenting accurately the findings of the study. Thus it is with these thoughts in mind that the following chapter interprets the findings of this study in the context of educational ICT research and in particular makes comparisons with previous notebook programme research.

Chapter 5

Interpretation and Synthesis of Findings

Introduction

In view of the multi-layered nature of the study, this chapter further examines the data collected for the key stakeholders. The staff, students and parent samples will be interpreted and analysed in turn. The key findings are highlighted and these are interpreted in the light of the research objectives. A synthesis of the results is compared and contrasted with relevant ICT research literature and specifically in the context of previous notebook studies.

Staff information

The following section considers the findings of the staff questionnaire and focus group discussions. It examines the SKC notebook programme in light of: (a) the staff software usage, (b) the teaching and learning effects, in particular project work, (c) the pedagogical impact on staff, (d) student motivation and work; (e) staff ICT competency levels and, (f) the attitudes of staff to the College notebook programme.

Use of software

It is probable that the high levels staff usage of key software packages is a consequence of good access to computers provided by the availability of personal notebook technology. The staff use of email and the Internet is high in comparison with most secondary schools in New Zealand (e.g. ERO, 1997). All staff at the College have an individual email address provided, whereas only 48% of 58 New Zealand secondary schools recently surveyed reported that all their staff had individual email addresses (The Learning Centre, 2001). As in most institutions the use of Microsoft software, in particular Microsoft Office, is perhaps not surprisingly the dominant software in use at SKC.

The most common application software used by staff were; word processing, email and the Internet. This is consistent with many other ICT studies in schools (e.g. Cuban, Kirkpatrick and Peck, 2001; Johnston, 1996; Kessell, 2001; Newhouse, 1999; and Parr, 1994) and reflects the most obvious beneficial uses of the technology by teachers.

However, it is the integration of these software packages and others into the schemes of work within the school to enhance the delivery of the curriculum that should be used as a measure of the success of any ICT innovation of this type. Halliday (2000) undertook to evaluate this in a recent New Zealand study into the integration of ICT into the curriculum and found in general a low level of ICT use in core subject areas in 18 urban secondary schools. The parameters of this study were distinctly different to the work by Halliday, and an investigation of the level of curriculum integration was not completed in the context of this research.

Effect on learning and teaching styles

The findings suggest that the regular and integrated use of notebook computers has had an impact on the teaching methods and style of staff. A further selection of staff comments made during the focus groups are presented below:

My delivery has changed, I use CD roms and a data projector, however the content has not changed that much (Science teacher).

It took me several years, but where it is appropriate it has changed my delivery completely, it has totally changed the way I teach geometry (Mathematics teacher).

While others in the group felt it had little impact, as one English teacher stated:

It hasn't changed my teaching practice much at all, it's there to be a tool to be used.

A key finding to emerge was that the majority of staff (65%) felt that the notebook classroom environment has resulted in less 'talk and chalk'. A number (39%) of

teachers also indicated that there was more student centred teaching in lessons. The sense of 'performing' had decreased and there is evidence to suggest staff adopted the role of facilitator rather than director of learning. This is in contrast with the findings of the King's College study where 67% of staff surveyed felt that there had been no change in the time spent lecturing to the entire class (Johnston, 1996). Indeed in the 1992 survey at King's College it was found that 'about 20% of the staff opened the laptop once a week or less' (Parr, 1994 : 12) and only approximately 50% of staff had used their notebooks during classes. So there is some evidence to suggest that the SKC experience has led to slight but observable changes in the teaching and learning styles of staff.

Little (2000) suggests the terms 'facilitator' and 'guide by the side' which have been used to describe the new role of teachers are far from adequate, as such terminologies may do more damage than good to the public perception of what effective teachers do in technology enriched classrooms. Instead, Little proposes that 'architects' would be a better term to describe the role of teachers within a technology-rich learning environment. How relevant or accurate this new role of teachers is within the context of the SKC study is undefined. Data suggests that there has been a slight shift in the teaching styles of teachers towards the facilitation of learning in notebook classes at the College. The question remains whether this change is short term or evidence of a lasting shift in the learning culture within the College.

There was evidence to show that staff have altered their patterns of movement about the classroom, spending more time circulating and monitoring student work. In some cases they have repositioned their desk at the rear of the room to enable them to view on-screen student's work or they have rearranged the classroom layout to achieve the same objective. As one staff noted, 'I asked the students to sit with screens facing me so that I could see their notebook screens at all times'. This rearrangement of classroom layout has been observed in other studies where teachers have reported that 'laptop screens are barriers between themselves and the pupils' (Passey et al., 1999a : 107). Of course, these behaviours by staff could be seen as a reaction to the potential loss of control by teachers within a notebook classroom environment.

The fact the most staff felt the introduction of the notebook programme had resulted in changes within their classroom environment and teaching methods is consistent with previous studies (e.g. Ainley et al., 2000; Hill et al., 2001; Passey et al., 1999a). The changing nature of classroom interactions is considered as one of the benefits of a technology enriched learning environment (Gottfried and Gilliland-McFeely, 1997). The majority of the staff clearly perceived that within the new classroom environment their style of teaching had less teacher centred instruction, greater student collaboration and more independent student focused learning. However at the same time the role of the teacher remains critical and can within a notebook classroom become even more demanding on staff (Hennessy, 2000).

These findings are, consistent with those of many other studies (e.g. Becker and Ravitz 1999; Rockman et al., 1998; Schofield, 1995; Windschitl and Sahl, 2002). In contrast, Cuban, Kirkpatrick and Peck (2001) found that only 19% (4/21) of staff reported that they had modified their teaching style despite having high access to ICT resources and it also observed little evidence of an increase in student-centred instruction. Thus, it is the interplay of numerous factors, some beyond the teacher's control or influence, that influence the teaching style adopted by individual staff members in ICT enriched classrooms.

Technology overload

The observations by teachers that at times more energy and time has been devoted to the technology rather than directly enhancing the learning of students is also consistent with observations elsewhere (Stolarchuk and Fisher, 2001a). The students tended to be focused and preoccupied with learning the 'how to' rather than the 'why' or 'what for' and only with longer term regular usage will the focus potentially move to the more meaningful levels of learning. This shows the value of longitudinal studies, such as those carried out by Kessell (2001) in Australia; in the United States the ACOT (Fisher et al., 1996; Tierney et al., 1992) and AAL studies (Rockman et al., 1997, 1998, and 2000) have shown that with time and experience student mastery of the technology becomes less of an issue as they assimilate the necessary software skills into their everyday learning processes.

Changes in teaching pedagogy

The answer to the question as to whether the notebook programme at the College had changed the pedagogical approach of staff is less clear. Staff data suggests that although the impact is noticeable in terms of classroom management and teaching style, it has not as yet given rise to a paradigm shift within the classroom learning environment. This has also been observed at other secondary schools that have implemented student notebook programmes, such as Penrhos College in Australia (Kessell, 2001). As one SKC teacher commented in the focus group, 'it's just a tool, it's not helping me to teach more effectively'. Johnston (1996) noted that for staff to successfully use computers, they must be willing to 'critically reflect on their existing practice' (44). One could question whether staff at SKC have had the time and opportunity to do so, given the pace of work within the College environment?

It has been suggested that the physical layout of the classroom, small class size, the absence of discipline concerns, with a corresponding increased level of student maturity and personal ownership of their learning, are factors that impact substantially on any possibility of pedagogical change within the learning environment (Windschitl and Sahl, 2002). At SKC these factors are largely beyond the control of staff participating in the notebook programme and hence it is perhaps to be expected that little change in teacher's pedagogy has occurred.

For some staff the challenge is not the physical use of notebook technology, rather it is the accompanying change in learning culture and the challenge of a greater adoption of a constructivist pedagogical approach within the classroom. This view is consistent with that argued by Miller and Olson (1994) that teachers largely use computers according to their pre-existing concepts of teaching. Student centred learning is a particular challenge within a school culture such as at SKC, where traditional didactic style teaching methods are considered the norm by all key stakeholder groups. The resistance of a few teachers to the usage of notebooks within the classroom has been noted in a similar educational environment at King's College, where a small number of staff participating in their pilot notebook programme were resistant to the change and hence under utilised the technology within the classroom (Johnston, 1996). Teachers tend to adapt the use of the technology to match their own teaching style rather than change their pedagogical approach.

Conversely there is also the risk that some staff may, in their enthusiasm to embrace the new technology within the classroom, be tempted to use the notebooks for everything and overlook that there may be more traditional methods which are equally or even more effective teaching methods. As one commentator at the University of Western Ontario remarked, 'if the only tool you have is a hammer, it's amazing how much everything looks like a nail' (The Node Learning Technologies Network, 1999 : 8). Given that the staff at the College have a diverse range of tools at their disposal, it is perhaps unlikely that this narrow focused approach occurs. The appropriate classroom usage of ICT has always been one of the main objectives of the SKC notebook programme.

There was sufficient evidence to suggest that staff are beginning to use the notebooks as 'thinking tools' to enhance student learning but this is a gradual process. For some, the author would propose, a model of 'punctuated equilibrium' is more appropriate, with short periods of rapid ICT development and integration of new ideas, followed by longer periods of consolidation and stasis before the next episode of ICT innovation and integration occurs.

The role of effective professional development cannot be understated in terms of the positive impact it has on the pace of ICT integration within the classroom (Johnston, 1998). Staff expressed concerns that more time was needed for the planning necessary to ensure success in the implementation of seamless integrated notebook technology within the classroom. Similar comments have been reported in other studies, both in New Zealand (e.g. Johnston, 1996; Parr and Bairstow, 1992) and abroad (e.g. Hill et al., 2001; Stolarchuk and Fisher, 2001b).

The move at SKC to integrate a wider range of ICT skills and software programmes within the everyday classroom environment appears to be at a stage beyond that encountered in other similar educational institutions that have introduced student notebook programmes. In an Australian secondary school it was observed that 'very few teachers attempted to use computers for anything other than word processing' (Newhouse and Rennie, 2001 : 241). Student use of notebook technology exclusively for word processing has been described as instructional conservatism (Windschitl and Sahl, 2002) and negates the power of the technology in substantial ways.

At SKC notebook technology is viewed by the majority of staff as a means of enhancing and transforming instructional practice. A similar approach has been observed in a study of the Technology Enhanced Secondary Science Instruction (TESSI) project in the UK, where staff 'integrated technologies incrementally into their programmes, courses and curricula' (Mumtaz, 2000 : 327). The TESSI study concluded that the integration of ICT in classrooms can significantly transform teaching and learning. One of the integral parts of this transformation was long-term personal and professional commitment of teachers to the initiative (Mumtaz, 2000).

It is suggested that improving the level of staff ICT literacy together with encouragement and support to develop curriculum usage of the notebooks is essential for the success of the notebook programme. Expressing a view held by many, one staff commented:

Unless the teacher inspires the students just as in the past, the students will lose interest. The computer cannot manipulate the student to learn, it is after all just a computer (Maths teacher).

Level of staff ICT knowledge and skills

The results of the self-assessment by staff of their ability to teach effectively in a notebook environment suggest that they have the knowledge, skills and confidence to teach within a notebook classroom. Only 12% of respondents indicated that they would rate their ability as below satisfactory, while 60% felt they were effective within a notebook classroom. The mastery of the technology itself complicates the change process and suggests that it may take most teachers several years to become comfortable and confident users of ICT within their classes (Herman, 1994). So the implication for SKC is that the successful implementation of the notebook programme is greatly influenced and perhaps even determined by the 'knowledge, skills, attitudes and confidence of the teachers involved' (Johnston, 1998 : 15).

Comparison with earlier New Zealand studies undertaken in the 1990s is limited as the advancements in technology quickly dates the information collected. Yet there is a place for comparisons of teachers' attitudes, as these are not software or hardware specific and less prone to change due to technological advances alone.

The SKC data compares favourably with other studies when they are translated into the level of staff adoption of ICT. Over a third of the staff surveyed during the King's College research indicated that they were either, unsure, a bit unsure or very unsure about using computers in their teaching (Parr, 1994). While not using exactly the same terminology it would be fair to suggest that most staff at SKC believe they are sufficiently confident and familiar with the technology to enable them to adapt it to best suit the learning needs of their classes. The findings of a larger New Zealand ICT survey (The Learning Centre, 2001) found that only 23% of principals believed that their staff were at level five of the six levels on the scale developed by Knezek and Christensen (1999). At SKC, on the evidence gathered during the course of this research, the majority of staff would likely to be at level five or six. That is, they are able to make creative application of technology to new contexts, and are able to use it as an instructional and integrate it into the curriculum.

Increasing role of project work

The findings suggest that there has been an increase in the level of student collaboration and independent student activities. Whether in this study these changes in teaching style were directly as a consequence of the notebook programme is difficult to determine as no control group for comparison was possible. Also for comprehensive evaluation of the impact of the notebook programme on student learning and achievement one would need to control Input variables (Astin, 1991) and give consideration to the level of past student ICT experience, individual student academic abilities and the personalities and ICT knowledge and experience of teachers, in order to more clearly determine the effects of the notebook programme on the outcome variables. In short, the control of these variables is highly problematic. However in this research, it was fortunate that the staff perceptions elicited from participants were based on their personal professional experience, and many teachers had taught on both notebook and non notebook Year 9 classes in recent years at the College.

The results were unable to quantify the level of project work undertaken by students, nevertheless it is believed, particularly from the researcher's own experiences and observations and from student comments in the focus group, that in some subject areas there has been a noticeable increase in student based project work. This is consistent with the trend identified in the literature review, that in notebook classrooms there is

often an increase of project based learning. This has been quantified in the pilot study of the AAL project, which recorded the teaching styles used in a range of notebook classroom environments. There was an increase from 35% to 61% self reported usage of project based work recorded by a group of 104 teachers (Rockman et al., 1997). Others have observed that an entirely new 'research cycle' is possible using notebook technology (Hill, Reeves, Grant, and Wang, 2001).

Student motivation

The SKC notebook programme was generally perceived by staff to have had positive effect on student motivation within the classroom. This heightened interest and enjoyment of classes is in keeping with observations made in other high access ICT programmes such as the United Kingdom ImpacT study reported by Johnson, Cox and Watson (1994), the National Council for Educational Technology research (Stradling, Sims and Jamison, 1994) and AAL studies in both the United States (Rockman et al., 1997, 1998 and 2000) and in the United Kingdom (Passey, et al., 1999a).

Staff in this study affirmed that the use of notebooks had the following positive effects:

Adds fun and excitement to lessons with juniors. Language learning is interactive, you need a teacher, and computer use is limited as it is restricted only to mechanical parts of the course (French Teacher).

It has increased their motivation, they love a glimmering screen (English Teacher).

It speeds up the creativity of students (Art Teacher).

However, although notebook technology 'can be highly motivating this is not a sufficient reason to use it' (Hennessy, 2000 : 256). There must be good range of educational benefits to justify the implementation of any technology enriched learning environment such as the SKC notebook programme. Many of these are evident from the participants responses within the broader context of this research.

The student personality factor

The successful use by students of the notebook computers was believed by staff, at least in part, to be a reflection of student personality and educational motivation rather than their academic ability. As staff commented in the focus group:

It had more to do with the personality of the student rather than the intelligence of students.

Those kids who never had their pencil or their book, never know what they are doing, they are just the same with their computers as they are with anything else.

Organised students regardless of ability if motivated, can achieve because the notebook requires different skills. It enables some students to shine who wouldn't otherwise.

At any level, if the student is lazy or unmotivated the notebook programme encourages this trait.

These comments, from different perspectives (e.g. organisational ability, self motivation, student personality) suggest that, regardless of the structures and support mechanism the College has in place, the success and effectiveness of student notebook usage is in many ways in the hands of the students themselves.

Concerns regarding student work

A number of staff expressed concerns specifically about student computer generated written work. These are best stated in their own words:

It is a very useful tool, but it actually doesn't aid creativity, or spark imagination (Music Teacher).

What looks attractive may be full on errors (English Teacher).

When students word process work, they think it's a final copy because it looks good, but they need to proof their work...They jump to the end product
(English Teacher).

These views are in contrast to the views expressed by staff in an American study, which surveyed 26 sites and generalised that students' written work improved when notebook computers were used. The ease of editing led students to create more rough drafts, and spend more time on content rather than mechanics and presentation. Students were more willing to make corrections and revise their work (Rockman et al., 1997).

Similarly, English teachers surveyed in the Northern Island study were 'unequivocal in their view that the content and presentation of their pupils' work had improved' (Gardner, Morrison and Jarman, 1993 : 15). Yet when experimental tests were carried out there were no statistically significant differences between research samples of notebook and non-notebook students.

There are implications for the SKC programme in terms of the lack of quality of some student work. When appropriate, possibly more emphasis and class time needs to be devoted to training and allowing students the opportunity to redraft their work. As one teacher insightfully commented:

The computer screen demands a response, it's like a ringing telephone, it wants a conclusion; while a blank piece of paper seems to allow students to ponder.

'Cut and paste' technology

Staff also expressed concerns that student work was not always original and that authenticity was a problem. The use of the 'cutting and pasting' function of the technology can allow students to copy work without a deep level of thinking and it is also difficult to monitor the individuality of student work. This is not an issue unique to notebook usage, as computer generated material is in general much easier and faster to copy. Teachers must develop new ways to assess student understanding of work presented, possibly through the use of informal questioning or testing (Selinger, 1999). This form of plagiarism of either fellow students' work or published information is an

issue that will require ongoing monitoring and proactive staff intervention and student education. This is particularly true in light of student work undertaken for research achievement standards within the NCEA qualification system.

The attitudes of staff towards the notebook programme

As outlined in Chapter 4.1, the findings would suggest that SKC staff were relatively enthusiastic and supportive of the College notebook programme. The mean rating of staff enthusiasm for the use of notebook computers was 4.7 (on the 1 to 7 scale), which is lower than the rating of 5.6 calculated in the larger AAL study in which 144 teachers from 12 public and 8 private schools were surveyed (Rockman et al., 1998 : 53). A very positive level of staff enthusiasm has also been recorded as part of the research undertaken at the Athens Academy (Hill et al., 2001 : 40), where in a sample of 36 staff, over 85% either 'agreed' or 'strongly agreed' to the statement that they felt enthusiastic about their college notebook programme. A year earlier a small sample of teachers (n = 8) surveyed in the first year of the Athens Academy notebook study indicated that they were very enthusiastic about the portable computing programme at their school and reported that their teaching had benefited as a consequence of notebook usage within the classroom (Hill et al., 2000).

Explanations for these differences between the responses of New Zealand teachers and staff participating in notebook programmes in the United States can only be speculative. Perhaps the American teachers are generally more positive and less self-critical than New Zealand teachers? Maybe their experiences within notebook classroom environments have indeed been more positive and rewarding? The findings suggest, however, that there is a good foundation of support for the College notebook programme and efforts should be made in the future to foster the level of staff (and indeed, student) enthusiasm for the innovative use of notebook technology in teaching and learning.

Impact on learning

While there is a difference in the perceptions of SKC staff in terms of the benefits of the notebook programme for differing ability groups, there was an overall positive view of

the impact on student learning of the use of notebooks. Stevenson (1999) found a similar level of staff response, with between 50% to 60% of teachers indicating that the notebook programme in their school had a positive impact on student learning. It would be unrealistic to expect a 100% positive endorsement of this technological innovation, given the personalities and classroom experiences of all the staff participating in the College notebook programme. The findings of the SKC study have been consistent with other research, and the focus for the future should be to further improve the means by which notebook technology is utilised to enhance student learning.

Effectiveness of the notebook programme

Most staff view notebook technology as making a valuable contribution to the College learning environment, however they were less positive in their views on the effectiveness of the notebook programme. Comparison with a recent New Zealand wide survey indicated that approximately 50% of secondary principals (total sample = 57) agreed that the use of ICT had resulted in major improvements to the 'efficiency' and 'quality' of curriculum delivery in their schools (The Learning Centre Trust, 2001). However measures of efficiency and quality are subjective and the Learning Centre Trust (LCT) survey appeared to focus on administrative uses rather than the use of ICT within the classroom environment. The LCT survey was completed by principals rather than classroom practitioners, so the comparison may not be valid; yet there is evidence to suggest that the use of notebook technology has had a positive impact on both the administrative functioning of the College and the delivery of the curriculum.

Staff adoption of notebook technology

The staff indicated that they consider themselves to be able to teach effectively in a notebook environment and it would be fair to suggest that they were on the whole at level five or six in terms of the stages of adoption of new technologies outlined by Knezek and Christensen (1999). For staff the notebook computers have become 'mission critical' tools, where they could not function effectively without them on a daily basis (Papert, 1993).

This has also been clearly identified in other contexts, such as a palmtop computer study in the United Kingdom which found that the staff considered them invaluable and that the technology had helped improve their efficiency and self confidence (Robertson, Calder, Fung, Jones and O'Shea, 1997). Yet despite evidence that notebook computers are regarded as essential by the SKC staff for administration and communication purposes, whether they are considered by the majority of teachers as essential classroom learning tools is not conclusive.

Staff concerns

This section outlines the issues identified by staff as concerns related to the College student notebook programme.

Students with non functioning notebooks

One common concern was the number of computers that according to the students were out of commission at any one time due to software or hardware failure. Also particular students regularly encountered notebook problems and this meant that other materials were needed for them to participate actively in lessons rather than passively observe another student's computer screen. The number of non-functioning machines in any one class was generally, from personal experience and formal records, between one to four computers. This translates in a class of 25 students to a figure between 4% to 16%. These problems have the potential to disrupt and ruin lessons and a range of new classroom management techniques are necessary to ensure student learning is achieved. These concerns are common to many notebook studies as demonstrated in the literature review.

Although these findings are a concern, they are lower than those found in other notebook programme studies. The American AAL Pilot study noted staff estimates of non-functioning notebooks at between 5% to 30% in a class group (Rockman et al.,1997). The AAL research also reported that for some students the notebook uses were not sufficiently robust for everyday student use. A similar statement could equally apply for a number of the students participating in this study. The College will need to give serious thought to this issue, while recognising that ultimately, the design

specifications of the notebook computers available are commercially driven decisions and thus may be beyond the control of the College.

Student keyboard skills

The lack of keyboard skills was not seen by staff to be a major barrier to student notebook use; however, students with poor keyboard skills were a source of staff frustration. As one staff member stated during the focus group, 'notebooks demand a higher level of skills than traditional pen and paper methods'. This differs from the results collected by Stevenson (1999) who found that student keyboarding skills was one of the major or overwhelming problems that staff had identified. However it is possibly that the lack of a direct reference in the staff questionnaire to the issue of student keyboarding skills has resulted in an underreporting of this concern by staff at SKC? It would be wise for SKC to consider enforcing an achievement based test of 'keyboarding skills' in addition to the current practice of simply providing the necessary keyboarding software on the student notebook computers.

Off task student behaviour

Another area of concern identified by staff both in their written responses and also during focus group discussions, was the temptation for students to engage in off task computer related activities during class. These may take the form of computer games or simply students adjusting the settings on their machines rather than focusing on the lesson task. The issue of student distraction has been identified in other similar studies (e.g. Hill et al., 2000) and the use of the notebook has resulted in a 'new era of student misbehaviour' (Johnston, 1996 : 42) and the management of this is an ongoing classroom challenge for staff. The College has developed in recent years a code of 'best practice' in terms of the classroom management in a notebook learning environment.

The classroom environment

The physical classroom environment was a concern for staff. The desk space/size and layout within the classroom, together with sufficient access to power sources and associated risks with power cables snaking all over the rooms, worried staff. These are common factors of concern in other schools with student notebook programmes (e.g.

Passey et al., 1999a). The potential for injury to students and perhaps more probable damage to the computers themselves was ever present and staff made conscious efforts to minimise these risks.

These and other practical barriers, such as access to printers for student work, made effective use of the technology within particular classroom settings difficult at times. Some staff felt quite strongly about this issue, and this is illustrated by the statement made by one staff member:

I strongly support computer use, but our environment and structures are at odds with our notebook system (Music teacher).

‘Down time’ with notebooks

The potential for time wasting when using notebook computers within the classroom was commented on during the staff focus group discussions. As staff stated:

*They are very slow to power up, and shut down, wastes a lot of time.
“oh Sir my computer suddenly shut down” is a recurrent litany
frequently used to disguise the fact that the boy has not done the work
set.*

*With the ‘special needs’ class I found that so much time was wasted
setting up, coping with problems etc relating to each boy’s notebook
that I began to only use the notebook for homework related activities.
Even then, assignments were not given in on time due to printer
problems etc at home.*

The researcher’s own personal experience supports the view that the checking of student homework can take longer on screen than on paper. Setting up the paraphernalia to present a data show using a notebook computer and data projector can use two to five valuable minutes within a lesson. This potential for time wastage has been recognised in other studies (Woodbridge, 2000). However, it is possible that changes in teachers’

classroom management techniques could eliminate some of the wasteful 'down time' associated with classroom notebook use.

Also in situations where there has been insufficient student training or lack of recall of ICT skills by students, teachers may find themselves at times teaching ICT skills rather than their curriculum material. This potential misdirection of teachers' focus towards ICT education rather than core subject material has been reported overseas. For example, The Node Learning Technologies Network report (1999) based on North American notebook programmes at secondary schools and universities, and also Stolarchuk and Fisher (2001a) in Australian secondary schools. Ricci (1999; cited in Boyd, 2002) likewise concluded that there was a need for teachers to focus less on the tool and the teaching of ICT skills and more on content.

Certainly a number of staff at SKC felt that this was the case at times in their classes and that the student notebook programme had slowed the pace of teaching. As one teacher stated:

Notebooks have slowed things down, and (we) get through less work.

In contrast, there is evidence that within some institutions the introduction of student notebook programmes has increased the pace of teaching. As one pioneer of a notebook programme who has been using portable computers within the classroom since 1988 put it, 'take your existing material and double it' (Munro; cited in The Node Learning Technologies Network, 1999 : 10). Likewise Morgan stressed that 'technology can increase productivity in the academic classroom just as it does in the administrative office' (1996 : 50). However the findings of the present research have not revealed any clear evidence of an acceleration of the teaching programme at SKC.

Implementation of the notebook programme

Some staff were critical of the implementation of the notebook programme at the College, as one stated:

The college is moving too fast – ‘laying the tracks in front of the train’ (It is) not thinking through things and ensuring programmes are fully functional before implementation.... (They need to) slow down the pace of innovations. Place more emphasis on quality learning and the notebooks being the tool, rather than the basis of learning.

There was a frequent request recorded in the staff written responses for more specific in- service training as part of staff professional development. This was particularly focused on the integration of ICT in curriculum areas. This is in keeping with the findings of previous staff notebook studies (e.g. Parr, 1994). The role of individual teachers is crucial to the success of the notebook programme and mere compliance to decisions made at the senior management and Trust Board level will be too weak a basis to make the notebook programme successful. This emphasises the essential requirement for on-going effective ICT professional development programmes and further educational opportunities for staff within the College.

Other evidence of staff concerns regarding the notebook use

The concerns identified in this study are similar to those raised at an internal staff forum held at SKC in May 2001. The notes produced as a result of this informal meeting identified issues identical to those raised by staff participating in this study. While recognising that many of the staff participants in this study were obviously also participating in the forum, a much larger staff group of over 50 teachers had the opportunity to contribute to the staff forum on ICT at the College. This collaborative data is a further strand of archival evidence that supports the validity of the findings of the staff survey undertaken in this research.

Advantages for staff of personal notebook usage

The advantages of the use of notebooks for personal staff professional use have been studied previously as shown in the literature review (e.g. Falba, et al., 2001; Phillips, et al., 1999). These benefits were not examined or assessed as part of this thesis as the research focus was on the student notebook programme. However in the context of the staff focus group the following observations were noted.

The portability of the notebooks to and from and around the workplace, together with the ease of access to College software and databases were noted as positive benefits of staff use of notebook computers. However the additional responsibility for the security of the notebooks, for both staff and student machines, was recognised by participants as a potential burden on teaching staff and equally on the students.

Student information

The following section considers the data collected based on the student questionnaire and focus group discussions. It reviews the notebook programme student data and addresses such areas as: (a) the frequency of notebook usage, (b) types of software usage, (c) a comparison of home and school usage, (d) student attitudes to the programme. In addition; (e) it reports a range of student comments on the programme and; (f) recognises the barriers to learning and specific notebook problems encountered by students. Data is interpreted in the light of other notebook research and similarities and differences have been identified and discussed.

Frequency of the usage of notebook across the curriculum

Student use of their notebook computer is, in part, determined by curriculum appropriateness. For example, SKC students indicated little use in Mathematics, a subject in which little specific software other than graphical packages were used at the College. Perhaps a more important factor is the level of staff adoption and integration of the notebook technology within regular classroom teaching within a department. For example, in science 50% of students indicated that they used their computer 'All the time' in lessons and as the Head of that Department the researcher is well aware that

science staff have made considerable efforts to integrate the regular use of notebooks within their lessons.

Other New Zealand studies have indicated that classroom usage of ICT is more common in the language (English) curriculum area than in any other Essential Learning Area outlined in the National Curriculum Framework. This is consistent with the finding that the use of computers is primarily a tool for the presentation of student work (Ham, 2001). These results correspond favourably with those of a study of middle school teachers at an American college which found that the highest classroom usage of notebook occurred in English and Science subject areas (Hill et al., 2001). Similar data was collected by Stevenson (1999) in another American context. Stevenson found that notebook computer use (at least once a week) was common in English/language arts, Science and Social Studies. The research also addressed the frequency of use across three year groups and identified a general decline in notebook usage in all the main curriculum areas as students progressed up the school. This decline may well be an issue that SKC will also need to address.

Given the unique status of this study, in which all students have their own personal computers, the findings suggest that College staff teaching in all curriculum areas are making more frequent use of the technology than in other equivalent schools, though this is a tentative observation as no direct comparative data is available from other sites.

There is a question of identification of the appropriate Learning Area, as students may well be using their notebooks to a greater degree in Science and Social Studies, yet the activity they are using the notebook for may in fact address a language Learning Area goal such as writing. This concern highlights the problematic nature of artificial curriculum boundaries and makes the assessment of notebook usage in terms of the appropriate Learning Areas difficult to assess. Indeed the student data for this study revealed the most common use by students of their notebook computers was for word processing, a skill used across all areas of the curriculum, which is consistent with the findings of other notebook studies (e.g. Ainley et al., 2000; Hill et al., 2001; Newhouse and Rennie, 2001).

The level of student computer use within the classroom recorded in the staff survey indicates that on average students use their notebooks for just below 50% of available lesson time. This figure is significantly higher than that found in ACOT studies (Dwyer, 1994), which recorded that in only 14% of classes did the use exceed 50% of class time. However different methods of recording usage time may make any comparison invalid. The results of the third AAL programme research project (Rockman et al., 2000) are similar to those of this study yet again a different methodology of data collection limits trustworthy comparison of data. Hill et al., (2000) found that in their survey of over 60 7th grade students (age 12–13) at the Athens Academy the students stated that their notebooks were used on a weekly basis rather than on a daily basis. An Australian study found that on average students used their notebooks between 30 and 50% of the school day (Owen and Lambert, 1998). The comparison with these overseas studies suggest that in general the students at SKC are using their notebook computers more than in other similar learning environments. However, the question remains whether frequency of use is a particularly good or appropriate measure of quality and/or academic usefulness of the technology.

It has been suggested, without substantiated evidence, that in ICT rich classrooms the maximum benefit occurs when students work with computer resources for only 30% of the total lesson time (Osborne, 2001). Some would dispute this figure and any generalisation is always conditional on its context. Students at SKC appear to use their notebooks for a higher percentage of class time and whether there is an optimum productive level has yet to be determined. Indeed a search for an optimum percentage time may be counter-productive, as potential benefits will always be directly related to the context in which notebooks are used. In short, this is a techno-centric measure of usage and may be of limited value in terms of the evaluation of educational effectiveness.

Software usage

The most commonly used software programs used by students were the following Microsoft applications, listed in order of usage: (a) 'Word', (b) 'Excel' and (c) 'Powerpoint'. Other programs were utilised to a lesser extent and dependent on subject appropriateness. The findings are in keeping with observations recorded in numerous

other overseas notebook studies described in the literature review (e.g. Fouts and Stuen, 1997; Hill et al., 2001; Passey et al., 1999a; Shears, 1995).

The results are also consistent with the findings of recent New Zealand research into classroom activities observed in a case study of ICT professional development clusters (Ham, 2001). In a sample that included a mixture of both primary and secondary schools, data revealed that the major use of ICT by students was for word processing or desktop publishing, followed by information gathering (Ham, 2001). There is always a risk of becoming too focused on the readily available and pre-installed Microsoft software packages and this 'tunnel vision' approach has limitations. At SKC the desire for curriculum enhancing software is strong, with good ICT resourcing available and departments are encouraged to evaluate the full range of subject specific software.

The comments taken from both the questionnaire data and those noted from the focus group suggest that students predominantly view the notebook computers main function to be a writing machine used to replace paper and pen. This perception has been observed in other studies (e.g. Newhouse and Rennie, 2001; Kessell, 2001). The College administration needs to be aware of this perception and continue to work towards a greater diversity and enhancement of teaching using the technology.

There is, of course, a danger with a preoccupation with the software being used, as 'it is not what software is used but how well it is used, to enhance teaching and learning processes and/or outcomes, that matters' (Wild, 1995 : 3).

Home and school usage

While most students surveyed made use of their notebook computers at home, this study did not directly address the use of other computers at home. The results of the parent survey indicated that approximately a quarter of students (27%) used another computer at home. Many desk top computers have larger screens, greater processing power (and better games) and these may have been utilised by students in preference to their own notebook computers (Ainley et al., 2000). The Norwood School study found that students often left their computers in their lockers as computers were readily accessible at home and more convenient, particularly in terms of Internet use, larger screens and

printing capabilities (Woodbridge, 2000). At SKC there is anecdotal evidence that some students are doing likewise, particularly in light of travelling to and from school on public transport, and students wish to avoid carrying the additional weight of the notebook computer.

The study did not directly examine the range of software used in the home setting by students and it is thus impossible to identify whether SKC students used a greater or less range of software at home than while at the College. However it is evident that students made regular use of their notebook computers at home (Fig 4.17). It is noteworthy, that a recent study of two Californian schools, reported that students' home use spanned more applications than during classroom instruction (Cuban, Kirkpatrick, and Peck, 2001). Whether a similar pattern of home usage for SKC can only be speculated.

The home use of student notebook computers places students at SKC in a privileged position when compared with New Zealand secondary students in general. In 2001 student access to home computers is still relatively low, with only 21% of secondary schools reporting that 50% or more of their students have access to a computer of any form (e.g. desktop or notebook) at home (The Learning Centre Trust, 2001). How accurate these figures are may be debated, however the level of computer access for most New Zealand students is clearly much lower than the individual personal computer access enjoyed by the notebook programme students at the College. This is hardly surprising given the socio-economic status of the College community and the success or otherwise of the notebook programme must be understood in this context.

The effect of notebook usage on student attitudes

The data collected supports the view that in general student attitudes towards the use of notebook computers are positive, with 67% of students indicating that they would like to work in a classroom where notebook technology is utilised regularly or at least occasionally. Shears (1995) in a case study of Victorian schools using notebook computers indicated that short term exposure and use of notebook computers by students had a positive impact on student attitudes towards working within a notebook learning environment. Longer duration studies such as the AAL project suggest also that students respond positively within a notebook learning environment (Rockman et al.,

1998 and 2000). Likewise the observations of the ACOT studies found similar positive improvements in student attitudes when students had been immersed for a longer term in a high access computer environment (Tierney, Kieffer, Stowell, Desai, Whalin, Moss, 1992).

Students participating in the 1991 King's College notebook programme demonstrated high levels of enthusiasm for the duration of the year. Like this study, whether these positive attitudes were maintained in the long term was outside the timeframe of the King's study (Parr and Bairstow, 1992). This remains an unanswered question.

In contrast the one year trial of student portable computer use in Northern Ireland concluded that the impact of the high access to the technology upon student attitudes was relatively marginal, and where there was an impact it generally related to processing of information using ICT skills within specific curriculum tasks (Morrison, Gardner, Reilly and McNally, 1993).

A comparison was made with the data reported in the MLC study (Loader, 1993), as outlined in the literature review. The levels of support and enthusiasm of MLC students were considerably higher than the student data collected as part of the SKC study. Perhaps the novelty factor may be an influence on the responses of those students in the innovative notebook programme at MLC? Loader went on to highlight an important aspect on notebook enhanced learning and stated that 'although learning was not seen as easier, they (the students) felt they had attained new skills' (Loader, 1993 : 15). Whether these skills are specifically or uniquely ICT based is unclear.

The findings of this study differ from those of a recent study in Perth (Kessell, 2001). The Penrhos study found that Year 8 - 10 female students consistently expressed negative views regarding the use, benefits and value of notebook computers in their educational setting. While they did value notebook use for the improvement in their presentation and organisational skills, many felt the value ended at that point.

Closer to home, a contrary observation was made in a study of girls participating in a pilot notebook programme at St Cuthbert's Junior School (Selby, Elgar and Ryba, 2001). It was found that Year 5 students were very enthusiastic and excited with their

use of notebook technology within the classroom. After six months of use they felt more confidence in both their learning and computer skills. The students also indicated that the portable computer had a very positive effect on their homework, and they considered it to be 'fun, easy, interesting and quick' (Selby et al., 2001 : 31). Although a much younger sample, the St Cuthbert's findings are clearly different from this research, where 42% of SKC students indicated that notebook usage had a negative effect on their homework.

A recent study in an American middle school recorded that students expressed a sense of pride in having their own computers, despite the inconvenience of the weight and cost of the notebook computer. In addition, they reported that they were more organised because most of their school work was stored on their notebook (Windschitl and Sahl, 2002). Also in the pilot notebook project in one rural school in Maine, prior to the state wide distribution of notebook computers to all seventh grade student, found that since the introduction of state provided notebooks for these 12 year old students, both absenteeism (by 50%) and misbehaviour by students decreased, and 91% of students improved their grades in at least one academic area at Pembroke School (Mehren, 2002).

Similar anecdotal evidence from the Notebook Valley project (New Zealand Education Gazette, 22 July, 2002), suggests that the provision of notebook computers for students provides an incentive for student learning and has improved student retention at a senior level in Science, Mathematics and technology. However, no formal assessment of the impact of notebook technology on student learning has been completed in the project.

Boyd (2001) highlights that caution must be exercised in using attitudinal data as an indicator of success of any programme, unless positive attitudes or attitudinal change can be shown to relate directly to improvements in learning outcomes. Thus, given the mixed messages expressed in terms of the student motivational impact of high access to computers in the studies reviewed, the real measure of a positive attitudinal change may be dependent on the durability of the effect and this can only be ascertained over a longer period of time. This remains a challenge for those working at SKC, and further investigation would be advised.

Impact of notebook use on academic performance

There was no direct assessment of the impact of the SKC notebook programme on student academic achievement as this was not one of the research objectives. The data related to student perceptions of the impact of notebook usage on different aspects of their work was inconclusive (as evidenced by Questions 4, 5 and 9 of the student questionnaire, Appendix H). Most students felt notebook computers had made school work easier and that it had a positive effect on the standard of their work. These results are consistent with the findings of the King's College study where by the end of the year 74% of a total of 47 students felt that notebooks had been advantageous to their academic performance (Parr and Bairstow, 1992).

Perhaps of greater interest is the fact the majority of SKC students indicated that notebooks has not helped them to understand their lessons any better. Whether this observation contradicts the view expressed in the previous paragraph is debatable.

At St Cuthbert's, as a means of recording improvements in student academic performance resulting from notebook use by students, researchers attempted to quantify changes. This was achieved by carrying out a pre and post analysis of performance in the Progressive Achievement Tests (PAT's) for a small sample of 13 students. They concluded that despite a large improvement for a few students, overall there was no statistically significant improvement in the average PAT scores. As the authors rightly suggested, both the time frame (six months) and the sample size were too limited for valid assessment of possible improvements in the PAT scores for participating notebook students (Selby et al., 2001). One could also question whether such a crude measurement tool as PAT test scores is appropriate; however, assuming that no other form of assessment was available it was at least an attempt to quantify the impact of notebook usage on student academic performance. Nevertheless, PAT scores are problematic and they may not reflect the less tangible positive or negative impact of this ICT innovation and its effect on the learning culture within any given classroom. The implication for the research conducted at SKC is that PAT scores would not offer a valid form of assessment of student academic performance, particularly as there is no formal PAT testing across the main curriculum areas at the College at the Year 9/10 level. Thus, the measurement of the impact of the notebook programme on student academic achievement remains highly problematic.

However, of note is an evaluation of the impact of notebook use on the academic performance of middle school students participating in the Beaufort County School District Laptop Notebook project (Stevenson, 1998). The project found that although there was a significant difference between the scores of notebook and non-notebook students using a nationally standardised achievement test, the difference could be attributed to pre existing differences in the performances of students within the two sample groups based on their prior test scores. Nonetheless, the researcher did conclude that the use of notebook computers was associated with sustaining the student levels of academic achievement over time, as the test scores for non participants had actually declined when compared with their scores from two years earlier while the scores of notebook students were maintained at similar levels over the sample two year period (Stevenson, 1998). Although this study raises some ethical issues as the notebook programme was optional, participation by students was decided at the family level, rather than by a policy of the institution, the findings are worthy of recognition.

The second phase of the UK AAL study undertook quantitative measurements of student achievement in selected learning areas/skills and addressed specific issues in the light of notebook use by students (Passey, Whytock and Davies, 2001). The research used a range of data collection techniques and using basic statistical analysis found a significant improvement in students' performance in only one Year 8 school sample. The notebook students did, however, show a positive shift in their ICT capability attainment levels in comparison with national expectations. Given that six learning areas/skills were evaluated the results were disappointing, however the relatively short time frame (one academic year) of student notebook usage may have been an influential factor.

The long term impact of notebook use

Newhouse and Rennie (2001) found that older students tended to make more use of their notebooks at home rather than at school. Qualitative data from Kessell (2001) in Perth suggested that as the students progressed into senior school, their notebook use declined further, with fewer than 20% of Year 11 and 12 students still using their notebooks for academic purposes. Similar observations were made in the third year evaluation of an American middle school notebook project (Stevenson, 1999).

However observations of students participating in the ACOT programme in the United States found that students' interest in and engagement with the technology did not decline with routine use (Dwyer, 1994).

The differences in student responses in these studies once again highlights the importance of context as a mediating factor. Whether the same trends will be the case for students in the notebook programme at SKC remains to be seen in the coming years. Evidence from an internal College survey completed in May 2001 of Year 12 teachers found that usage varied greatly from 6% to 80% in the full notebook classes, while in classes where a majority of students had notebook computers, only 15 to 50% of students were using their notebook. The results also indicated that many Year 12 notebook students were not bringing their computers to classes (H. Berends, personal communication, 11 May, 2001).

Interestingly, the Year 10 students participating in the focus group indicated that they had made more effective use of their notebooks in 2001 than in 2000 because they had a better understanding / skills level, with less focus on the machine and more on learning. This is in keeping with student experiences elsewhere (e.g. Kessell, 2001; Rockman et al., 2000) where students have had a longer and continuous exposure to a technology enriched classroom learning environment.

Improved student skills

There is evidence that the student use of the notebook computers has improved student understanding of the workings of computers and has developed students' physical computing skills. As the data indicates the majority of students consider they have a good level of ability using common software such as word processing and presentation programmes. This is in keeping with previous studies, where it has been noted that in the short term, there can be more learning about the computer than learning with the computer (Stolarchuk and Fisher, 1999). As one student wrote:

Notebooks are one of the main things that taught me how to use a computer... It builds up your computing skill simply by using it.

The notebook computer has been described as a 'two edged tool', for it is a positive and helpful tool for getting work done and aiding in learning, yet at the same time it is a tool that requires students to learn how to operate and master it (Ainley et al., 2000). There is a danger that the procedural knowledge required may deflect attention away from the task of using the computer to accomplish a learning activity within the classroom.

The objective, however, is to learn *with* rather than learn *about* computers by using notebook technology to enhance the classroom learning experiences for students. This is not a binding goal and ideally both may occur concurrently. Many of the students surveyed in this research felt using the notebook computer had changed the way they learnt, however few were able to explain precisely how its use had done so. The inability of students to articulate clearly how they thought the notebook had helped them has also been observed in other studies (Selby et al., 2001). While this is not surprising, perhaps they suffer from false clarity or 'snowblindness' (Fullan, 2001a). This observation indicates that it may be problematic to place too much emphasis on the student perceptions of the notebook programme. The history of educational innovation is full of examples where participants have a perception that differs significantly from the external view of reality held by other stakeholders.

Positive impact on presentation and content of work

In terms of skills, notebook usage had a positive impact on students' presentation, spelling, researching, and organisation of their notes. At SKC 90% of students indicated that the notebook had a positive effect on their written work, primarily in the presentation and spelling. By comparison a similar percentage of students (75%) participating in the King's College programme mentioned that their written work had improved with notebook use (Parr and Bairstow, 1992). Pride in presentation was seen to help student motivation in both studies and has also been recognised in other overseas studies, and it was particularly noticeable for boys in the United Kingdom AAL report (e.g. Passey et al., 1999a). It is clear that at SKC one of the universal observations of all the key stakeholders is that the presentation of student work, in all its varied forms, has improved with the introduction of the notebook programme.

Increased student productivity

The SKC students also believed that in general using the notebook computer had increased their productivity and saved them time in class, as has been observed in similar technology related studies (e.g. Dwyer, 1994; Parr and Bairstow, 1992; Stolarchuk and Fisher, 1999). Whether the perceived increase in productivity has had an impact on the quality of learning is perhaps questionable. But it would stand to reason that if student productivity has increased then their understanding and learning would likewise improve. Further research would be necessary to determine the degree to which this is the case.

Other benefits and enhancements

The pilot project of the AAL programme noted changes in student attitudes, motivation and behaviour within a short time frame. Other benefits perceived for students included an increase in collaboration and a move towards independent learning and more engagement in problem solving (Rockman, et al., 1997). Stevenson (1998) recorded that 65% of sixth grade students (age 11-12) reported that notebook use had improved their spelling and 60% stated that the notebook had improved their writing skills; however, these perceptions were untested, as no summative assessment of student performance in these learning areas was undertaken.

A four year longitudinal study (Tierney et al., 1992) carried out by as part of the ACOT research programme, focusing on a small randomly selected sample of only six high school students using desktop computers in the classroom and provided at home. The study found that:

The computer enhanced their ability to do problem solving and communicate ideas effectively, to use alternative symbols systems, to establish goals for themselves and to perceive strengths and weaknesses of their work and experiences (1992 : 11).

This finding suggests that given a longer time frame it is possible, indeed probable, that there will be further positive changes in students' attitudes and their performance using notebook computers at SKC. However this is highly likely to depend on how the

notebook computers are used and perceived by both staff and students. If they are used as adjunct components that students and teachers consider apart from the normal processes of learning, then student attitudes towards the use of notebooks may become more negative than positive. Alternatively if, as is the goal of the notebook programme at SKC, they become essential elements and seamless parts of the classroom learning environment, the student attitudes are more likely to be positive (Hill et al., 2001). Of course the 'subjective realities' of the innovation may result in a range of responses from positive to negative.

The invisibility of the notebooks within the classroom is the ultimate goal. The challenge is to make them an integral part of the normal classroom, in the same way that pen and pencil have been in the past. This is while recognising that the notebook is not a totally neutral innovation, nor is or was the pen and paper.

In the context of this study the diverse range of student written responses collected suggest that it may be the student's personality, influenced by their personal experiences, that determines their attitude towards the College notebook programme. This is evident from the following positive and negative student responses.

There were a diversity of **positive views** expressed by students:

It is a good experience and it can build up your skills. The Notebooks have a good effect on the student, and now days jobs require the usage of computers.

It helps with your workload quite a lot and you're always ready for work. Notebooks are used by most people and they are an advantage. It is easier to do work with a notebook.

I think they are worthwhile - They help enhance your learning.

The Notebooks help your presentation and storage problems. It may help your ability to learn in a wider range.

While equally there were a range of **negative views** expressed by other students:

Too much hassle for not enough gain !

It is a bit of a waste of time, because it slows you down too much in work, you can do good work, but not as much.

It has a negative effect on your learning.

These comments need to be placed in context. One of the lessons from the innovation and change literature (e.g. Fullan, 2000) is that individuals respond at a deep level to particular innovations and we should be cautious of sweeping generalisations in this regard. In short, we should be wary of making judgements on the basis of the views expressed by one or more individuals.

A barrier to learning – The issue of notebook problems

One of the significant de-motivating factors that hinders the use of the notebook computers is the issue of reliability. The problems associated with use of notebooks identified in this study are not unique by any means and these will continue to be the focus of further research and development by portable computer providers. The range of computer problems provided in the student survey instrument was based on a review of previous studies. A predetermined range of options was provided for students to select. It is worth noting that few students opted to record any additional issues/problems in the space provided for general comments, which suggests that the list of options provided were appropriate and relevant for this study.

The main problems identified were:

- The weight of the computer was a concern for 88% of all students surveyed. The addition of a notebook computer to other school bags, made carrying the notebook an uncomfortable task to and from and around the school
- Security of the machine, at school and during transit
- Printing related problems, both at school and at home

- Battery life and hardware failure
- The set up/shut down time. This was a common concern resulting in student frustration, as was the slower processing time of the notebook computers in comparison to many desk-top machines which students had access to at home.

These concerns were noted in both the written comments of students in the survey and as recurring themes during the focus group. All these issues have been common problematic features in studies of many other notebook programmes as identified in the literature review.

The weight issue would appear to be a universal concern and this despite the portable nature of the notebook computers. As two students in this study wrote:

Reduce the weight of the laptops and they (the College) should get better models, faster and ones with more space.

Weight of laptop and bags. It get a bit of a hassle carrying a laptop, musical instrument, books and sports gear some days.

Students in focus group interviews in other studies have also expressed concerns regarding the weight of the machines (Hill et al., 2001). There is evidence of potential health risks to children's developing musculo-skeletal system associated with students participating in notebook programmes. Carrying a notebook can result in discomfort, particularly to the shoulders of student, while with prolonged and repeated use of notebook computers students experience discomfort, with the most common site of discomfort being the neck (Straker and Harris, 1997).

If possible the carrying weight issue needs to be addressed at the College level, in terms of student textbook and exercise book requirements, and by advice to students and notebook manufacturers. However the trade off between weight, functionality and strength of the notebook computer is an ongoing commercial research challenge and 'despite the best efforts of the manufacturers to make laptops robust, they are still relatively delicate devices and do not stand up well to rough treatment' (Passey et al., 1999 : 107). At SKC there has been some reduction in the exercise and textbooks

students are required to carry and staff are endeavouring to further reduce the student load needing to be transported.

However, as has been observed elsewhere, students were willing to carry the additional load, if they perceive that the notebook will be used regularly in class (Newhouse and Rennie, 2001). As one student at SKC succinctly put it, 'use them more or don't use them at all'. As researchers in the United Kingdom AAL study commented, the mere presence of notebooks within the classroom does not ensure their on going usage and that 'unless teachers actively encourage use, on occasion, pupils are unlikely to choose to use them' (Passey et al., 1999 : 75). So from the student's perspective, there would appear to be more that the College could endeavour to do. The College should continue to investigate reducing the physical overloading of students. It must also work to develop the curriculum usage of notebooks in ways that students see relevant and meaningful, and thus the potential extra weight to carry their notebook may be perceived as being worthwhile and fruitful.

The views of the SKC Director of Information Technology

In a personal interview with the Director of Information Technology to discuss the study findings and hereby enhance the ecological validity of the research, the following observations were noted.

The high levels of non-functioning notebooks recorded, as perceived by students, is unlikely to be a true reflection of the actual level of notebook failure or faults. The recorded level of notebooks serviced by the college IT support staff was significantly lower than the 50% figure that the student data would suggest (see Table 4.7). Problems that students attributed to hard drive failure or faults were generally not hard drive related. In the opinion of the Director, the most common cause of over 90% of student notebook faults were as a consequence of students wilfully or unwittingly altering the settings and configuration of their notebooks. For example, when they installed personal software programmes some were non-compatible and resulted in non-functioning computers. This problem has also been identified in the report on the United Kingdom AAL pilot study (Passey et al., 1999). A further cause of hard drive failure was due to students not following the recommended procedure when shutting down the notebook

and failing to allow sufficient time, approximately 10 seconds, before moving and/or packing up the notebook.

By comparison the rate of hard drive related problems on the staff notebooks was less than 1%, suggesting that with a greater degree of care, and possibly less physical movement of the machines around, and to and from the campus, less problems would occur. The staff failure rate was well below the 4% figure regarded as the industry standard for computers in general (W. Chieng, personal communication, November, 2001).

In the opinion of the ICT Director, the high percentage of battery/adapter related problems were likewise, due to inappropriate maintenance and handling care and in particular the charging and discharging of the battery. However there was an acknowledged problem with the robustness of the power adapter of the specific model of notebook used by this year group of students in 2000.

Regarding computer related problems (see Table 4.7) the Director acknowledged that the weight issue was a significant concern. In addition he considered that much of the frustration felt by students regarding the printing off their work was a consequence of student behaviour. Based on his observations, students have a tendency to, rather than allowing sufficient time to organise their use of school printers or printing work at home, leave printing to the last minute and hence face unnecessary time pressure and possible student queues for printer access at SKC.

The low level of negative written responses in the parent data, with regard to notebook technical problems, suggests that the figures for notebook software and hardware non-functioning may well have been over stated by students. Although, it is possible that some parents were simply unaware of the problems, as their son may have resolved many of these without their knowledge, support or intervention.

Student preferred level of notebook usage

There was an unexplained difference between the views expressed regarding the students preferred frequency of classroom notebook use. The questionnaire indicated a

strong preference (over 40%) for regular usage, while the participants in the student discussion group were not committed to regular use of notebooks within the classroom environment. However, given the number of self selected students participating in the discussion group (n = 12), possibly these views should receive less consideration when compared with the larger student questionnaire sample (n = 48). It would be worthwhile establishing at SKC a better understanding of what the students consider is a preferred level of notebook usage, however the classroom learning environment should not be seen to be determined by student desires, but rather by curriculum imperatives and proven teaching strategies.

Comparison with previous research

To establish an international comparison of the results of the SKC research, a review was undertaken of the data for notebook students participating in the AAL programme (Rockman et. al., 1998 and 2000). The AAL research used the same six student attitude statements as the student questionnaire used in this study. In addition, the 8th grade (equivalent to Year 9 in New Zealand) data collected as part of a single site notebook study in America, which had used very similar questions, was also included in the comparison (Hill et al., 2001). The findings are shown in Table 5.1.

Table 5-1 Comparison with American studies

Key: 1 : Strongly disagree - 5 : Strongly agree

Average of the five point Likert scale for each student attitude statement.	New Zealand SKC (2001)	USA Rockman et al. (1998)	USA Rockman et al. (2000)	USA Hill et al. (2001)
(a) I enjoy playing games on computers.	3.6	N/A	4.8	N/A
(b) I prefer to use computers to do school work.	3.1	3.8	4.6	3.6
(c) Computers make schoolwork more fun/interesting.	3.3	3.9	4.8	3.5
(d) Computers make schoolwork easier to do.	3.2	N/A	4.9	3.5
(e) Computers help me to improve the quality of my school work.	3.7	N/A	5.0	3.2
(f) Computers help me understand my classes better.	2.7	3.1	3.9	3.1

As can be seen in Table 5.1, the means (arithmetic averages) for the New Zealand data are considerably lower in each case than in the multi site AAL studies. However given that an average score of 3.0 would indicate a 'neutral' position with regard to the above statements, when considered in isolation the SKC results are generally positive. Possibly the American students were more generous in their assessment of the use of notebook technology, and/or their classroom experiences using notebook computers has had a greater impact on their attitudes. Interestingly when compared with the single site Athens Academy study (Hill et al., 2001) involving a sample of 68 pupils, near in magnitude to the survey of 48 students in this study, the data reveals close similarities in the attitudes of the students. These mean values are in general less positive than those expressed by students participating in the AAL programme (Rockman et al., 2000). It could be speculated that the fact that the AAL research was sponsored by interested third parties, namely Microsoft and Toshiba International, may have had some indirect influence on student responses.

The trends for each of the six statements in each data set are consistent. For example statement (e) had the greatest average for both the SKC and 2000 AAL study, while all four studies had their lowest respective average for statement (f). Perhaps surprisingly, the Director of Information Technology at SKC was quite satisfied with the near neutral mean value of students responses to statement (f). The philosophy of notebook use at the College is primarily based on the 'tool' model, where the use of notebook computers was intended to enhance student learning through the appropriate use of technology. In the words of the ICT Director, 'it's not something special', as the objective of the notebook programme is not based on the premise that notebook usage will enable students to achieve better academic results (W. Chieng, personal communication, November, 2001). Perhaps there is a small degree of self-contradiction in this view, for if notebook use is to enhance the learning experiences of students, does it not follow as a logical consequence that the students will gain a better understanding or insight into the curriculum issues being addressed.

Regarding the statement (e) about the quality of student work, clearly the students at the College perceived that the use of notebooks had improved the quality of their work (mean = 3.7). However an exact definition of quality was not determined and the comments made in the student discussion group suggest that by quality students

generally mean the physical presentation rather than the intellectual content of their work. However some students still prefer to use the more traditional 'pen and paper' mode of recording classroom activities, primarily for the perceived speed and convenience advantages, and this view is consistent with findings of previous studies (Gardner, Morrison and Jarman, 1993). This shows a need for SKC to adopt a pragmatic approach and ensure that logic should prevail, in terms of appropriate use of the technology by students. However, students should not be given too great a choice, as human nature to take the 'line of least resistance' may mean, that rather than up-skill themselves and improve their long term productivity, student may opt for the easier, perhaps less technical, non-notebook option.

Student expertise levels

Student data indicates a good self perceived level of expertise with the most frequently utilised software packages. In comparison with a North American study (Hill et al., 2000) the SKC students appear to be as confident in their ICT skills as were the US students (see Table 5.2). The exact nature of the software packages used in the American study is not stated, however reference is made to the common Microsoft software programmes within the published report and thus a comparison with the students at SKC is justified. It is noteworthy that in general, the New Zealand students at SKC appear to be more confident with the use of presentation software (e.g. Microsoft 'Power point') than those at Athens Academy in the United States; while in contrast, the American students appear more confident in their use of graphic packages.

These differences may be a consequence of the relative frequency of use of the specific software packages within each school context rather than a significant educational difference in terms of the ICT abilities of the two student populations. Also the student evaluation of their own abilities are subjective and should be complemented with trustworthy measures of ability and the skill levels of students. Within the context of this research no formal assessment of student ICT skills was undertaken as the research was not framed to have a software focus.

Table 5-2 - Comparison of NZ and US student self assessed ability for generic software usage

Key: 1: Very poor, 3 :Average, 5 :Very good

Student self assessed areas of expertise/ Level of ability to use generic software, using a five point Likert scale.	New Zealand SKC (n = 48) (2001)	USA Athens Academy (n = 68) (Hill et al., 2000)
Word processing	3.9	3.8
Graphics/drawing	2.8	3.3
Spreadsheets	2.9	2.9
Presentations	3.8	2.9

In summary, as previous studies have identified (e.g. Hruskocy et al., 2000; cited in Mumtaz, 2000) the level of student expertise will have a flow-on effect on the successful integration of ICT by teachers within the learning environment. The findings of this study suggest that the self perceived level of expertise of students would not appear to be a limiting factor on the successful use and integration of the notebook computers into the classroom teaching programme.

Parent information

The following section seeks to make some comparisons with previous notebook studies that have had parental input. It is perhaps somewhat disappointing that with a few exceptions, such as the studies at Penrhos College in Perth (Kessell, 2001), Balwyn High School in Victoria (Ainley et al., 2000) and Norwood Middle School USA (Woodbridge, 2000), most published research on notebook programmes has not considered this important stakeholder group. As explained previously, the term ‘parent’ is used in a broad sense to encompasses the full range of student caregivers who participated in the research.

This section considers: (a) parental attitudes, (b) impact of notebooks on student enrolment, (c) the vocational and educational benefits of notebook use, and (d) common parental concerns regarding student notebook use.

Impact of the notebook programme on student enrolment

It is difficult to gauge whether the implementation of the notebook programme at the College has had an impact on student enrolment. Obviously this study did not extend to include families who may have initially expressed interest in the college but subsequently did not enrol. Whether the notebook programme was a negative factor in their decision to not enrol their child cannot be assessed. However the sample data from the parent questionnaire reveals the College notebook programme did not have a negative influence on the decision of any family to enrol their child at SKC. Anecdotal evidence from overseas portable computer programmes conducted within similar educational institutions, suggests that in general the introduction of a notebook programme has a minor positive impact on student enrolment and retention levels (The Node Learning Technologies Network, 1999). This aspect of the College notebook programme has not been examined in detail within the context of this study and it may be a valuable area for future research in terms of patterns of student recruitment.

Given the additional expense of participating in the compulsory notebook programme at the College, another area of possible follow up would be to assess whether the introduction of the notebook programme has had an impact on the socio-economic demographic profile of the student population. Circumstantial evidence from administrators at North American educational establishments that have introduced notebook programmes believe that these 'expensive' programmes have had no effect of the demography of their student populations (The Node Learning technologies Network, 1999). This remains an issue for SKC to be aware of and possibly monitor in the coming years.

Vocational and educational benefits

The parental questionnaire reveals that parents generally perceive there are good vocational benefits to be gained with their child's participation in the student notebook programme. To a lesser extent, they also believe that there are educational benefits to be gained by notebook usage by students. The vocational benefit is self evident in terms of better ICT skills and knowledge; however, whether these factors will in the long term be an advantage in terms of either higher education or employment opportunities is beyond the scope of this research. Earlier research at King's College found that parents of

students participating in the Year 9 notebook pilot felt that their sons had gained confidence and understanding of ICT and related skills (Parr and Bairstow, 1992).

Evidence from North American notebook studies are consistent with these findings, with university student surveys revealing that between 80 – 90% of students believe that notebook usage has enhanced their career technology skills and their marketability as graduates (The Node Learning Technologies Network, 1999). There is a concern, however, that such data may reflect a misunderstanding in some parents' perceptions of the prime role of schools, which the researcher would argue, is to develop and challenge young people in the broadest educational sense, rather than to focus on preparing them solely for a functional role within the future workplace.

Parental concerns

This section outlines a number of areas of concern expressed by parents in relation to the student notebook programme at the College. To determine whether these are 'real' issues or simply 'urban myths' has not been within the parameters of this research. However, these issues represent the concerned perceptions of a number of the parents participating in the research. It would appear there is further work to be done in some areas; both in terms of students/teacher interactions and ensuring effective communication and understanding between the key stakeholders. The following issues have been identified by parents.

Spelling

While a number of parents (and also students) have remarked that notebook use has had a negative effect on student written literacy, some studies have suggested that the spelling and grammar check facilities of the MS-Word software package used, enables students to check and correct their work easily and that 'pupils have the equivalent of a tutor with them all the time, to guide them in spelling and grammar' (Passey et al., 1999a : 89). However as one parent pointed out this apparent advantage could have negative effects:

He cannot write quickly because he does not have many practices to write by hand. Sometimes he finds the spelling of words difficult because he depends so much on the computer to have the spelling check for him.

While others commented:

(His) spellings has not improved – either spell check ignored or does not pick up errors.

He says his spelling has deteriorated.

Handwriting

The issue of handwritten versus keyboard written work is an on-going debate and the opinions of the parent sample were divided between those who viewed notebook use to be advantageous and those who considered it as having a negative effect on their child's learning to write legibly.

The use of notebooks has enabled some students with poor handwriting skills to excel and produce written work of a higher standard; yet in the wider context of every day life handwritten communication skills are expected. Indeed at this stage there is no avenue for students to complete formal NZQA examinations using computers. The use of notebooks to assist in the production of internally assessed examination work is accepted practice within the College environment, particularly in cases of research and practical investigation reports. This needs to be addressed in practical ways as most would accept that students need handwriting skills of a reasonable standard.

Parents certainly had firm views on the effect of notebook usage on the hand-writing of their sons. These largely reflected whether their child had poor written communication skills or not. For those students for whom producing handwritten work was a struggle the use of a computer was considered a benefit. However, for others it was perceived to have been a negative influence on their written work. A sample of parental comments are presented to illustrate the range of opinions.

The following are a sample of **positive remarks** made by parents:

Layout and presentation improved, mainly because he didn't have to hand write things.

Presentational work is of a higher quality, moderately helpful with spelling.

The quality and quantity of work has greatly improved. Speed of processing for him is enormous. More independence to work on his own. Attitude and confidence is fantastic.

One parent indicated a mixed response:

Writing and editing some essay work using word processor function. Apart from this I have observed very few positive effects. (emphasis in parent's original text).

While a number expressed concerns about the **negative impact** of notebook usage:

Without notebook, normally every student writes their notes and homework and also improve their hand writing, but with the notebook hardly any hand written home work.

(A negative effect on) spelling and punctuation.

He can barely write and he certainly would not be able to write quick enough to finish an exam.

It has restricted his reading and writing growth. These are in our opinion still an integral part of the learning process.

These views are founded on parental observations of their child and as such are not an independent assessment of the students' abilities and skills level. Whether the students performance or non performance is a direct consequence of notebook usage can not be

accurately gauged. Quite possibly those students who produce good work or poor work would have produced the same quality and standard of work if they had not been using a notebook computer. The opportunity to assess student work, in the form of comparison of similar tasks with students either using or not using notebooks did not arise. There is, however, an implication that greater discourse between the College and parents would clarify and perhaps diffuse some anxiety with regard to the possible impact of notebook usage by students.

Student keyboard skills

An evaluation study of Norwood Middle School notebook programme found the parents of notebook students felt that a lack of adequate keyboard skills may reduce students' progress (Woodbridge, 2000). Norwood parents observed that their children's typing/keyboard skills were inefficient, undisciplined and that students developed bad habits (e.g. 'hunting and pecking'). Similar concerns were expressed by parents of students participating in the pilot AAL study, where the parents suggested more keyboarding lessons would be beneficial (Rockman et al., 1997).

The SKC parents did not raise these concerns and if anything their written responses suggest they were pleased with the development of their sons' keyboarding skills as reflected by the following comments:

He has certainly improved in his typing skills and he has a very sound knowledge on using the computer.

The ability to check and edit his work, the speed he can type rather than longhand, less searching for pens pencils and paper.

Improved keyboard skills, improved understanding of Excel spreadsheets and word applications. Navigation around the computer (in general)

A definite improvement in computer skills i.e. keyboard, use of windows etc.

However it is recognised that the statements above were recorded by parents in response to a question on the 'positive effects' of student notebook use and they were not directly asked to comment of their child's keyboarding skills. Any future survey of parents might wish to pursue this issue further.

Parental attitudes to notebook programmes

To place the SKC parental data in the context of previous research, that included parental input, the following commentary is offered.

As part of the joint Australian Council for Educational Research (ACER) and Toshiba (Australia) portable computer study in Victorian schools a survey of 21 families at Jamieson Park Secondary School was carried out. It found that parents of those students participating in the project were extremely positive in their responses to the effect of notebook computers on their child's learning and development. A significant majority felt that the notebooks had improved the interest, attitude, work and educational outcomes of the students (Narracott, 1995).

A recent Australian study found that the parents of boys in notebook classes were satisfied with the teaching methods and academic progress of their sons, while interestingly parents of girls within the notebook class were less satisfied. A possible explanation was the staff observation that 'girls were generally less interested in their computers and tired of them more quickly than their male counterparts' (Ainley et al., 2000 : 62).

However these Australian findings contrast with those of a study in an independent girls College in New Zealand (Selby, Elgar and Ryba, 2001). While the students at St Cuthbert's College were younger (Year 5) than those in either the Australian study or boys in this research, the parental responses were generally positive, particularly in terms of their daughters' response to homework, which was described as being more enthusiastic and motivated. In both these studies, as in the SKC study, common concern was expressed by parents, as they identified the weight of the notebook computer as a significant issue. Also, similar to the findings of this research, the parents expressed

concerns about the possible over-reliance on computers by both students and staff for the production of work instead of the more traditional 'pen and paper' writing exercises.

In summary, while some parents express genuine concerns, it is reasonable to state that the findings reveal a good level of parental support for the College notebook programme.

Comparison of higher and mixed ability student data

This section presents an interpretation of the data relative to the academic ability of students. This is in keeping with the original research questions and was undertaken in light of the trend in academic literature. A distinction was made on the basis of the student's class grouping, which was determined on internal school academic indicators, such as the students examination performances in Year 9. Thus the class groups reflect the general level of ability of students within broad bands. While acknowledging there are limitations in assuming that academic performance in summative assessments is the best or most appropriate means of distinguishing the academic abilities of students, it is, however, one of the commonly used means by which student academic potential is evaluated.

The sample of 48 student/parental questionnaire responses were divided into two groups based on the student's class allocation for Year 10. The higher ability sample consisted of 26 students, while the mixed ability sample consisted of 22 students. It is recognised that these two groups each have a relatively small sample size, in which the views expressed by a single student would equate to a 4 - 5% value. With these cautionary remarks in mind, the responses for both student and parent samples were interpreted.

The staff questionnaire specifically included in its design questions which considered the issue of student ability. The teacher's responses to these questions provide the following insights as to the influence of student academic ability on the effectiveness of the College notebook programme.

Staff information

The views of the staff as to the impact the student notebook programme has had on the thinking and learning processes of higher ability and mixed ability students are presented in this section.

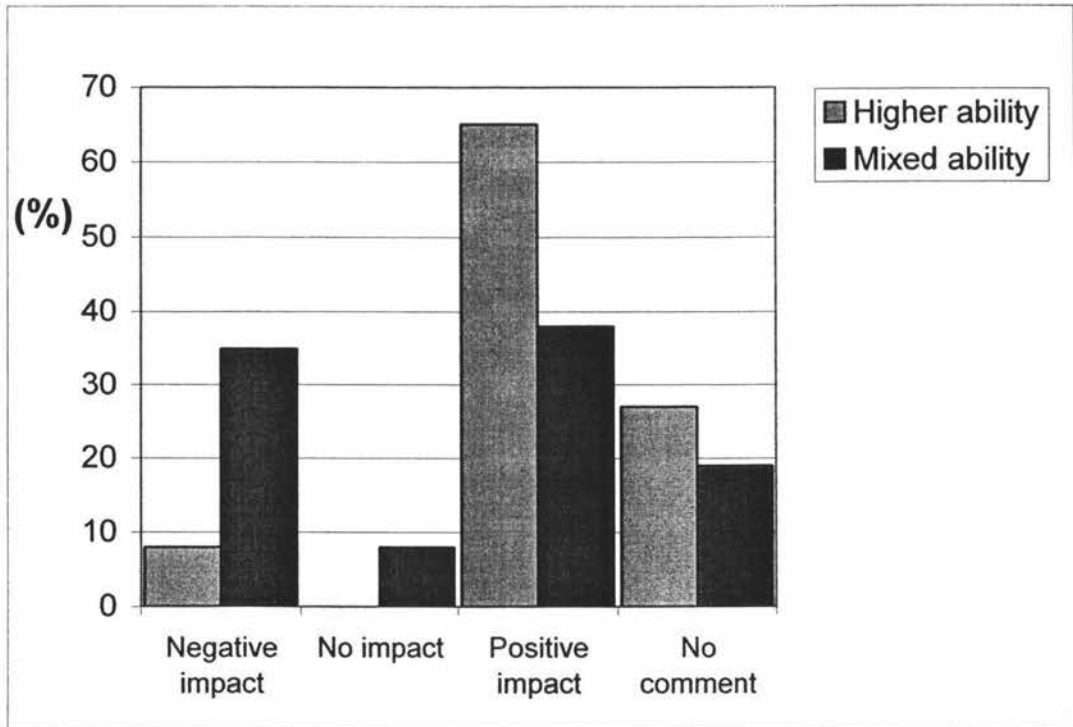


Figure 5-1 Impact of notebook use on thinking and learning according to student ability

Figure 5.1 indicates that staff perceive the notebook programme has had a positive effect (65%) on the thinking and learning processes of higher ability students. However, many (38%) perceive that the use of notebooks has had a negative effect on the thinking and learning of mixed ability classes/students. The significant proportions of 'no comments' are due, in part, to the fact that a number of staff taught only higher or mixed ability classes and hence did not feel able to comment on the effect with regard to the other grouping of students. While recognising there is the potential for bias in the data, as some staff taught only one academic grouping in Year 9, most staff are likely to have taught notebook classes of both ability groups at some stage in the previous three years of the optional notebook programme at the College. Thus, taken that these findings are as much based on experience as actual classroom involvement in Year 9 in 2000, there is a visible trend, that in general, staff perceive the notebook programme to be more beneficial for higher ability students.

These findings are in keeping with those of an earlier King's College study, where staff perceived that the higher ability students responded better to the technology and also that notebook use was a greater motivator for these students (Johnston, 1996).

A comparison of data considering the benefits of notebook usage on student learning with previous American research does not reveal the same pattern. The average rating of SKC staff for higher ability students was 5.3 (on the 1 to 7 scale), while in the AAL study (Rockman et al., 1998), the staff responses to an identical question gave a mean value of 4.5. The data suggests that the teachers participating in the SKC study perceived that there was a greater benefit of notebook use for higher ability students than in the American study. However, in both the American and in the SKC study, teachers reported that notebook usage was more beneficial for higher ability students than for other student ability groups. The mean rating in this study for mixed ability students was 4.2, which was comparable to the rating of 4.1 determined in the Rockman et al., study (1998). The data suggests that the teachers surveyed in SKC study appear to hold similar views to those in the AAL study regarding the relative beneficial nature of student notebook use for mixed ability class students.

The staff comments presented below support this interpretation:

Higher ability students are able to focus on concepts, the content, the mood, the learning in general, while the mixed ability students have a different focus, bogged down in the lower level things, such as typing in the info, playing with the computer, getting it functioning.

Lower ability students are easily distracted, easily lose their focus, and can spend the whole lesson trying to get their computer to work, rather than get out a piece of paper.

Organised students regardless of ability if motivated can achieve. This is because the notebook requires different skills and it enables some students to shine who would not otherwise do so.

These findings have potential implications for the future development of the College notebook programme. If the data collected accurately reflects general staff beliefs, this may result in lower performance expectations by staff for mixed ability classes and ultimately, these expectations may become self-fulfilling prophecies, with lower grades achieved by students in these classes. The College notebook programme should seek to address this area of concern and look for ways to ensure all students, regardless of ability, gain the maximum advantage from the integration of notebook technology into the classroom learning environment.

Student information

As with the parent sample a comparison of the student data was undertaken for selected questions. These questions focused on student attitudes towards and perceptions of the notebook programme (see Appendix H). The comparison of student responses did reveal some important differences between the views expressed by the two ability groups of students.

The effect of notebook usage on the standard of student work

As Figure 5.2 indicates, the higher ability students were generally more positive about the effect notebook use has had on the standard of their school work (42%), than compared with the mixed ability student sample (32%). The percentage values for 'no effect' and 'negative effect' were similar for both samples, regardless of their ability grouping. There was a small minority of students in both groups who perceived that notebook use had a negative impact on their school work. Possible reasons for these negative attitudes have been outlined in earlier sections of this chapter.

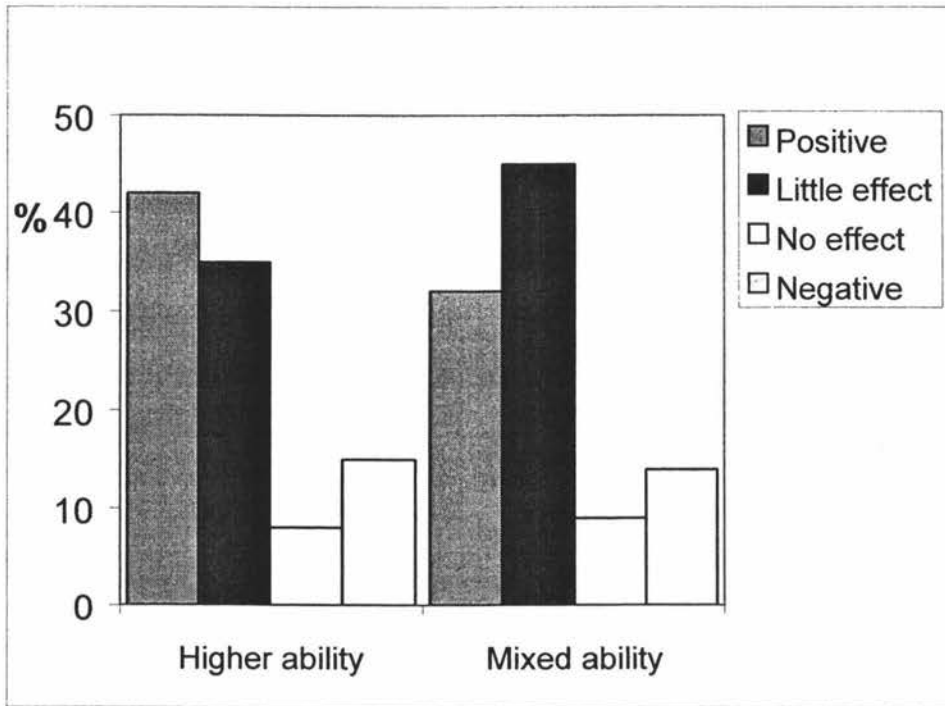


Figure 5-2 The perceived effect of notebook use on the standard of student school work

There could be a number of possible explanations for the differences in the responses of the two ability groups. While there is a risk in being too speculative, the difference in the effect of notebook usage on students' self perception of their work could be related to the class group dynamics, the personalities of the students themselves, or perhaps even to the teaching style of the staff these students had in Year 9. It was beyond the scope of this study to identify the reasons for these student perceptions; however, input from the student focus group would suggest that there was no one single factor which resulted in these views. One could even question whether students themselves, maybe especially those in a mixed ability class, had the maturity and/or ability to recognise the influence of notebook usage on their work? This could explain why nearly half of the mixed ability students (45%) indicated that the notebook programme had 'little impact' on their performance.

The use of notebook computers

Similarly, as Figure 5.3 shows, a large percentage (38%) of higher ability students enjoyed using their notebooks in class, while for the mixed ability students the most significant group was those who did not like using the notebook in class (36%). These differences could be attributed to the differing computer skill levels of these students

and their level of confidence and understanding of their own notebook usage. The concern for the College would be that if the majority of mixed ability students ‘dislike’ using the technology, the probability of a long term lasting impact may be limited.

It has also been suggested, by the Director of Information Technology, that the staff teaching mixed ability classes have, from experience, recognised that a greater commitment of time, energy and effort is required to ensure these students achieve a similar standard of work using notebooks. This may have lowered their expectations of the students and thus they may be less committed to the notebook programme and this, in turn, flows on to the students in these classes.

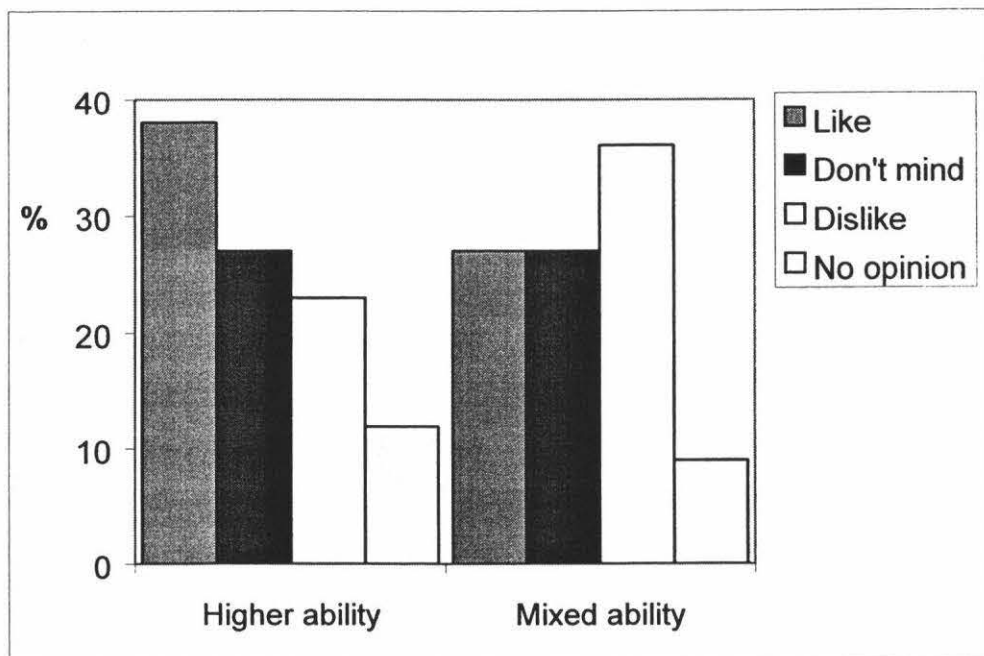


Figure 5-3 Student preferences regarding the classroom usage of notebooks based on their ability

In summary, there would appear to be a complex mix of variables that may come into play and influence the student’s perceptions of the notebook programme. While, in general, it would appear students of higher ability hold more positive views of the notebook programme, than those espoused by mixed ability students.

The notebook effect on student learning

As Table 5.3 shows, the impact of notebook use was perceived by the students to have had an effect on the way they learnt. Four areas which impact on student learning were also examined.

Table 5-3 The impact of notebook usage on learning according to student ability

Do you think using a Notebook changed the way you learnt last year?	Higher ability students	Mixed ability students
Data expressed as percentages	(n = 26)	(n = 22)
No	8	27
Not sure	8	9
Maybe	23	27
Yes	62	32
No comment	0	5

Table 5.3 shows that over 60% of the higher ability students report that the use of notebook technology changed the way they had learnt. While in contrast, only 32% of the mixed ability students expressed a similar view. Just over a quarter of mixed ability students perceived notebook use had not changed the way in which they learnt.

In addition four specific aspects of student learning were investigated, in terms of the differing perceptions of students, according to their ability grouping. These were:

- organisation of work
- productivity of work
- time management of class work
- time management of homework.

A five point Likert scale was used and the comparison of the findings for the two ability groups appears in Table 5.4.

Table 5-4 Mean values for student responses for four key aspects of notebook use

Mean value of student responses on a 5 point Likert scale for four aspects of notebook use	Higher ability students (n = 26)	Mixed ability students (n = 22)
Key: 1 : negative, 3 : neutral, 5 : positive response		
Notebook use had helped students to organise their work more effectively.	3.69	3.24
Notebook use had helped students to increase the amount of work they did, that is, it had increased student productivity.	3.19	3.33
Notebook use had saved students time during lessons.	3.35	3.05
Notebook use had saved students time outside of the classroom, for example on homework.	3.23	2.95

Given the sample size, and spread of data, the difference in the means for the two groups is not statistically significant. However, the data in Table 5.4 supports the view that in general higher ability students make more productive and effective use of the notebook technology. The notebook has also enabled them to be more organised. Notebook use would appear to have assisted more mixed ability students to produce a greater amount of work, though perhaps one could question the quality rather than the quantity of material produced. It is noteworthy that mixed ability students perceived notebook use as having a slightly negative effect on their homework and it would appear homework takes longer to complete using notebook technology.

These results are in contrast to those of a recent Australian study (Newhouse and Rennie, 2001) which generalised that computers were less likely to be used in classes with older, higher ability students and that their use was greater with younger and/or lower ability students. The results of this study are limited to a single year group thus no valid comparison can be made in terms of age. However, the majority of staff expressed the view that the higher ability student made more and better use of notebook technology than did mixed ability students.

The value of notebook usage

The student views on the value of using a notebook computer, relative to their ability group are presented in Table 5.5. For consistency and comparison a similar five point Likert scale was employed.

Table 5-5 The value of the notebook programme as perceived by students of differing ability

Perceived value of the notebook usage (e.g. 1 : not worthwhile, 3 : neutral/no view, 5 : very worthwhile)	Mean Ranking
Higher ability students	3.46
Mixed ability students	2.95

The data in Table 5.5 does not provide a general student endorsement of the College notebook programme. It is clear from a student perspective that the notebook programme is perceived to have had a more positive impact among higher ability students.

However, despite the differences in views expressed in some areas and the lack of a strong perceived value of the notebook programme, both groups of students held similar views in terms of preference as to the frequency of notebook use they would want in the classroom (Figure 5.4). The majority of students in both categories would wish to maintain notebook use in class, either on a regular or occasional basis.

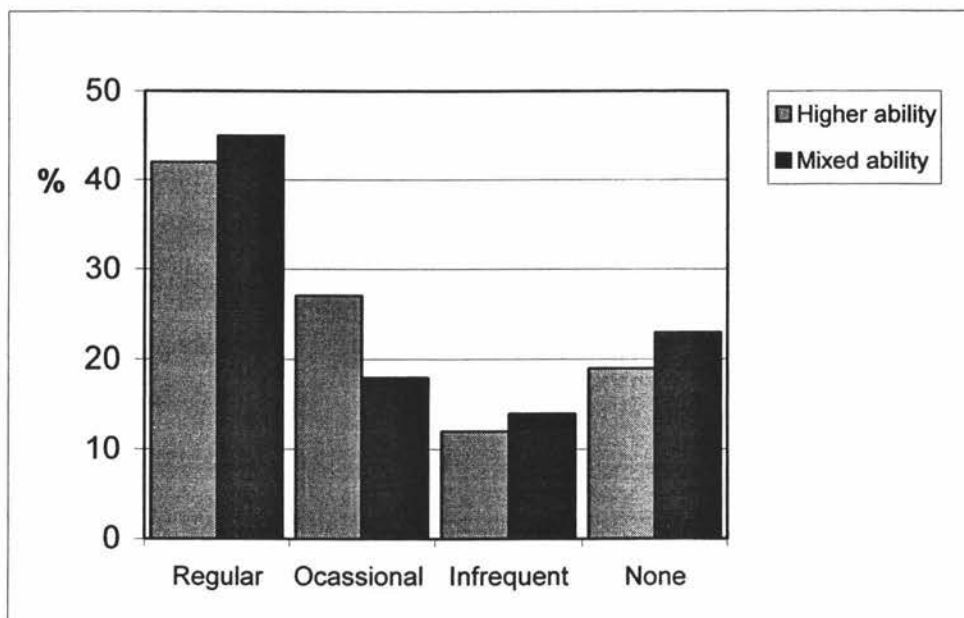


Figure 5-4 Student preference for level of classroom usage of notebooks by ability group

Student advice to other potential notebook users

A more emotive student response was deliberately anticipated to the final question in the student questionnaire concerning the value of the SKC notebook programme. Students were asked to give their advice to a potential new student as to whether or not to join the College notebook programme. This was a hypothetical question, given that the College notebook programme is compulsory for all students.

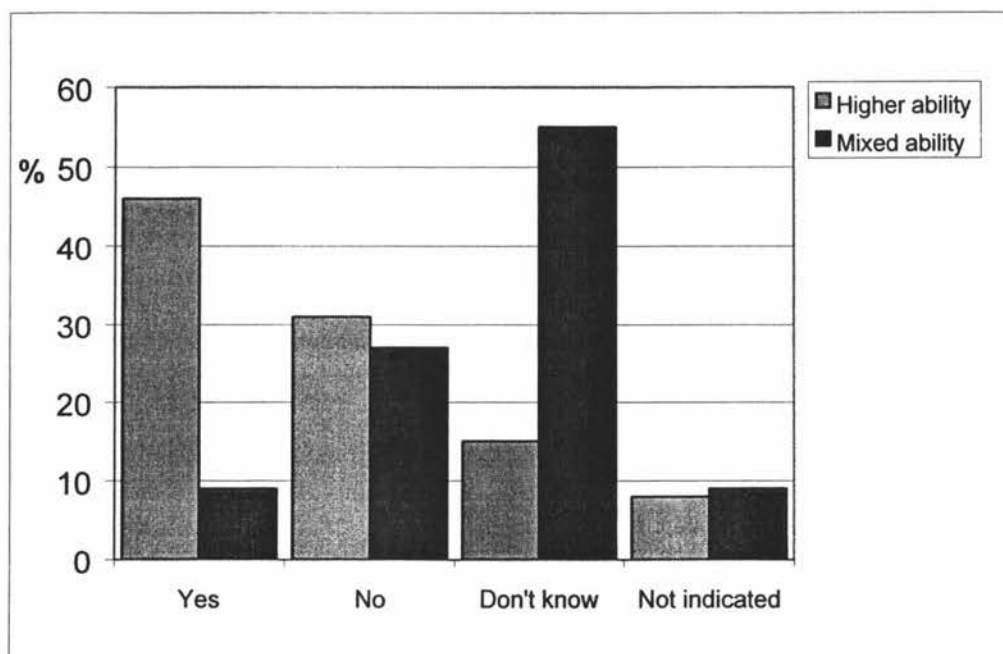


Figure 5-5 Student advice to a peer considering joining the College notebook programme by ability group

As Figure 5.5 shows, the views expressed by students suggest that approximately 30% of students, regardless of ability group, would advise a new student not to join the notebook programme. It is noteworthy that this percentage was similar for both ability groups of students, and appears to indicate a common attitude amongst the student population. In contrast, nearly half of higher ability student sample (46%) were supportive of the programme and would recommend any potential students to join; while the majority of mixed ability students were undecided (55%) and did not express a clear view, either positive or negative. Only a few (9%) of the mixed ability students would encourage other students to join the notebook programme.

The data suggests that there appears to be a diversity of student perceptions of the SKC notebook programme, some of which are negative. The College administration would do well to reflect on this result and review the general findings of this study. Then the administration should look for positive actions and means to improve the level of student support for the notebook programme in the future.

Parent information

A similar comparison of the parent data was also undertaken for selected questions. This comparison focused on parent attitudes towards and perceptions of the College notebook programme and aimed to identify any differences or common patterns expressed by these two sub samples.

As mentioned previously, the total parent sample was 49 as one family did not permit their son to take part in the study. The sample was divided into two groups based on the student class allocation for Year 10. The higher ability sample consisted of 26 parental responses, while the mixed ability sample consisted of 23 responses.

The benefits of student participation in the notebook programme

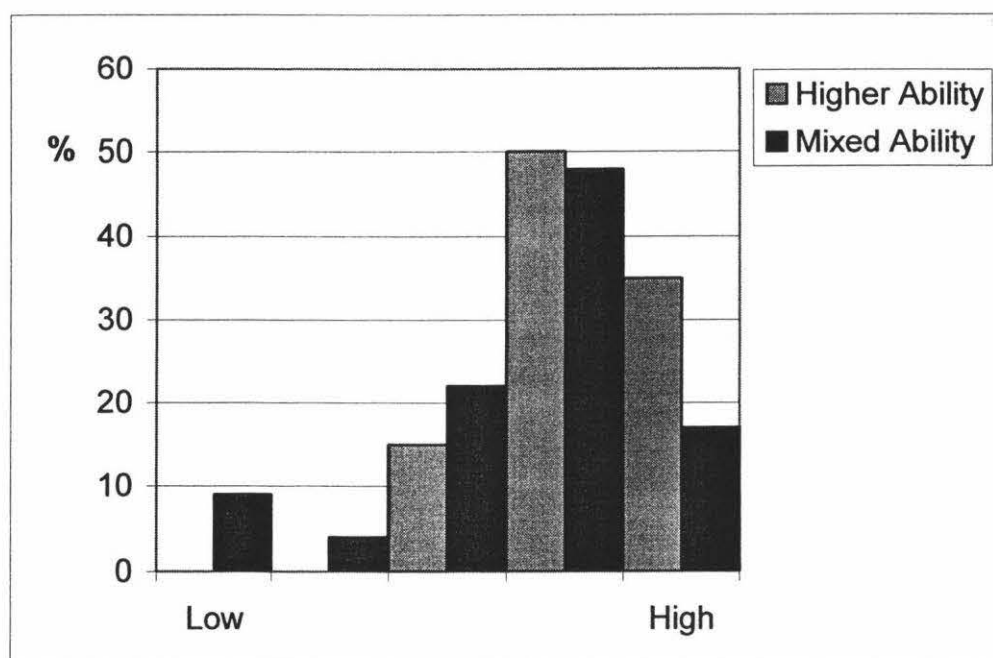


Figure 5-6 Parents perceptions of the vocational benefit of student notebook use

The data suggested that parents of higher ability students were generally more positive regarding the vocational benefits of their sons' participation in the notebook programme. Figure 5.6 shows that 35% of the higher ability parent sample indicated that they considered the vocational benefit to be 'high', compared with only 17% of the mixed ability sample. Whether this difference is a reflection of the parents' own exposure and appreciation of ICT is considered later in this section.

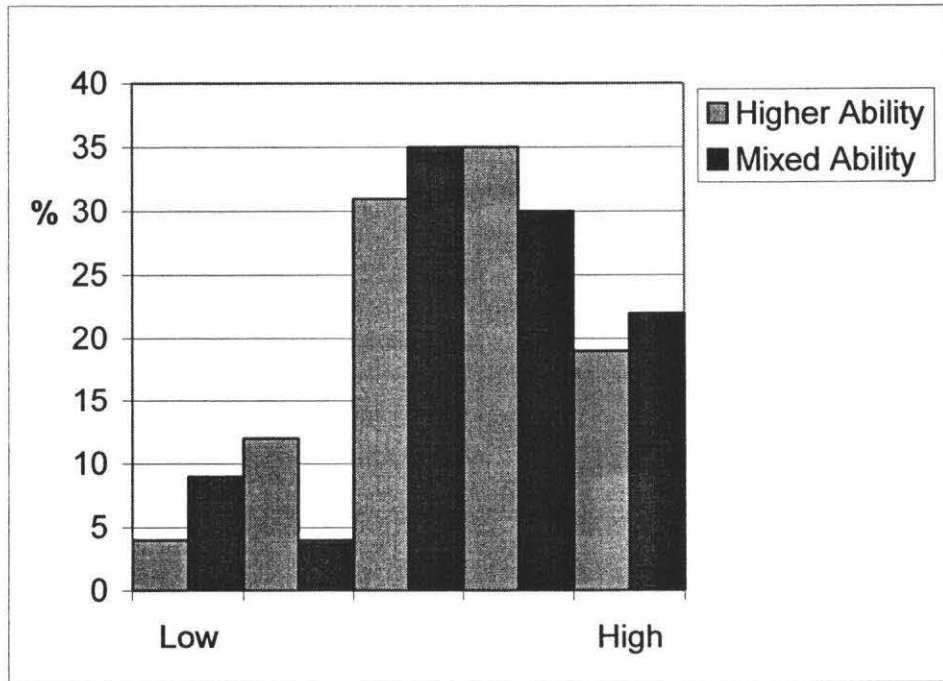


Figure 5-7 Parent perceptions of the educational benefit of student notebook use

There was little difference expressed by parents of the two student ability groups in terms of the educational benefits of student participation in the notebook programme. As Figure 5.7 indicates, a similar distribution of views were expressed by both groups of parents.

Figures 5.8 and 5.9 present the findings in relation to the parents' perceptions as to the effect of notebook usage has had on the quality of their child's school work.

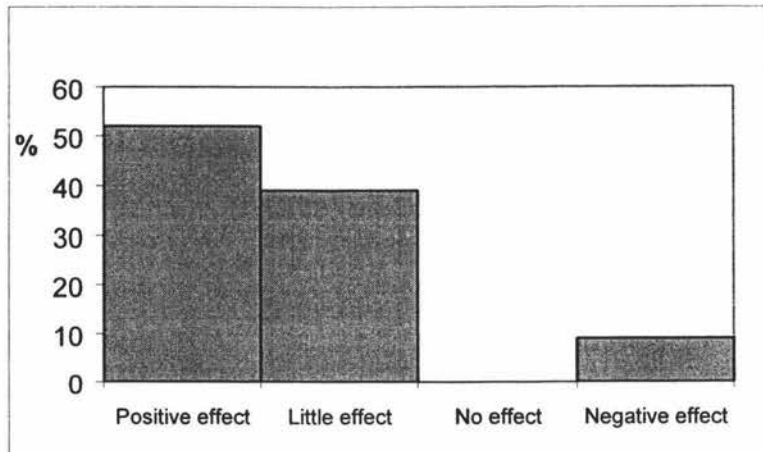


Figure 5-8 Parents of mixed ability students views on the effect notebook usage had on the quality of student school work

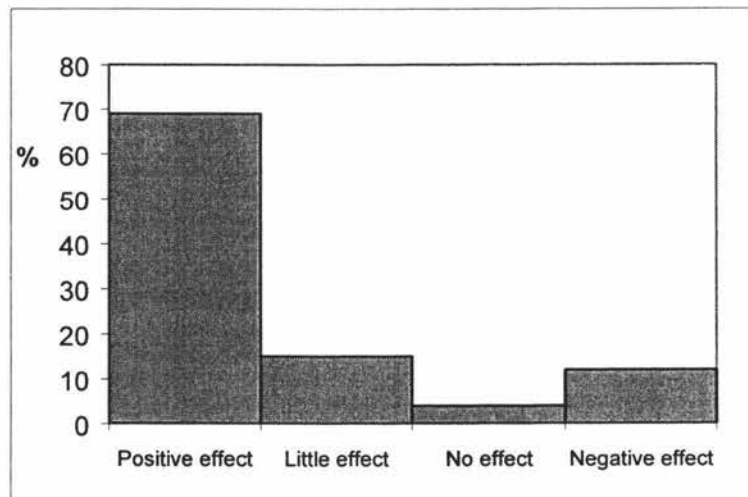


Figure 5-9 Parents of higher ability students views on the effect notebook usage had on the quality of student school work

The data in Figures 5.8 and 5.9 indicate that over two thirds (69%) of the parents of higher ability students expressed the view that notebook usage had a positive influence on the quality of their sons' school work. In contrast, just over half (52%) of the mixed ability sample expressed a similar positive response. The data suggests that in the opinion of the parents of mixed ability students nearly half felt that notebook usage had little or a negative effect on the work produced by their sons. This is an issue that

should be addressed and the findings of this study may be useful in establishing reasons for these perceptions.

Parents preferred level of student notebook usage in the classroom

The preferred frequency of classroom notebook usage by students are illustrated in Table 5.6 for the two parental groups. The data revealed very little difference in the views expressed by the parents, regardless of their child’s class ability group.

Table 5-6 Parents preferred level of notebook usage in the classroom

Parents preferred frequency of notebook usage in the classroom environment (% of parent sample in each category)	Percentage of higher ability parents (n =26)	Percentage of mixed ability parents (n =23)
Regular usage	65	65
Occasional usage	26	23
Rare or infrequent usage	4	4
No usage at all	0	4
Question not answered	4	0

Parental attitudes towards the College notebook programme

Analysis of the parent data collected with respect to the two sub samples, as determined by the student class allocation/ability range, support the following generalisations:

- Families of mixed ability students are generally more enthusiastic regarding student notebook usage. They also are more likely to view the notebook programme as being effective.
- Families of higher ability students are more supportive of the College notebook programme.
- A clear majority of all families expressed the view that usage of notebook technology has been beneficial for student learning.
- Families of mixed ability students expressed a more diverse range of views regarding their perceptions of their sons’ level of enthusiasm for using notebook

technology. Just over 50% expressed a positive level of enthusiasm by their sons for the student notebook programme, as compared with the 69% recorded for parents of higher ability group students.

In terms of the value and effectiveness of the College notebook programme, these findings may be influenced by the expectations of parents and the level of their own computer knowledge and understanding, this aspect however was not considered in detail during this study. It has been suggested, by the Director of Information Technology at the College that ICT literate parents have higher expectations based on their own experiences of ICT in the work place or home. Thus they may give lower overall ratings of the College notebook programme in relation to its effectiveness and value in their questionnaire responses. However, without published research to support this view, it may not reflect accurately the reasons behind the differences in the views held by these stakeholders.

Parents ICT knowledge and understanding

As shown in Figure 5.10 and 5.11, the data suggests that, while there was a similar pattern of the self assessment data expressed by parents of both student ability groups, more of the families of mixed ability students recorded that they had a ‘good’ level of knowledge and understanding of ICT (35% compared with 19% for the parents of higher ability students). Yet none of the mixed ability group parents expressed the opinion that they had an ‘excellent’ level of ICT knowledge and understanding.

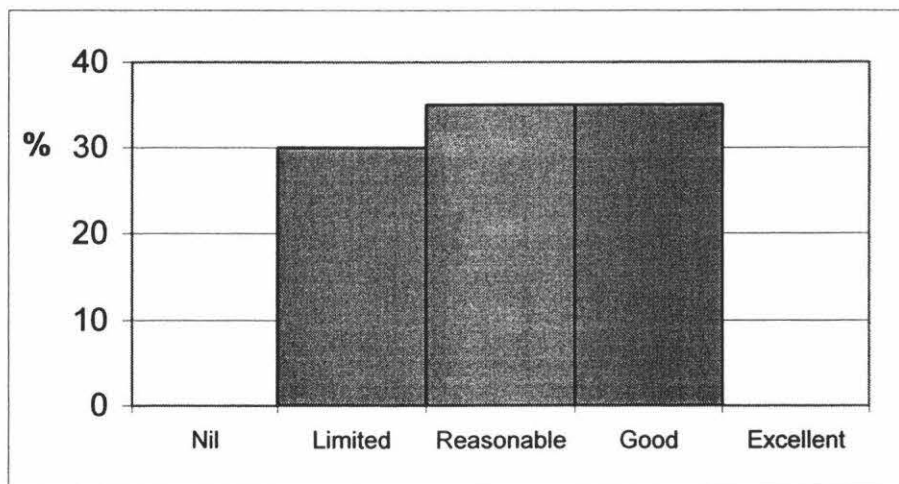


Figure 5-10 Parents of mixed ability students ICT knowledge and understanding

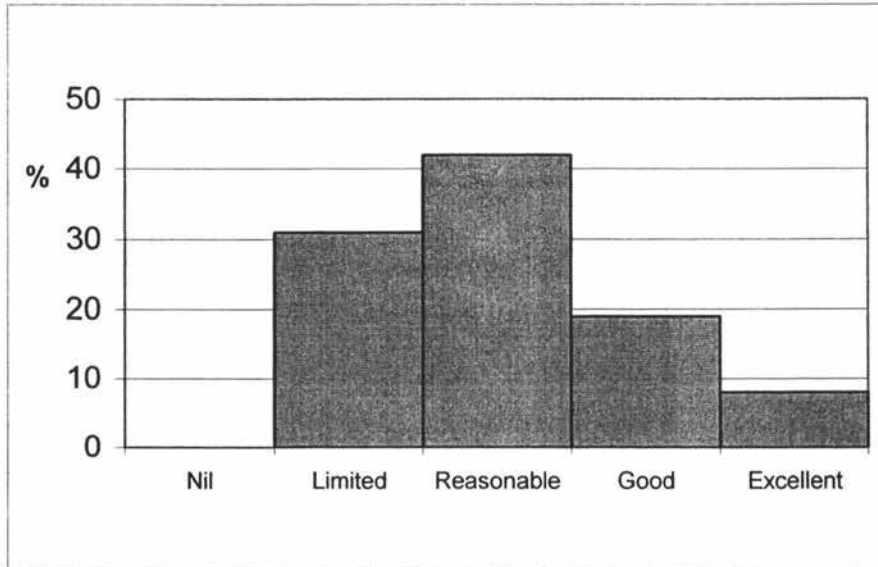


Figure 5-11 Parents of higher ability students ICT knowledge and understanding

There appears to be little difference in the self reported levels of ICT competency of the parents, based on their child's class ability group. Thus in relation to the parents responses to the vocational benefits of notebook usage (see Figure 5.6), the differences in data would not appear to be attributable to any differences in the ICT knowledge and understanding of the parents in either subgroup. While acknowledging this self assessment of ICT competency is unlikely to provide an accurate measure of the parents 'real' level of ICT knowledge and understanding, it is suggested that the parent stakeholders, regardless of their child's class placement, have similar levels of ICT competency.

Summary

This chapter has considered the interpretations of the findings of the research and examined these in depth with reference to the relevant ICT literature. For each of the three key stakeholder groups a synthesis of the interpretations of the findings of the study are presented below.

Staff

The key findings to emerge from the staff research include:

- The SKC staff were regular and confident users of common software packages.
- The student use of notebook computers has had a minor but identifiable impact of class management and teaching style. Further professional development will be necessary to ensure the innovation is ‘embedded’ within the learning culture at the College.
- The notebook programme has had a positive affect on student motivation, yet this was not universal, nor could it be justification alone for the notebook programme.
- In keeping with other studies (e.g. Johnson, 1996) the student notebook programme is perceived by staff to have had greater positive impact in classes of higher ability students.
- There were some concerns expressed by staff in relation to student notebook work, ‘cut and paste’ editing, and handwriting and spelling issues. Also identified by teachers were a number of technical concerns related to notebook failure, the ‘down time’ factor, and the pace of work achieved during lessons involving high notebook usage.
- It was noted that in general the data from SKC staff appears to be in keeping with staff findings of previous notebook related research.

Students

The key findings to emerge from the student research include:

- The level of classroom notebook usage was greater than in many previous studies, with around 50% of lesson time involved notebook usage in some form or another.
- The students reported that they were confident users of common software packages e.g. word processing, spreadsheets and presentation programs. The level of student expertise was similar to that recorded in a similar scale notebook study in the United States (Hill et al., 2000), with SKC students reporting a higher standard of expertise with presentation software than the American students.
- In general students expressed that notebook use had a positive motivational influence on their work, however, some students were less enthusiastic than others. Students did not perceive that notebook use had any impact on their academic performance. The physical weight of the notebook and bag was a major concern identified by students.
- In keeping with other studies both within New Zealand and abroad, it was clear that the notebook programme had improved students' ICT skills and understanding. It also improved the physical presentation of student work.
- Higher ability students expressed the opinion that participating in the notebook programme had changed the way they learnt, while in general it appears to have had little influence on the learning style of students of mixed ability classes.
- Higher ability students considered participation in the notebook programme to be of greater value than students of mixed ability classes. Mixed ability students did not in general endorse the programme, in contrast to the majority of higher ability students who expressed more positive support for the notebook programme.
- For a number of students notebook usage appeared to be a barrier to learning, and these concerns related largely to software and hardware difficulties experienced by students. However, many students expressed the preference for regular classroom usage of notebook technology.
- It was noted that the SKC student data in general appeared to be in keeping with student responses in previous research, and in particular to the findings of

notebook programme studies of a similar nature and methodology in the United States and Australia.

Parents

The key findings to emerge from the parents research include:

- The parents, regardless of the ability of their son, perceived that there were recognisable vocational benefits associated with the student notebook programme, and possible potential educational benefits, though these were not as identifiable.
- There were concerns regarding the impact of regular notebook usage on student handwriting and spelling skills, while most indicated that the presentation of student work was superior using the technology available.
- The parents on the whole reported that they themselves had a ‘reasonable’ to ‘good’ level of ICT related knowledge and understanding.

With these points in mind, the next chapter sets out to consider the findings and interpretations of this study in the broader context of general ICT research literature. In addition, it presents an overview of notebook use in the light of current educational change theory and concludes with a detailed reflective consideration of the limitations of the SKC study.

Chapter 6

Discussion

Introduction

This chapter considers the SKC research in the context of the wider ICT literature and addresses a number of broader issues using the College study as a frame of reference. It will address a number of ICT related themes, namely: (a) the role of ICT in education, (b) notebooks or desktops approaches, (c) the role of leadership in successful innovations, (d) teacher related issues, (e) school structural concerns, (e) the impact of notebook technology on pedagogy, and (f) a review the SKC notebook programme in the light of educational change literature.

Based on the findings of the study a number of possibilities for future research are suggested, in a comprehensive list of recommendations. Finally the chapter concludes with an evaluation of the SKC study, including a critique of the limitations of the research.

Emerging issues

The following section addresses a range of issues related to the use of ICT within the classroom and considers factors that may impact on the success of a notebook programme.

The place of ICT in education

The changes in ICT during the past several decades have been extraordinary in both their magnitude and rapidity (Schofield, 1995). Yet there is a degree of controversy as many authors question the intense and wide spread use of computer technology in education (e.g. Armstrong and Casement, 2000; Kirkpatrick and Cuban, 1998; Lightfoot, 2001; Oppenheimer, 1997; Stoll, 1995). These authors consider it an unjustifiable expense given the limited finances available to most educational

institutions. In addition, they question the rationale, validity and the necessity to adopt a technology-enhanced educational system. There are also concerns related to the sociological implications for society that a computer based education system may have in the longer term. Similar concerns have been recently expressed in the New Zealand popular press (Stirling, 2001). Pepi and Scheurman (1996) use the story of the Emperor's New Clothes to caution educators about their attraction and fascination with new technologies. They question whether the use of technology has had any tangible benefits for student learning. Clearly more research will continue to be necessary to establish where, when, who, with and how ICT will enhance the learning experiences of students?

Blackburn (1999) suggests a difference in emphasis used in the arguments presented by each group. Those supportive of ICT believe that the advantages of ICT are mainly practical and benefit students' during their learning experiences. Those of a more conservative persuasion, and also social reconstructivists, are generally concerned with the more broad sociological consequences of ICT usage in education.

There is a recognised need to develop ICT enhanced learning environments in which students may be challenged more in keeping with Bloom's Taxonomy (Bloom, 1956). Students need to develop the ability to use higher levels of thinking skills, such as problem-solving skills and critical thinking. In this approach technology should be developed to engage students in activities that will involve analysis, synthesis and evaluation, rather than, or in addition to, the use of ICT as a 'drill and practice' tool (Morgan, 1996). It is not the technology in and of itself that is likely to influence student outcomes, rather it is the way in which the technology is used within the classroom (Herman, 1994).

The fact that schools may have available modern computer technology does not necessarily result in innovative teaching and learning within the classroom. As Gawith (1998 : 5) states 'there is the myth that better technology equals better teaching and learning'. Similarly Ryba and Brown (1992) commented, 'advanced technology just does not equal advanced teaching and learning opportunities' (4). The findings of this study show that these factors are not mutually exclusive. It has been apparent in this investigation and can be stated with some degree of confidence that the innovative use

of notebook technology has resulted in examples of enhanced teaching and learning opportunities within the classrooms at SKC. Detailing specific examples of these innovations however fall outside of the research objectives of this thesis.

The focus of any ICT developments must be educationally led rather than technology driven. As has been stated, 'Do not ask what computers can do to students, but rather what students can do with computers' (Ryba and Anderson, 1990 : 9). As Papert (1993 : 168) remarks, 'they (the computers) should serve children as instruments to work with and to think with, as the means to carry out projects, the source of concepts to think new ideas'. This view needs to give due recognition to the fact that 'the computer may at times be a solution to an information and communication problem, but it is not always the best solution' (Brown, 1997b : 256). Technology must remain the servant rather than the master to teachers' classroom praxis. Currently at SKC, on the basis of the findings of this study, it was perceived that a number of staff, view the notebook programme as driving curriculum development, rather than supporting it. However, there must be a balance, for to effectively enhance the learning environment, will require staff focus and energy. This may understandably be viewed by some as placing ICT in the 'master' rather than the 'servant' role.

Despite advances in computer technology, of which student notebook computers have been one such area of development, the question remains, under what conditions will they improve and enhance student learning? If, as the results of this study suggest, there are a range of qualitative benefits of a technology enriched classroom environment, then a future possible path for ICT programmes within secondary schools is a little clearer. The technology does not need to justify its usage in terms of comparison with other more traditional forms of learning and pedagogical approaches, often characterised by 'pen and paper' learning, rather it does need to justify its inclusion in the diverse armoury of teachers simply on whether it is used to good effect and for appropriate curriculum related learning (Ham, 2001). It will have been successfully integrated when both students and teachers reach the stage that notebooks are unnoticed within the classroom. That is, they become 'invisible' and the focus is on learning. Others have reasoned that to be truly integrated notebooks need to move from being a 'product' technology to an 'idea' technology (Hooper and Rieber, 1995). At this point, the notion of invisible integration remains a potential goal for SKC.

It has been suggested that at present 'we are for the most part still in the early, experimental stages of integrating technology into the curriculum' (The Node Learning Technologies Network, 1999 : 17). This observation would appear to mirror accurately the present situation at SKC. The lesson is that future innovation must be granted sufficient time to become established, before reasonably expecting major benefits. Evaluation at this point may also be more able to define the progress that is made due to the technology.

The inclusion of ICT within the curriculum must be authentic and relevant. The use of notebook technology needs to be pedagogically sound and meaningful. If the classroom usage of notebook is sterile, artificial and not woven into the curriculum then questions need to be asked about the validity of any technology enriched notebook programme. As the staff comments and views recorded in this study recognise, this is not a simple task as there are a 'multiplicity of factors that are inherent in the integration of computers into instructional process' (O'Donnell, 1996 : 88). Schofield (1995) highlights this fact, stating 'a particular combination of hardware and software may be utilised in very different ways in different contexts with very different results' (5).

It is important to highlight that the technology itself can never be more than one rather small part of the whole story, and ultimately teaching is what teachers do. The role of technology should be to facilitate the teaching process and not supplant it (Fisher, Dwyer and Yocam, 1996). The goals of any notebook programme must be clearly articulated and continually revisited. It can become all too easy to focus on the technology and lose sight of the main objective which is to empower students with ubiquitous computing tools to enhance their learning within an educational setting.

Notebooks or desktops?

Equally others have been for some time convinced that the appropriate use of technology is essential for learning as we move into the Knowledge Age and the new millennium (Papert, 1980 and 1993). Some authors go as far as to state that notebook computers are the future of education. As one strong advocate remarked, 'laptop schools are clearly on the right-side of history... laptops afford children with the unprecedented freedom to learn in and out of the classroom' (Stager, 2001 : 2). Kontos (2002) views

student notebook programmes as a viable solution to some of the problems inherent with student inequity, whereby all students are provided with notebook computers, rather than only those who can afford purchasing and accessing the latest technology, commonly in the form of desktop computers, for home use.

Windschitl and Sahl (2002) state that notebook programmes are one of the fastest spreading phenomena in American schooling with over a thousand schools having some form of portable computer programme. It is suggested, that in time the universal use of portable computers by students in schools is inevitable. Windschitl and Sahl (2002) believe that portable computers are:

Orders of magnitude beyond the computers used in previous studies of technology-rich schools (considering factors such as processing speed, graphics display, video/audio capabilities, network connectively) (170).

When considering the use of portable notebook technology within the classroom there has been limited research into the advantages and disadvantages of notebooks *relative* to desk-top alternatives. Becker (2001; cited in Newhouse, 2001) discussed the potential negative and positive impacts of student portable computer use from a financial perspective and concluded that the expenses were comparable. Indeed few of the benefits claimed for portable computers are unique to the use of this type of technological hardware. Indeed it has been suggested the advantages associated with 'portability' are a myth in the context of the every day classroom reality (Albion, 1999). This thesis has not addressed these issues as they are beyond the scope of the study research objectives. Also given the context of the College environment and the absence of classroom desk-top computers no valid comparison would be possible.

Role of leadership

The approach that is adopted by the leadership within each educational institution will determine the focus and ultimately to a degree the success of any ICT innovation (Woodrow, 1991). Any innovative programme which involves a change in the culture of the school will require skilled change agents. These change agents may be in a range

of positions within the structures of the institution. Clearly, as research has shown, the Principal strongly influences the likelihood of change and the successful implementation of any major innovation within a school (Fullan, 2001b).

The Principal is the person most likely to be able to shape the organisational conditions necessary for success. The transformation of the culture of a school by the Principal is his or her ultimate goal (Fullan, 2001b). At SKC the Headmaster has the full support of the Trust Board and the Senior Management Team, together with a highly skilled and motivated Director of Information Technology. Collectively they have been able to introduce and implement the notebook programme within the College. The continuation of this ICT-based innovation depends on the successful institutionalisation of the notebook programme within the College culture and classroom praxis.

At the departmental level, the integration and use of notebook technology is influenced and directed by the leadership of the Head of Department. The observation in this study that certain departments were perceived to have made better use of and had a higher frequency of student usage (see Chapter 4) is in part related to the motivational and self-actualized leadership of staff within these departments. The author believes that the sense of collegiality and willingness to share ideas and experiences has been one of the strengths of the notebook programme at a departmental level at SKC. This needs to be acknowledged, and support and opportunities provided to further the effective integration of notebook technology within the curriculum.

Staff professional development

If the SKC programme is to advance, one important focus is the requirement for staff professional development in relation to the ICT programme. It is evident that the education of the educators, that is the classroom teachers, must be one of the primary initiatives to ensure the successful integration of any ICT innovation (Kessell, 2001). This is well expressed by researchers participating in the ACOT research programme. After a decade of research focused on the use of personal computers as a learning tool within the classroom, the findings recognise the importance of professional development for participating teachers stating that, 'the major challenge to supporting

school learning with technology lay not with technology but in the professional development of educators' (Fisher, Dwyer and Yocam, 1996 : 7).

Stager (1995) commends the importance of both on-site and off-site professional development opportunities. The advantage of ICT up-skilling staff of on-site is that teachers can utilise the ICT resources normally available within the school and application of these within the classroom curriculum is a natural imperative. Off-site professional development, such as attending courses on generic or subject specific ICT software applications or conference presentations, have the advantage of removing staff from the immediate workplace pressures and demands and permitting them to focus on their personal professional development. Godfrey (2001a) from a pro-constructivist viewpoint, suggests that to increase teachers' confidence and enable them to make pedagogical transformations they must have access to adequate professional development and support. This professional development should address both the rationale for integrating computer-based tools into their teaching and provide teachers with opportunities to master new and appropriate ICT skills. This remains an ongoing challenge at SKC, as there are many, at times conflicting, demands on teachers' discretionary time, and this dilemma appear likely to continue and to increase.

Teacher commitment to the notebook innovation

When utilising notebook technology the quality of teaching is one of the many variables which is potentially beyond the control and direct influence of institutional leadership. A good level of commitment from classroom teachers to the notebook programme is essential. Ryba, Anderson and Brown (1992) state that the success of any new educational innovation ultimately depends upon the support and attitudes of the staff involved. The ability of teachers to inspire and motivate student learning using effective classroom management and well developed ICT practices is one of the most significant factors in the successful implementation of notebook enhanced learning (Gardner, Morrison and Jarman, 1993).

This factor together with a strong collegial ethos among teachers are strong indicators of successful implementation of any innovation or reform (Fullan, 1991). Rosenholtz (1989) identified that 'learning-enriched schools' were ones in which there was

evidence of shared goals and in which principals and teacher leaders actively fostered collegial involvement.

Mumtaz (2000) recognises that there are many different factors involved in different teachers' journey to successful ICT usage. There is a sense in which there are multiple realities and it may be hard, if not impossible, to definitively state what actions must be accomplished and supported to ensure effective and successful integration of ICT by teachers within their particular learning environment.

Research has noted that the resistance of teachers to technological change or any other type of change for that matter, is often based on perceived difficulties in changing habits, resulting in fears and a sense of futility in attempting to adopt yet another innovation into their teaching repertoire (Waldrop and Adams, 1988; cited in Adams, Adams, Cheng and Sutherland, 1992). Robertson, Calder, Fung, Jones, O'Shea and Lambrechts (1996) argue that teachers' resistance to computer use could be divided into several broad-based themes:

- Resistance to organisational change
- Resistance to outside intervention
- Time management problems
- Lack of support from the administration
- Teachers' perceptions
- Personal and psychological factors

As a participant in the SKC notebook initiative, it appears that there has been little resistance as a consequence of 'outside intervention', as the notebook programme is a school-based initiative. There has also been good support from the College administration, both in terms of on site ICT training opportunities for teachers and technical backup for staff. However it would be fair to say that the other themes identified by Robertson et al., (1996) may well have had been the root cause of some resistance from particular members of staff. As Johnston (1998 : 17) succinctly stated 'if teachers do not change there will be no change'.

This view concurs with the findings of other studies, such as the study by Veen (1993; cited in Mumtaz, 2000), which found that teacher factors far outweighed the institutional or school factors in relation to the successful implementation of an ICT innovative programme. Similarly, Owen and Lambert (1998) state that many experts in this field of research strongly believe that the teacher's attitude and skill remain the critical factors in whether placing computers in the classroom makes a qualitative difference in the learning environment.

At SKC the findings show that there is a reasonable level of staff commitment to the notebook programme and the impact of teachers who may be resistant to the innovation of notebook technology is limited. In time, they are likely to be forced either by curriculum demands and/or student expectations to transform their classroom teaching to adopt notebook technology or risk being left behind as 'notebook luddites'.

'Private practice' teachers

The identification of staff that would be described as displaying 'private teacher practice' (Riel and Becker, 2000), where teachers are socially and intellectually isolated from their peers, was not investigated as part of this study. However, it is clear that teacher isolation may have an impact on the successful implementation of the notebook programme at the College. The conditions of professional isolation and minimal preparation time during the school day is stated by Windschitl and Sahl to 'virtually assure that teachers will not make fundamental advances in their instruction or experiment with technology' (2002 : 203). Riel and Becker (2000) found that only 4% of the 1800 private practice teachers in their study were highly active computer users and that private practice teachers tended to engage in teacher-centred instruction (Riel and Becker, 2000 ; cited in Windschitl and Sahl, 2002).

Teacher isolation will be a barrier to the effective implementation and functioning of any ICT programme. By its very nature the notebook can facilitate work place isolation as teachers can choose to do their work and exploration of the technology at home or in any other location. Schools where collaborative behaviour is the norm are more likely to result in learning-enriched learning environments (Rosenholtz, 1989). The collegiality of staff at SKC has had a positive impact on the sharing of ICT skills and resources

between teachers. However there is a need to institutionalise this behaviour and the provision of non-contact time for intra departmental staff discourse, together with the use of professional development opportunities should be considered essential and beneficial.

Staff ownership of the notebook programme

It is questionable, whether at the planning and initial implementation stage (circa 1997 – 1998) all teachers participated adequately in the innovation process. Consistent with the change and reform literature (Berman and McLaughlin, 1977; cited in Herman, 1994) teacher empowerment and ownership are critical to the innovation process and that ‘change works best when teachers are involved in making decisions and in transmitting new ideas to other teachers’ (Herman, 1994 : 139). Fullan (2001a) states that one of the most fundamental problems in educational change is that participants often lack a clear and coherent sense of the reasons for and/or ownership of innovative programmes within an institution. In the context of SKC only a small portion of the total staff were initially involved in the establishment of the notebook programme. Indeed this study was on the first complete year group of students to use notebook computers and there were a number of teachers participating in the notebook programme for the first time in 2000. It would be useful to give staff the time for reflection and further input on the notebook programme, and hence create a greater sense of collective ownership and responsibility for the programme within the College teaching community.

Timetabling, homeroom setting and the primary versus secondary learning environments

Observations of classroom activities utilising a constructivist approach have found that in general fewer topics are covered than is the case within the typical traditional curriculum approach, however these topics are often explored in greater depth. In addition it is important to note that the restrictions of rigid curriculum timetabling at the secondary level may work against the effective use of ICT within the classroom. The large degree of integration of the curriculum and the homeroom setting commonly found in primary schools is a good context in which notebook use can be implemented (Owen and Lambert, 1998). Newhouse (2001c) concluded in a case study of wireless

notebook use within a primary school that a more relaxed and flexible timetabled learning environment together with a commitment to student-centred (constructivist) pedagogy was a key to unlocking the 'powerful potential of computer support for learning' (13).

The successful integration of ICT within a secondary school learning environment constitutes a greater challenge and is one that SKC is in the process of addressing. There are, nevertheless, some salient lessons from the experiences in primary schools and it is evident that many younger students have benefited from a less compartmentalised curriculum structure (Nolan and Brown, 2001). This will be an ongoing issue for the management of SKC to consider in the years ahead.

'New wine in old wine skins'

The section considers the impact of notebook technology on pedagogy. One of the concerns regarding the introduction of notebook enhanced learning environment within the classroom, is that it may become a case of 'new wines in old wine skins'. The simple replacement of exercise books and pens with notebook computers may not be effective. If the traditional methods of didactic teaching and the passive learning style which students so willingly adopt are not challenged, then no matter how powerful the notebook processor, nor how rapid an Internet connection can be made, the learning processes will not change. Indeed it is quite possible that the standards of achievement may even decline.

To be effective and hence beneficial a new classroom learning environment needs to be developed. It must be one that while being consistent with the traditional curriculum requirements for students has a new focus. The teacher is no longer the sole expert and instructor, rather he or she guides, plans, models, manages, facilitates and participates within the context of the learning environment (Rowe, 1993; Ryba and Anderson, 1990). The integration of ubiquitous computing may inevitably be a key catalyst in the move from teacher centred to student-centred classroom learning environments. However as Salomon remarked, the computer 'is a crucial trigger for change, but it cannot be a very effective trigger if nothing else is triggered by it' (1990b : 51). There is a range of factors which are intrinsically linked to the move to new student learning

environments and computers are just one, all be it a significant factor in the complete evolutionary process.

However the question remains to be answered in the years ahead at SKC. Can the 'new wine' of the notebook enhanced learning programme, which may well require fermentation within a constructivist learning environment, successfully produce a new vintage at the College? Or are we trying still to pour 'new wine' into the old wine skins? Is using notebook technology as a 'tool' simply supporting the existing mode of teaching and learning rather than challenging it. Cuban, Kirkpatrick and Peck (2001) expressed a similar view, suggesting that when teachers adopt technological innovations, these changes maintain rather than alter existing classroom practice.

Gillian Eadie, Principal of Samuel Marsden Collegiate School, after a study of the impact of ICT on a number of schools in Australia, United States, England and Hong Kong concluded that 'once ICT becomes an integral part of student learning, teaching styles and classroom organisation cannot remain unchanged' (Eadie, 2001 : 39). Whether the change will be for the better, is a question that will only be answered in the years to come.

The necessity for the implementation of any notebook programme to be accompanied with a rethinking of teaching approaches has also been argued by others who have specifically conducted research in this specialist field. Newhouse (1999 : 11) believes that 'there is little value in investing in computer hardware and software without encouraging teachers to reflect on their beliefs about learning and consider the role of computers in their teaching'. Newhouse suggests that successful student centred learning environments were predominantly achieved by teachers with constructivist leanings. Stager another who espouses constructivist views as the basis for successful use of notebook technology within the classroom, claims that:

Laptops provide schools with not only a window on the future, but also a microscope on the past... This provides a rare opportunity to make schools better places to learn, for teachers as well as students (Stager, 1999 : 5).

At the Athens Academy, a secondary school in Georgia, USA, the researchers stated after two years of a five year study into notebook usage that:

The integration of ubiquitous computing is predicted to shift classroom from teacher-centred to student-centred; we are already seeing indications of this happening in the middle school (Hill et al., 2001 : 38).

If the views expressed previously are correct then, as many have suggested, a significant pedagogical shift may be necessary to successfully integrate notebook technology within the classroom of the new millennium, and thus move on from the broadcast learning model to an interactive learning model (e.g. Graham and Martin, 1998; Loader, 1993; Peck and Dorricott, 1994; Reeves, 1992; Schank and Cleary, 1995). Indeed this vision for radical change in the future of education has been highlighted repeatedly over the past decade; for example, Knupfer (1993) remarked:

Today's teachers face a much larger challenge than simply implementing another teaching machine into the traditional classroom. With this challenge comes the opportunity to restructure education as we know it in the traditional sense (178).

There is however a paradox, in the sense that, one could question whether the implementation of a technology enriched learning environment will result in a shift in the pedagogy of the classroom towards a more constructivist environment, or whether the pro constructivist approaches must precede the successful integration of notebook technology within the classroom learning environment.

Whether this shift in learning theory can or should be achieved at the secondary educational level in New Zealand is questionable given the constraints and demands of the national curriculum and the implementation of the National Certificate of Educational Achievement (NCEA) as the national assessment system. Parr (1994) observed that institutional factors such as common and regular testing would make it difficult to concentrate on learning at the expense of the acquisition of curriculum content in preparation for summative assessment. Other studies have reported on the

potentially paralysing influence of external examinations on the use of ICT in the classroom (e.g. Collis, 1989; Mandinach and Cline, 1994; McIntosh, 1995; cited in Newhouse and Rennie, 2001). Schofield (1995) relates the experiences of a Californian school, where after an intensive period of ICT enrichment within the classroom and related innovative teaching practices by staff, the results of standardised national tests failed to show any improvement. Thus after only one year of the programme disillusionment set in and the Californian programme was abandoned over the course of the following year. These studies indicate that any notebook innovation must be located within a much wider and supportive social practice, both within the school and nationally.

A two year ethnographical study by Windschitl and Sahl (2002) of three teachers working in a notebook programme in a middle school, found three important factors which impacted on staff adoption and use of notebook technology within their classroom curriculum and learning activities. They concluded that:

The influence of ubiquitous technology on instructional decisions was mediated in substantial ways by teachers' interrelated belief systems about learners in that particular school, about what constituted 'good teaching' in the context of the institutional culture and about the role of technology itself in the lives of students (Windschitl and Sahl, 2002 : 195).

In addition, Windschitl and Sahl (2002) concluded that notebook technology was in terms of pedagogy, an 'agent of change' only in classrooms where teachers had a pre-existing desire for change or a dissatisfaction with current teaching practice. They state that the availability of technology enriched classroom was 'neither a necessary nor a sufficient condition to affect pedagogy' (2002 : 201). Although there was limited evidence of a shift in classroom management and learning environment recorded in staff survey undertaken during this study, the author agrees with the views expressed by Windschitl and Sahl. Further research would be necessary to confirm this assertion, however as an 'insider' the researcher believes that the impact of SKC notebook programme on staff pedagogy has been limited.

Perhaps the greater barrier to any radical pedagogical change will be passive resistance of teachers, students and probably the wider parent community. Their personal experience and expectations of traditional education may see them opposed or at the least uncertain about any change in the classroom learning theory and practice. As suggested by Hannafin and Saveyne (1993), although 'teachers may be receptive to technology, they may be resistive to the accompanying change in learning theory' (cited in Newhouse and Rennie, 2001: 241). Olson (1981) found that teachers act to protect their influence over core elements of their work, such as presenting the curriculum fully and maintaining their credibility. As Mumtaz (2000) points out 'these protective strategies for maintaining classroom influence may erode the potential of computer-based teaching' (329). Any radical change in classroom practice will have to be achieved in a gradual and embracing evolutionary manner rather than as a rapid shift or transformation of the learning environment to a pedagogy beyond the comfort zone of teachers, students and parents alike. Hence, this shows that an innovative development, such as the SKC notebook programme, is inherently political in nature, as it must challenge the cultural norms within the educational institution.

Performance assessment

The assessment of students, and the measurement and accountability of teacher performance may be a serious barrier and hence perhaps the greatest challenge to the transformation of education to a new ICT inclusive pedagogy. If new skills and collaborative work are to be recognised, new methods will need to be devised to report student (and teacher) success (Dwyer, 1994). Brewster Academy in the United States has undertaken a radical reformation of its teacher performance evaluation, designing a multi-method system, which involves students, teachers and administrators (Kavanaugh-Brown, 2000). Such a shift in the mode of assessing performance has major implications across a wide range of professional areas and would be unlikely to receive a favourable hearing with the current NCEA focused secondary educational environment in New Zealand.

A contrary view questions whether a pro-constructivist approach to teaching with technology is warranted or indeed wise. Professor Walker, Stanford University, made the observation that the ACOT programme, which had initially focused on teacher-centred ICT innovations had over the course of a few years moved to espouse

constructivist pedagogy. Walker (1996) believed that ACOT leadership should have maintained their commitment to teacher directed classroom focused innovations and strategies which would have had a greater long term benefit for student learning.

The findings of this study reflect the view that the College is attempting to integrate the use of notebook technology within a traditional instructional learning environment. Early evidence from the larger AAL studies recognise this is a functional approach, resulting in the successful integration of notebook technology within the classroom environment and suggested that, 'rather than shifting the focus away from traditional academics, laptop use appears to enhance more traditional academic subjects and activities for students' (Rockman et al., 1998 : 59). It is not the conventional nature of the subjects that determines the successful use of portable computers by students rather it is the learning environment in which the technology is utilised.

Given the relatively short period of four years since the phased introduction of this ICT innovation at the College, perhaps it is not surprising that this is the case. Staff and student thinking and learning styles tend to change slowly, with a degree of resistance to any radical shifts in classroom practice. Indeed it has been suggested 'it seems that when a new technology becomes available, the most natural thing to do first is to apply old techniques and methods to it' (Rieber and Welliver, 1989 : 27). While Fullan (2001a) identifies that 'effective change takes time... bringing about institutional reforms can take 5 to 10 years' (109).

As Cuban (1993) suggests, schools do not feel a need for change and in the most part are firmly grounded in cultural beliefs about student-teacher and not student-machine relationships. Whether this assessment of schooling nearly a decade ago holds true for SKC in the new millennium is debatable. Mumtaz (2000) when reviewing more recent ICT studies concluded that when given the right conditions some schools have successfully integrated ICT into the classroom (e.g. ACOT programmes in 1990s). The researcher believes that a similar positive supportive environment exists at SKC and in time more effective use and greater integration of ICT within the classroom curriculum is likely to occur.

Thus it is apparent that there is the risk of pouring 'new wine into old wineskins' and the College will need to consider the centrality of ICT within the culture of the school and in particular the pedagogical approaches espoused by the staff in relation to the College notebook programme. What has become increasingly clear is that it is important to change educational practice rather than simply accepting the notebook computer as just another new classroom tool. Mumtaz (2000) highlights the important role of teacher pedagogy and suggested that teachers' beliefs about teaching and learning with ICT are central to the integration of ICT within education. Adopting and integrating the technology is an evolutionary process. As the AAL study in the United Kingdom noted:

Where subject teachers are focusing merely upon subject content, the uses of laptops are perhaps limited. Often the outcomes are copies of what might be achieved in other ways. Where teachers are viewing laptop use from a learning perspective, as pedagogues and considering the teaching and learning implications then the outcomes appear to be less limited in terms of the types of activity being undertaken (Passey et al., 1999 : 113).

Looking ahead there is a need to create a new school culture where there are effective components of both instructional and constructivist learning styles. To use a metaphor, there needs to be a balanced diet of different learning opportunities within a technology enriched classroom environment (Dwyer, 1996). To adopt a single purest cognitive theory would be to limit the learning opportunities for students and teaching styles for teachers, when a broader approach incorporating aspects of diverse cognitive theories may reap greater rewards for all participants within the learning community. This position has been advocated by authors such as Grabe and Grabe (2000).

This is the espoused ICT goal of the College in which this research study has been completed. The use of notebook computers is to be more than that suggested by the 'tool' metaphor, but rather to be a valued factor contributing to effective student learning via a range of teaching modes. There is a danger in adopting a pure 'tool' mentality to notebook technology, for as in the commercial world of engineering and construction, tools come and tools go, but all builders still need to learn carpentry and similarly this the essential role for educators in an ever changing learning environment.

In addition viewing the use of the notebook simply as ‘tools’ risks relegating computers to the level of ‘supplies’ such as pencils and paper (Morton, 1996).

This approach could be described as ‘the path less trodden’ and only time will show if indeed it has been a better path for the students. The results of this research would indicate that the route SKC has adopted may be in the right direction, but is it the best route? Ultimately the teachers, students and their families will make their own assessment of the long term value of notebook enhanced learning. The ownership and outcomes must rest with the community in question.

The student ownership of a mobile suite of powerful technological tools combined with high-speed access to the Internet with its global repository of information and ideas represents a new enriched learning environment. Making good use of this opportunity is the challenge for the College as it plans for the future.

The challenge of educational change

ICT has been seen as having the potential to be a powerful vehicle for changing education and one that is capable of creating a revolution in teaching and learning (Miller and Olson, 1994). The implementation of the student notebook programme at SKC has had an important role in the change of educational thinking and practice at the College. Under the leadership of the then Headmaster Reverend David Williams, the introduction of the compulsory notebook programme in Year 9 was just one of a number of changes in emphasis and practice at the College.

Fullan (2001a) describes innovation within the classroom as a multidimensional process. Three key components together with their relationship to the notebook innovation at SKC are:

- The use of new materials, in this case computer notebook technology.
- The possibility of new teaching approaches, the ubiquitous classroom usage of ICT.
- The possible alteration of beliefs, perhaps teaching styles more attuned to a constructivist pedagogy.

Importantly change in just one dimension is not likely to be a significant change nor will it have any fundamental impact. As Fullan (2001a) concludes, ‘the change has to occur in practice along the three dimensions in order for it to have a chance of affecting the outcome’(39).

Changes in beliefs and understandings are at the foundation of achieving lasting reform (Fullan 2001a). In the context of this study it has been difficult to establish whether there has been any fundamental changes of classroom pedagogy and praxis. As presented in Chapters Four and Five there has clearly been measurable changes in the classroom activities and attitudes both of staff and students, whether there has been a radical change within the educational culture of the College is questionable. For some the notebook programme has been the springboard to move in new directions while for many notebook technology is merely another tool in the educative armoury of staff and students alike.

The process of change is not instant and ‘teachers do things for good reasons and the process of change is not an overnight affair’ (Miller and Olson, 1994 : 123). While the notebook programme may have been a stimulant for change, an enriched ICT learning environment in itself is not a direct change agent. It has been argued that the development of innovative teaching practices has more to do with the pre-existing pedagogical beliefs of teachers. The routine and prior practices of teachers influence their computer use in powerful ways (Miller and Olson, 1994). The technology in and of itself can accomplish very little in education reform, rather the way in which it is used and the functions it serve, together with the extent to which it is grounded in and advances ‘best practice’ in the classroom setting remain the critical elements (Kulik, 1990; Scott, Cole and Engel, 1992; cited in Herman, 1994).

Godfrey (2001b) argues that ultimately the task of assimilating technological innovations rests with the teachers’ understanding and acceptance of the need to change current pedagogy, coupled with a willingness to forego their power base in the classroom. It is not only the acquisition of ICT skills and understanding, but rather challenging the deeply held beliefs, attitudes, perceptions and experiences with regard to teachers’ pedagogy that will result in successful integration of ICT within the curriculum (Godfrey, 2001a). This challenge may well be beyond the boundaries that

mainstream traditionalist teachers at SKC are willing or indeed able to achieve in bringing about such a radical transformation of the institutional culture of their working environment. This study is only the first step in documenting such a journey and future evaluation will be required if these long term changes occur.

In the light of the simplified change process outlined by Fullan (2001a), it would appear given that the notebook programme at SKC has now been in operation for over five years, it has passed through the initiation and implementation stages and is gradually becoming assimilated within the culture of the College. Change as a consequence of any innovation is in itself a continuous interactive process and it is not a simple or guaranteed process. Fullan (2001a) suggests that any 'larger scale efforts can take 5 to 10 years with sustaining improvements still being problematic' (52). Nor can the full impact of change be predicted at the outset of an initiative such as the student notebook programme. Schofield (1995) rightly points out that:

'...in adopting the technology one is likely to be accepting, or more probably evolving, an entire set of unplanned changes as well as the planned technological ones' (227).

Thus continuation of the notebook programme cannot be assumed. Indeed one of the most powerful factors known to undermine continuation is teacher and administrative staff turnover (Fullan, 2001a). Teacher turnover slows the institutionalisation of technological innovations and tends to contribute to the maintenance of common 'traditional' teaching practices (Cuban, Kirkpatrick and Peck, 2001). Given the level of staff turnover in 2001-2002, this factor may have a significant impact on the longer term continuation of the College notebook programme. However it is fair to say that those in leadership continue to espouse the vision of enhanced teaching and learning using notebook technology. It would be interesting to revisit the SKC notebook programme after a five year period to observe the longer term impact of the compulsory student notebook programme introduced in the year 2000.

Managing change - Successful implementation of innovation

At this point, it is relevant to probe further the implementation of the College notebook programme in the context of current literature on educational change. Fullan (2001a) distinguishes four interactive characteristics related to successful innovative change within an educational institution. These are:

- Need
- Clarity
- Complexity
- Quality.

These issues need to be addressed during both the initiation and implementation stages of any change process. All stakeholders must perceive the **need** for the notebook innovation within the context of secondary education in the 21st century classroom. There must be a **clarity** of the vision and goals of the notebook programme. In short, all participants must know the ‘why’ as well as the ‘what’ and ‘how’. Diffuse goals can result in misguided actions by staff and administrators. Also it may result in ‘false clarity’ in the sense that the objectives and vision on which the innovation is founded are oversimplified by participants and the ‘message becomes lost in the medium’ in this case the innovative use of ICT notebook technology within the classroom to enhance teaching and learning.

The greater the **complexity** and more ambitious the innovation and the degree of impact on the actions and beliefs of participants, the greater the likely effect. However, as Fullan (2001a : 78) points out ‘there is more to gain and correspondingly more to lose’. The implementation of a College wide student notebook programme is a major and far reaching innovation and thus ultimately has a significant impact on all stakeholders.

The **quality** of the implementation of any innovation will affect its success. If there are insufficient resources or a lack of forward planning the implementation of any significant change will be undermined (Fullan 2001a). In the case of the notebook programme at SKC the Trust Board allocated generous funding and resources to support this technological innovation. The knowledge, understanding and practical experience based on limited optional notebook usage within the College in the three years prior to

2000, has in the opinion of the researcher, supported by the evidence of this study, ensured that the implementation of the compulsory student notebook programme at Year 9 was well developed, and supported and this has resulted in a sound level of quality.

Thus in reviewing SKC in the light of these four factors it would appear that the student notebook programme has addressed the third and fourth issues while in the view of the researcher, the first two issues need to be further investigated. It would be interesting to question more fully a range of stakeholders to record their understandings of the aims and objectives of the College notebook programme. The continuation of any significant innovative change will rest in part on ensuring that all stakeholders have a sound understanding of the need for and purpose/vision of the notebook programme.

This is particularly important in the case of new stakeholders, staff, students and parents who join the notebook programme in subsequent years. The College cannot assume that the 'new comers' understand and support the vision for this innovative ICT programme. Thus an ongoing 'preaching and teaching' of the vision, coupled with critical reflection on the part of participants will be essential.

Evaluation of the study

The focus of this research has been a case study of a particular notebook programme at an independent secondary school in New Zealand. The findings and their interpretation reflect this objective. It has been an opportunity to gain a deeper understanding of the College notebook programme and assess this in the context of other portable computer programmes both in New Zealand and internationally.

It did not set out to measure the effect of the notebook programme in terms of student cognitive achievement. Indeed this would be impossible given the scenario of this research in which no comparative control group of non notebook students was available, nor were the resources available within the limited time frame of the study. This research does not attempt to quantify the 'value added' effect, if any, on student academic performances over the course of the year. This is in keeping with the trend in current ICT school based research, that has recognised that a shift in the way computer

based tools are perceived in the classroom has occurred. Greater emphasis is being placed on the quality of learning experiences for students rather than on simply measuring quantifiable outcomes (Godfrey, 2000a).

Morgan (1996), using Bloom's Taxonomy (Bloom, 1956) as a foundation, provided four checkpoints to assist teachers to put theory into practice in terms of the implementation of ICT programmes and their impact on enhancing the cognitive learning of students. The checkpoint questions suggested were:

- How does technology provide students with multiple exposures to variation of concepts?
- How does technology increase student productivity?
- How does technology actively involve students in the learning process?
- How does technology engage students at the higher levels of Bloom's Taxonomy?

(Morgan, 1996 : 51)

It would be worthwhile to discuss these checkpoints with teachers participating in the SKC notebook programme. As the checkpoints were not directly considered in the context of the current research, it would be unwise to interpret the data collected and make meaningful summative responses to these questions. However, there is evidence that the SKC notebook programme has increased student productivity and for some students it had increased their motivation and thus they have become more actively involved in the learning process.

Ham (2001) suggests four indicators for identifying the educational value of ICT usage in the classroom. These factors place an emphasis on the learners and learning experiences of students rather than on the medium and technology employed. These factors are summarised below:

- The extent to which the student ICT activities relates to specific curriculum objectives.
- The levels and types of cognitive processes or creativity associated with particular ICT activities.

- How well the ICT activity is integrated within the learning programme developed by the teacher (or department).
- The nature and effectiveness of collaborative learning if and when the ICT activity is undertaken by groups of students.

(Ham, 2001 : 11)

At the commencement of this study the list of indicators were unavailable. Had the researcher been aware of them, it is likely that additional questions would have been included in the staff research instrument to seek data which may have revealed direct insight related to these specific areas of ICT integration at SKC.

There are issues associated with trying to measure the contribution of ICT to learning, these include questions such as, whether it is valid to compare control and experimental groups when they contain unique groups of students and how can the future potential vocational benefits be reasonably assessed? (Hammond, 1994). How could the input variables (Austin, 1991) be adequately regulated to permit valid quantitative comparison and evaluation of the impact and effects of the student notebook programme with other non-notebook learning environments?

These concerns were clearly beyond the parameters of this single site one cohort case study. However other questions such as those listed below do warrant consideration.

1. Do the views of the participant groups adequately reflect the advantages or disadvantages of the student notebook programme?
2. How is it possible to isolate the impact of the notebook from the numerous other variables interacting within the learning environment?

It is difficult to determine the degree to which the data collected accurately reflects the reality of all the key stakeholders. However the consistency and overlap of the questionnaire responses and the focus group material expressed in all three sample groups, suggest that this study does present a picture that closely resembles the 'realities' of the notebook programme at the College. It is not practical if indeed possible to isolate the effects of the technology alone on the students' learning

experiences as the use of notebook computers is an integral component of the learning environment in which these students and staff operate.

The case study research methodology adopted in this study was a deliberate decision given the unique nature of the learning opportunities afforded by the ubiquitous use of notebook technology by students and staff within the classroom environment. It has explored the ideas and actions of participants in the College notebook programme within a real life context and timeframe (Anderson, 1998). The fact that case study research is not easy to generalise is not a significant issue. In terms of understanding and applying a theory of innovation and change Fullan (2001a) proposes a 25/75 rule, that is, he believes that 25% of the solution is based on having clear directional ideas, while '75% is figuring out how to get there in one local context after another' (2001a : 268). Thus while lessons and insights may be gained as a consequence of this particular study it must be recognised that the successful implementation of any similar ICT innovation will be predominately determined by unique onsite factors.

The research objectives of this SKC notebook study have focused on three of the five specific areas of impact found in a review of previous research into notebook programmes by Boyd (2002). It has considered student motivation and attitudes, staff attitudes, skills and roles. In addition, based on self-assessment by participants, it has recorded the student and staff technology skills. Unlike most other studies the research sought input from parents and caregivers and this has enriched the findings of the research. It provides a formative element in gathering feedback from participants on problems and issues they have encountered and these have been shared with senior management and, in particular, the ICT steering committee at the College.

Morgan (1996) suggests a number of checkpoints that could be used to evaluate the notebook programme. These are in terms of cognitive learning theories and the measurement as to whether the infusion and integration of technology in the curriculum is enhancing student learning within the classroom. These checkpoints could provide the starting point for further investigation of the SKC notebook programme.

Overall, in terms of an evaluation of the study, the findings would indicate moderate support for the conclusion that student usage of notebook computers enhances the

learning experiences, motivation and ICT skills of students. The recording of these observations in a New Zealand based case study fulfils one of the prime aims of this research.

What of the future?

The sustainability of the College notebook programmes will be determined by a number of key factors and the findings of this thesis will be of value to those in positions of responsibility who are called upon to make decisions regarding the use of notebook technology. The significant changes in the Senior Management Team at SKC and, in particular, the appointment of a new Executive Headmaster, will impact on the future of the College notebook programme.

The implementation of the present notebook programme was one of the inspirational visions of the previous Headmaster and whether this will be sustained remains to be seen. The vision for the programme must be communicated effectively, for if it falls on barren soil the momentum for change and innovation may stall. There must be opportunity for feedback from all key stakeholders and collective ownership of the notebook programme is essential. Indifference and perhaps combined with the pressures and demands on staff coping with the challenges of the implementation of NCEA across the senior school may result in a lack of time, energy and motivation to support the programme effectively within the classroom.

Suggestions for future research

The following section outlines a number of areas which are offered as possible avenues for future investigation of the SKC notebook programme.

Best practice

There is a need for further research within ubiquitous notebook classroom environments to establish where possible what is 'best practice', in terms of effective integration of portable technologies into teaching and learning processes. Ideally this should be curriculum related, that is to say, 'best practice' needs to be identified and developed at the departmental level, in conjunction with school wide sharing of common elements of 'best practice' in the area of notebook enriched learning. There is also a need to look at patterns of technology integration across and between subject areas and also compare usage at different year levels.

Has there been a shift in pedagogy?

An avenue for possible investigation would be to examine the classroom learning environment to determine whether the notebook programme has impacted significantly on the pedagogy of teachers. Windschitl and Sahl (2002) adapted from Becker and Ravitz (1999) a list of the elements that characterised a constructivist classroom and used these as an index to describe changes in instruction and technology use in a notebook programme in an American middle school. The five elements identified are:

- Students engaged in collaborative group projects
- Designing activities around teacher and student interests rather than in response to an externally mandated curriculum.
- Focusing instruction on students' understanding of complex ideas rather than on definitions and facts.
- Teaching students to assess their own understanding
- Teacher exhibiting a willingness to be 'co-learners' with students rather than as the 'fount of all knowledge'.

The application of these five characteristics to a study of SKC classrooms would yield useful insight as to the extent of the impact of the notebook programme on staff pedagogy at the College. Such a focus would provide a deeper layer of insight into the notebook innovation within the College environment.

The impact on student enrolments

Anecdotal evidence from overseas portable computer programme within similar educational institutions suggests that in general the introduction of a notebook programme has a minor positive impact on student enrolment and retention levels (The Node Learning Technologies Network, 1999). This aspect of the College notebook programme has not been examined in detail within the context of this study and it may be a valuable area for future research in terms of patterns of student recruitment.

The impact on student achievement

In this study there was no intention to undertake performance measurements as to the impact of the notebook programme on student academic achievement, and this is one aspect of the notebook programme that warrants further investigation. Indeed, Gardner, Morrison, and Jarman (1993) reported that it is difficult to measure curriculum-related learning enhancement, particularly within a one year time frame of an ICT project. Thus, how the specific impact of notebook programme could be successfully measured is a complex question given the multitude of confounding factors that would need to be addressed. Yet this is one area where further research would be beneficial, if achievable. After all, if there is no longer term benefit on student achievement then the value of the notebook innovation may need to be questioned.

Impact of long-term notebook use

The question remains as to whether the perceptions and practices of participants' in the SKC notebook programme have changed or will change as they continue to utilise notebook technology. Longitudinal studies overseas have observed a decline in notebook usage over a longer time span. In Australia, Kessell (2001) reported a large decline in student notebook use as students moved into senior classes; while an American study noted that:

As a general rule, the longer a student was involved with the laptop project, the less the likelihood that the laptop was used for work at school (Stevenson, 1999 : 10).

There may be a number of possible reasons for this trend, for example, students may use their notebook more productively at home in the senior years rather than bring it into the classroom. Stevenson (1999) also noted teachers in their third year of participation in the notebook programme were less likely than first or second year staff to use computers for lesson planning, research or instructional delivery. Again there may be valid reasons for this trend, however these observations raise critical concerns and questions for further research.

Given the investment of time, energy and money by the College, students and families to bring about the infusion of notebook technology within the learning culture of the College, further study and evaluation of the notebook programme at SKC is warranted. Indeed it is imperative that the College intends to carry out further research to assess the longer-term impact of the notebook programme (W. Chieng, personal communication, 11 March, 2002). As one parent suggested, when asked for ideas to improve the programme, there is a need for more parental communication and feedback through surveys (such as the parental questionnaire undertaken as part of this study).

Sharing the vision

There needs to be a clear understanding and promulgation of the vision and objectives of the notebook programme at SKC. If these are not clearly understood and owned by all stakeholders, and based on individual personal experiences there is the risk of misconceptions and these may result in negativity and disillusionment with the College notebook programme.

Bennis and Nanus (1985) make it clear that the formation of a well founded vision is a dynamic interactive process. There needs to be a shared sense of purpose at SKC concerning the use of notebook technology and the process used to guide the implementation of the notebook programme across a complete year group at the

College. Vision building is a constant and evolving process (Fullan, 2001a) and it should not be assumed that once stated it is understood and espoused by all stakeholders. Indeed as advances in technology continue at a pace and during a period of considerable educational change associated with the implementation of NCEA in the New Zealand secondary education system, there is a need to revisit, revise and revitalise the shared vision statement on which the College notebook programme is founded.

A clear understanding of what the various groups of stakeholders see as the goals of the notebook programme would be beneficial. The research undertaken at Norwood School, USA, (Woodbridge, 2000) found that parents were unable to express clearly the approach and goals of the school notebook programme. Parents however, were able to specify the skills they wished their children to possess, but were unable to articulate and identify specific analytical skills. They wanted their children to have software application skills, Internet and research skills and that writing skills (editing, spelling, elaboration of thoughts and organisation/outline) would be supported by computer technology and innovation. Most importantly parents wanted students to feel comfortable with the computer and be efficient in their chosen technological methods. Woodbridge (2000) concludes:

The need to continually clarify and communicate program goals to all stakeholders and align evaluation efforts with program objectives cannot be overstated... Evaluation programs without the support of a program framework can suffer from ineffectual data collection, haphazard implementation strategies, role confusion, ambiguous achievement of results and inadequate sustainability mechanisms (18).

Thus in the context of the SKC notebook programme it would be useful to investigate further the understanding of parents and to ask questions similar to those above of them and other key stakeholder groups. Questions such as the following may be worthy of consideration:

- What do they view as the key objectives and over riding vision of the College notebook programme to be?

- What learning and ICT skills do they view as being important for their child to develop?
- What do they consider to be the short and long-term goals of the notebook programme?

The collection and analysis of data along these lines would enable the College to implement innovative improvements and evidence based refinements founded on a clear understanding of the current perceptions and views of the stakeholders. Articulating the desired outcomes will be one of the next steps towards documenting the effectiveness of technology based reform projects such as the SKC notebook programme (Herman, 1994).

The impact of the SKC wireless network

Given the technological and perceived educational advances that the wireless network installed at SKC in 2001 have made, there is clearly a place for further research into the impact of this development. Newhouse (2001c) recently completed a study on the effects of a similar wireless network within an Australian primary school and to the researcher's knowledge no systematic research has ever been conducted in New Zealand. There is an opportunity, perhaps in the near future, to revisit the SKC notebook programme and research the effect in a holistic sense of the wireless network on the classroom learning environment. The findings of this study would offer a possible baseline for some comparison, of a 'pre and post wireless world', in terms of the student notebook programme at SKC.

Critical reflections – The research limitations

This last section addresses the limitations of the study. It considers the methodology used and recognises possible weaknesses in the light of published research literature related to educational ICT programmes, specifically those focused on the use of portable computers within schools.

Single site

This study had the deliberate intention of focusing on a single year cohort as a ‘bounded system’ (Stake, 1995). Thus any broader generalisations must be seen in the context of this backdrop. While a number of other studies (e.g. Morrison, Gardner, Reilly and McNally, 1993; Passey et al., 2001; Rockman et al., 1998) have made comparisons with control groups of students, staff or parents, this study did not have that opportunity. Like most notebook research studies this thesis has focused solely on those stakeholder groups participating in a specific portable computer programme within a single educational institution. Herman (1994 : 152) suggests that ‘presumed controls are largely illusory’ as there are too many confounding factors within the context of comparative classrooms. It is unlikely that they are identical in every aspect. Despite the weak potential for generalisation, it is maintained that the single site case study approach offers the best opportunities for rich in-depth contextual based research.

Methodological approach

The case study approach adopted and argued as appropriate for this research is in keeping with most other notebook research; however, it should be recognised that other methodological approaches have been employed to research the use of enhanced technology within the classroom. At Tawa Primary School (online article, 2002) in Wellington there is an ongoing study based on an Action Research model, carried out by teaching staff in conjunction with Christchurch College of Education and Curtin University (Perth). This different approach is an equally valid form of research and given the goals of the notebook project at Tawa School it is considered by the researcher to be highly appropriate.

Likewise, Newhouse (2001c) found that an ethnographic action research approach was a valuable tool in assisting the implementation of a wireless notebook programme within

a primary school. With the recent implementation in 2001 of the wireless network at SKC in mind, it is of interest to note that Newhouse concluded that in the primary school setting 'the technology (wireless + portable) had passed the tests' (2001c : 13). In the future, an action research strategy could be considered for advancing further an understanding of the notebook programme at SKC.

The sampling

In the present study the sample comprised of three groups, each of reasonable magnitude and proportion in terms of the total available populations. Hence it is argued that the views and findings of this study can be considered representative of the participating stakeholder groups. A small number of students (13) of the total Year 9 intake (197 as at February 2000) left the College during the course of the year and the views of these students and families have obviously not contributed to the findings of this study. Whether any or all these students were withdrawn from the College as a direct consequence of dissatisfaction with the notebook programme is uncertain and indeed unlikely. From discussions with the College admissions department it is believed that the student's participation in the college notebook programme was not a significant factor in the departure of any of these students.

The study recognises that to a degree the sample can not be considered as having an unbiased baseline of attitudes towards ICT on which the impact of the student notebook programme can be measured. By the very nature of the enrolment process, one would expect the majority of students/families in the Year 9 cohort to be sympathetic or at least passively neutral towards the use of notebook technology by students, otherwise they would have looked elsewhere to enrol their sons. The parent data on this issue reflects this assertion as none of the parent sample stated that the College notebook programme had a negative influence on the enrolment of their son(s) at SKC (see chapter 4).

There was no distinction made between the views expressed by students who had greater experience of notebook use and those for whom the use of a notebook in 2000 was a new experience. As 88% of the student sample were new to the College notebook programme it was felt that to separate the views of a few students (6) who had prior notebook experience in either Year 8 or Year 7, would not be appropriate nor would it

be statistically justifiable. Further research could be undertaken to examine whether different lengths of notebook usage in terms of each year, had any effect on student views and levels of adoption of the technology.

Sampling methods

A wide range of data collection methods have been successfully used in numerous overseas notebook studies (e.g. Ainley et al., 2000; Hill et al., 2000 and 2001; Kessell, 2001; Rockman et al., 1998 and 2000) and these and other sampling methods have recently been reviewed and summarised by Boyd (2002).

If greater resources and time had been available further sampling methods would have been used. These may have included, direct researcher classroom observations, individual student shadowing, the use of student diaries or logbooks and individual participant interviews (either in person or by telephone). In addition, formal summative assessments of student performance have been utilised in some quantitative research. Examination of school documentary evidence and analysis of examination results are further possible methods of measurement.

It is recognised that the data collected during this study was primarily based on two distinct sampling techniques. These were; written questionnaires and focus group discussions. There was little existing appropriate documentary evidence related to the notebook programme within the College and what was available has been reviewed. Given the limited time frame and resources, other forms of evidence associated with case study research, such as examining records, 'detached' observations, physical artefacts, student portfolio assessments and participant observation techniques were not employed (Gillham, 2000; Herman, 1994; Yin, 1994).

As mentioned previously, in retrospect thorough examinations of the teaching schemes used in 2000 by departments in terms of their ICT component and integration could have been undertaken as has been done in other studies (e.g. Halliday, 2001; Parr and Bairstow, 1992). This would have added another dimension the research data collected.

It is difficult in a questionnaire to determine the accuracy of the self-reporting by participants of their ICT skills levels. However the consistency of the written

questionnaire data with that collected during the focus group discussions, and also the institutional knowledge related to the researcher's own experiences as an active participant in the College notebook programme, would suggest that the qualitative views expressed and the quantitative data accurately reflect the 'realities' of the notebook programme at the time of this study.

Statistical analysis

In keeping with the research objectives, there was little to be gained from any detailed statistical analysis of the data as the main intention has been to gather in-depth understanding of the College notebook programme. The size of the sample was considered adequate to determine a representative picture of the key stakeholders of the notebook programme. It was, however, not sufficiently large enough (i.e. $n < 50$) for reliable statistical analysis.

As notebook usage was compulsory for all students in the Year 9 intake there was no possibility of a 'control' group of non-notebook users with which statistical comparisons could be made. Any analysis with data from other published notebook research would be fraught with the danger of misinterpretation or misunderstanding of statistical data presented in the literature. Hence, the researcher was aware of these statistical limitations and the results were interpreted accordingly.

Parent focus group

In the context of normal College practice, parent consultation in the form of focus discussions activity was not considered appropriate nor has it been commonplace, as it is outside the scope of normal College evaluation procedures. However, the lack of a parent focus group to discuss and confirm the data acquired using the written survey instrument is recognised as a possible weakness of the methodology used.

While acknowledging the time constraints and limited opportunities available within this research, a parent focus group would have added a further dimension and aided in triangulation of data. It is noteworthy that the data collected in both the student and staff focus groups did not differ in any substantial way from the findings of the written

surveys, suggesting possibly the same would have occurred if a parent focus group had been included in this study.

The language and terminology

The selection of terms used in the written questionnaire could be questioned as some may have been interpreted differently by participants. For example, the term ‘regularly’ may have been interpreted to indicate a range of different frequencies, although where possible additional specific qualifier statements were used within the context of individual survey questions for clarification.

The participants’ assessment of ‘effectiveness’ of the College notebook programme is not benchmarked against any external standard or norm. The data collected represents the perceptions of the participants who had limited knowledge or experience of other forms of ICT enhanced learning environments. None to the knowledge of the researcher had transferred within a recent time frame to SKC from schools with similar ICT initiatives.

It was recognised at the conclusion of the student data collection phase that there may have been a degree of ambiguity in the wording of the categories used in Question two of the student survey instrument (Appendix H) in which students were asked to describe the frequency of time allocation where they made use of their notebook computers. The categories ‘all the time’ and ‘regularly’ were similar descriptors, as students have only one lesson of each subject in any given day. However despite this lack of discrimination between two of the five categories, the trends for the core subjects are clear.

In addition some of the technological terms in the survey instruments may have been misinterpreted or misunderstood by participants. Unfamiliarity with ICT terminology may have inadvertently resulted in inaccurate data collection. A case in point is the term ‘Hard drive failure/faults’, which was used in Question 12 of the student questionnaire (Appendix H), which the students may have associated a ‘re-image’ of their computer as being a specific hardware fault, which may not necessarily have been the correct diagnosis of the problem. However these variations in interpretation are considered to be minor within the larger scale of the data collection process.

Time frame

The data collection was undertaken during six to nine months after the completion of Year 9. One may question the memory and accuracy of recall of pupils, staff and parents in relation to specific classes, subjects and activities. The expectation that students accurately remember six to nine months later how many hours or how many times they used their notebook in class or at home, is potentially an area of weakness in the data collection. However the participants' attitudes to the range of ICT related issues investigated in this study are not conditional on the time frame of the sampling and thus these data are considered valid.

In addition, it is recognised that one of the limitations of this research is the relatively short time, that is, a single year, students had participated in the notebook programme. It has been suggested (Boyd, 2001) that a one- or two-year timeframe could be too brief to adequately do justice to reporting and evaluating the outcomes of such an innovation.

The pace of ICT innovation and research data

It is worth noting that rapid technological developments in notebook hardware and also software applications available, have the fortunate consequence of making what seemed impossible five years ago now readily achievable. Thus it is possible that, given the ongoing and rapid developments in this field, the limitations that may have had negative impact on previous studies could well now be irrelevant.

Thus given the pace of ICT innovation and development, research data in ICT could be said to be 'out of date' from the day or year it is collected and therefore it is true to say the same fate will befall this study. Indeed since the sampling for this study was completed the College has implemented a wireless LAN, which will have a significant impact on ICT use within the classroom environment at the College (Chieng and Caulfield, 2001).

These rapid developments make assessment and evaluation of technology based programmes difficult as ICT advances are constantly creating new possibilities for instruction. While recognising the beneficial effects of these developments the net result is that finding ways to measure the goals and potential effects of technology on students

is a moving target (Herman, 1994). It is hoped, however, that studies similar to the SKC research add dimensions that provide a challenge on which innovation and developments may be based.

Quality of student written work

The SKC study did not systematically judge the quality of student written work. It would be a worthwhile investigation however to compare and contrast student work, preferably by the same students when placed in two different learning environments. That is with or without notebook technology to assist in the completion of the task.

This form of evaluation was undertaken as part of the third AAL study. A 30 minute written essay was completed by two groups of matched students (total sample = 217), half the classes using notebooks and the others without. The essays were scored blind by an independent in-house team of researchers and ‘in two of the three cases, laptop students’ writing rated stronger in all four scored areas: content, organisation, language/voice/style and mechanics’ (Rockman et al., 2000 : viii). The choice of topic may influence student performance and the fact that different students participated (although in matched groups) made it difficult to reach any conclusive statement. However there seems to be some evidence to the assertion that notebook use can improve student writing (Rockman et al., 2000). The SKC study did not seek to judge any such changes in the quality of the English composition of student work, and such judgements may be ethically problematic.

Staff assessment of ICT adoption

It would have been of interest to assess individual staff adoption and integration of ICT using recognised survey instruments such as those developed by Knezek and Christensen (1999) or the five stage process postulated by Sandholtz, Ringstaff and Dwyer (1997). Measurement of the level of integration of ICT into the teaching and learning process has been utilised recently in a larger New Zealand study (The Learning Centre, 2001).

Furthermore an investigation of the impact of teachers’ age, classroom experience and gender in relation to their ICT adoption and usage could be another possible avenue of

research. However, it is noteworthy that Cuban, Kirkpatrick and Peck (2001) found that these factors made little difference to the level of teachers' ICT use in the classroom. Given the relatively small SKC staff sample ($n = 26$), analysis along these lines was considered inappropriate.

The self assessment by staff related to the six stages of adoption categories proposed by Knezek and Christensen (1999) would enable comparison of the staff participating in the notebook programme and their integration of ICT within their teaching, with that of teachers at other institutions. It is likely that most staff at SKC would consider themselves at stage five or indeed stage six, as generally they are able to adapt their use of ICT to specific curriculum situations during their everyday teaching and are using notebook computers as meaningful instructional tools within their classrooms. Whether this observation can be substantiated could only be established by quantitative surveying using one or more of these overseas survey instruments. Staff participating in a pilot notebook scheme using iBook portable computers at another Auckland independent school were assessed to be at the similar advanced level (five or six) in terms of their adoption of new technology (Selby, Elgar and Ryba, 2001).

A simple classification system for assessing teacher response to a notebook enhanced learning environment has been outlined by Newhouse and Rennie (2001). It categorised staff according to three broad groups; Active, Passive or Negative. How staff would be assigned objectively to a particular group is problematic and as the author recognised, teachers are not always consistent in their classroom interactions, which may vary over time and with different student groups and academic levels. These broad categories were refined into a model in which there were eight types of responses demonstrated by teachers (Newhouse, 1999). Given the findings of this research, it is suggested that most staff at SKC could be considered as either Active or Passive, with only a few teachers demonstrating Negative responses to their participation in the College notebook programme.

There are other similar possible models on technology integration into the classroom which could also be considered, such as the Instructional Transformation Model proposed by Rieber and Welliver (1989) and the later refined version entitled the Hooper-Rieber model (Hooper and Reiber, 1995) which can be used to assess the integration of ICT into the classroom environment.

Based on past research, it has been suggested that not until teachers reach a comfort zone with the technology will genuine instructional innovation begin to emerge (Dwyer, Ringstaff and Sandholtz, 1990; cited in Herman, 1994). The staff data collected for this research would suggest that such innovative practice with the infusion of notebook technology is now beginning to appear within the classroom at the College.

While stage theories may be useful as heuristic devices for educators to examine the levels of ICT integration by teachers within an institution or individual classroom, it must be recognised that such linear progressions do not accurately reflect the reality of teacher's learning and can be problematic in their application (Windschitl and Sahl, 2002). They can be misleading and if rigidly applied place the emphasis in the 'wrong' area of the research outcomes.

Student assessment of impact of notebook enhanced learning

Boyd (2002) states that in many notebook studies the observed improvements in students' achievements, attitudes, motivation and ICT skills have not been clearly reflected in changes to student achievement measures. As in this research, positive changes tend to be shown by qualitative data rather than by quantitative measurements, which when they have been undertaken have generally been inconclusive (e.g. Passey et al., 2001; Rockman et al., 2000). It was beyond the scope of this thesis to carry out quantitative evaluation of the notebook programme in terms of student academic performance. Indeed, as has been shown, it is difficult to develop such appropriate measurement tools. It is possible, however, that the assessment of the impact of the College notebook programme could involve an analysis of pre and post assessment of the academic performance of students, using recognised instruments such as Progressive Achievement Tests (PAT).

This form of assessment was included in the St Cuthbert's Junior School study (Selby, Elgar and Ryba, 2001) as part of their evaluation of the notebook programme. However there are a number of difficulties associated with attempting to isolate whether any change, either an improvement or decline in academic performance of students, could reliably be attributed to the inclusion of notebook technology within the learning

environment of students. Other factors, such as developmental improvement with time and teacher influence will impact on student learning. To be effective a larger sample size and a comparable control group of non-notebook using students would be necessary for a more valid comparison and this was not feasible nor ethical within the context of this research.

The quantitative evaluation of notebook programme students and non-notebook using students with recognised performance criteria such as national formal assessments is being undertaken in some overseas studies (Rockman et al., 2000). However even this does not guarantee success, as was found in the Beaufort County School District study (Stevenson, 1998). In addition, studies of this form raise serious ethical considerations. Stevenson, using a nationally standardised achievement test, found that pre-existing differences in the academic performance of the two different notebook and non-notebook student groups meant that no meaningful statement could be established to verify or refute that notebook usage had improved student performance.

Indeed, a recent ERO report (2001) found that:

In the last 10 years a considerable amount of research has supported the view that the use of ICT in schools enhances students' learning attitudes and behaviours. However, there is little conclusive evidence of improved student achievement through the use of ICT... Many studies cite teachers' perceptions that ICT has improved their students' learning outcomes. However, because of the nature of the learning process, achievement cannot be attributed in any definitive manner to the use of ICT in the classroom alone (2001, section 4).

Thus, clearly it is difficult to isolate the influence, either positive or negative, of ICT usage on the academic performance of students.

Assessment of the learning environment

It is argued that any research into the use of computers in the classroom needs to consider the overall learning environment (Newhouse 2001a). Newhouse (2001a) on the

basis of a literature review and personal experience in notebook research in Australia, has developed two instruments; the New Classroom Environment Instrument (NCEI) and the Concerns-Based Adoption Model (CBAM) (Newhouse, 2001b) and recommends these as useful tools for ICT researchers. It was not possible in this study, due to the time frame of their publication, to utilize these potential instruments.

Stolarchuk and Fisher (2001b) focused their recent research on a specific aspect of the impact of ICT in the classroom. They examined the 'teacher-student interpersonal behaviour' in the notebook learning environment of 23 science classes in nine Australian schools. The Questionnaire on Teacher Interaction (QTI) was originally developed in the Netherlands (Wubbels and Levy, 1993; cited in Stolarchuk and Fisher, 2001b) and had been refined and simplified for use in the context of the Australian research. This instrument was used to investigate the effect of notebook computers on students' perceptions of teacher-student interpersonal behaviour in science classrooms. The findings suggested that students using notebooks generally perceived that the teacher-student relationships were positive within the notebook environment. This form of investigative assessment, using the QTI would be yet another possible avenue for any further research at SKC.

Hill et al., (2000) as part of their five year evaluation of a student notebook programme in Athens Academy, Georgia USA, used a simple series of 5 point Likert questions to gather staff and student perceptions of the classroom learning environment. These focused on activities which occurred during lessons, and on whether they were teacher or student focused and/or initiated. The study provided useful insights as to the impact of notebook technology on the classroom. The notebooks were most frequently used for individual work and only rarely for group work. Students also reported that they learnt most from teacher demonstrations, class discussion and group projects rather than from individual project and class presentations.

Identification of the precise form of classroom notebook usage was not made in this study and should be if further research is to be undertaken at the College. It would be valuable to assess the form of usage within the classroom environment. Such questions as to whether notebook use is in the form of teacher or student directed use, and whether it is individual or group focused usage could be addressed. In addition, an assessment of

the type of activities students think they ‘best’ learn from would be beneficial, as it may give some indication as to whether students and staff are moving from a teacher centred to a student centred learning environment. Indeed, as the Athens Academy study (Hill et al., 2000) noted:

Given the students’ positive attitude towards teacher directed instruction, they may find moving to a more student-centred approach challenging (30).

Perhaps the students’ prefer the teacher-directed instruction/demonstrations, a traditional approach rather than the student-centred constructivist approach as a natural consequence of their past experiences within the classroom. Also student academic laziness or passivity tends to support a student preference for a teacher focused learning environment, as both staff and students reported being most comfortable with a more traditional teacher directed curriculum delivery style (Hill et al., 2001).

Obviously given the time frame and limited scale of this research the use of the holistic research instruments mentioned in this section was not practical and indeed at the planning stage of this research many of these instruments were unavailable. It is, however, a possibility that such approaches could be worthy of consideration for any future notebook research at SKC.

Measuring ‘effectiveness’ and ‘benefit’

As noted previously, the terminology itself may be an important issue in determining the level of effectiveness of the notebook programme at the College. It has been recommended that the educative value of notebook enhanced learning should be expressed in terms of achievement of curriculum goals, standards and objectives and not in terms of technological skills and objectives (Ham, 2001). As it is stated:

We should not be gathering evidence of what a difference ICT makes to teaching or learning, nor evidence of what it does for our students. What we should be doing is.. (looking for)... evidence of what our students do with ICT when they happen to use it (Ham, 2001 : 12; emphasis in original).

This suggests that there needs to be a change in emphasis in ICT research to place greater importance on the use of ICT to achieve curriculum objectives and cognitive learning, rather than focusing on the technology itself and its physical impact within the classroom. This would be a difficult, time consuming and evolving process. This research certainly sets out to raise awareness of some of the factors that need to be considered and in itself may contribute to that educative process.

Some studies of students with high access to ICT have shown a slow evolution in the classroom environment where student achievement occurred over a much longer time period (Fisher, Dwyer and Yocam, 1996). Stevenson (1999) found that students did not view the primary purpose of notebooks to be to improve academic success and ‘most students thought that the laptops did not make a difference in grades’ (1999 : 16). While Schofield (1995) suggested that administrators, teacher and parents may expect that utilising computers would improve standardized test scores, these are in themselves blunt instruments and often will not measure the kinds of skills students develop using computers, especially if ICT is used in innovative ways. These concerns could pose a problematic issue for SKC, as some stakeholders, may have expectations of improved student achievement, which may not be satisfied, if no means can be provided to record the improvement, if indeed there is any to detect.

Herman (1994) went as far as to state that ‘policy-makers and educators should not expect standardized test scores to show the impact of many technology projects’ (150). He commented that although research evaluations may not have demonstrated any significant effects on student performance measures, they had nevertheless provided empirical evidence of instructional impact of ICT innovations. Herman (1994) went on to state:

Technology-using classrooms exhibited dramatically higher incidences of complex learning tasks, teachers involved as facilitators rather than lecturers, students working in small groups, students interacting productively with one another and students highly engaged in learning activities (155).

The chosen research objectives of this thesis did not permit the opportunity for detailed assessment of the learning environment at SKC along these lines. The findings of the staff questionnaire indicated some changes in keeping with those identified by Herman and other researchers (e.g. Rockman et al., 1998). It would be interesting to carry out classroom observations and make use of other research tools that were specifically designed to consider the instructional impact of the notebook programme within the student learning environment.

In other situations, such as at Brewster Academy in the United States, researchers while recognising that ICT was only one aspect of a number of changes made during a time of major reform at the school and its culture, found that the infusion of high access ICT within the classroom has had the following benefits:

Improved academic achievements, technology skills, student conduct, student retention, collaboration, college placement and faculty expertise and culture (Kavanaugh-Brown, 2000: paragraph 5).

At Brewster Academy these success factors can not be solely credited to the implementation of a notebook programme, rather they appear to be the consequences of a radical pedagogical shift at the school. The School Design Model (SDM) developed by Alan Bain (1996) is an example of a technologically based innovation within a school environment. This demonstrates the difficulty of trying to isolate the impact of notebook technology alone based on changes to stakeholder attitudes, motivation, ICT skills and in the case of students, academic performance.

The concerns regarding the cost effectiveness of the notebook programme will in time need to be addressed. However it would be short-sighted to think about cost effectiveness only in terms of basic skills attainment. The evolution of new technologies adds further challenges to the measurement of cost effectiveness as their use may be an essential prerequisite to new learning opportunities and these learning opportunities may well be impossible in the absence of the technology. The author would concur with the view expressed by Herman (1994) that:

It is clear that schools must get a better handle on the teaching effectiveness of technology before they can sensibly respond to questions of its cost effectiveness (161).

In addition Herman (1994) highlights that evaluation of the influence and impact of technology in the educational setting is problematic. Research has failed to conclusively provide answers to apparently straight-forward questions such as:

- What are the effects of technology on student learning?
- What are the effects of technology on teacher productivity?
- Is an investment in technology cost effective?

Indeed, the findings of this study, are unable to adequately address these issues. However, whether these questions are the most important, or most appropriate ones to ask could be questioned. Herman recognises this dilemma and goes on to state that there are a number of factors that render these relatively 'simple' questions 'essentially unquestionable in many innovative projects' (1994 : 134). A number of possible moderating and confounding factors are considered below.

Moderating factors

There are a number of moderating factors that may have had an impact on the data and thus its interpretation. There is a complex interaction of a range of variables in play within any learning environment and although this research has focused on the role of notebook technology it is self evident that other factors have an important influence. As Herman (1994) states:

Real schools are messy and noisy environments for research, far from the pristine, controlled setting available in the research laboratory, the model on which most quantitative evaluation studies are based. The confounding variables are legion...(145).

The list of moderating factors would include the personality, intelligence and motivation of students, the personality and teaching styles of participating teachers and

the support and commitment or otherwise of the parents to the College notebook programme. Other factors acknowledged in previous studies need also be considered. Schofield (1995) further highlights the following; (a) purpose of computer use, (b) the specific software and hardware chosen, and (c) the class size and frequency of use.

If the notebook programme is merely considered by teachers and students as an 'add on' to the existing traditional pedagogical approach of staff, then it is unlikely that improvements in student achievement or classroom learning environment will be observed (Boyd, 2002). In contrast, it is recognised that many of the staff participating in this research, were selected as teachers of Year 9 classes on the basis of their willingness to do so and in some cases their perceived ICT competency. Hence, there is potential that the views expressed by the staff sample, may overstate the success and worth of the notebook programme, and it is possible that the findings for this particular group of teachers may not be representative of the SKC staff as a whole.

The context in which the notebook innovation is employed will have a bearing on its impact. As Stevenson (1999) found students participating in notebook programmes in some school settings were more successful than in others. If this is found on an inter-school level, it is equally so at an intra-school level. Notebook technology is rarely implemented in schools in isolation from other school interventions and reforms. Thus disentangling the unique contribution of the notebook programme within the wider school environment is nearly impossible (Herman, 1994). At SKC the implementation phase of the notebook programme coincided with a major reform of the College pastoral care system and these and other reforms were initiated by the newly appointed Headmaster at the College.

Miller and Olson (1994) point out that it is unwise to ascribe a 'cause and effect' relationship between staff adoption of computers and innovative learning practices within the classroom setting. The context in which the innovative use of ICT occurs is likely to be a consequence of the nature of the teacher's normal teaching practice rather than the mere presence of computers within classroom. They suggest 'we ought to look at what the teacher has done in the past' (Miller and Olson, 1994 : 136) rather than at the features of the technology itself. Likewise, Herman (1994) suggests that differences in how teachers use technology signal the teachers' different instructional objectives

and goals for student performance. The SKC research did not seek to provide the opportunity to consider the indirect influence of past practice and personal pedagogy of teachers and their impact on the use of notebook technology. While recognising this as a possible limitation of the study, it should be noted that such aspects would not have been directly related to the prime objective of the study, that is, to make an evaluation of the Year 9 notebook programme at the College.

Confounding factors

There is the possibility of confounding factors (Clarke, 1985) such as the ‘Hawthorne effect’ based on a novelty factor. Students using notebook computers for the first time in the context of the classroom may feel excited about their learning and regardless of the level of effective use of the technology may view it in an extremely positive light. Another potential confounding factor may have been the impact positively or negatively on students of attending a new school as 88% of the student sample were new to SKC in 2000. As Parr and Bairstow commented on the King’s College study, ‘it is difficult to separate out the motivation effects of the computer from the effects of attending a new school’ (1992 : 37). These may have influenced in un-measurable ways the data collected during the course of this study.

Perception leads to reality

That the majority of the three key stakeholder groups at SKC (students, staff and parents) perceived that the notebook programme had a positive impact is important. Perception, to some extent, is reality. If students and teachers believe something is making a difference, they tend to work consciously and unconsciously in some cases, to affirm their belief. Thus the fact that most stakeholders believe in the benefits of the notebook programme better assures they will be used effectively (Stevenson, 1998). In turn, this means that the findings of this study need to be recognised having the potential for some degree of ‘self fulfilment’. The perceptions of the specific stakeholders may reinforce their preconceived notions of the impact of technology, in this case, portable computers, on education.

The role of the researcher

The fact that the researcher was a current member of the teaching staff at the College, may perhaps be a potential limitation to the validity of the findings of this research. It is acknowledged that, consciously or more likely subconsciously, the researcher may have to some degree interpreted data in the light of personal experience and institutional knowledge. Hence the author recognises that this study uses records based on a subjective evaluation of the SKC notebook programme. As clearly argued in chapter one, however, the researcher firmly believes that the insights and understanding that an ‘insiders’ account of the College notebook programme, and the use of a case study approach is worthy justification for the completion of this research.

Summary

This chapter has discussed the SKC notebook programme in the context of international ICT research literature and to a lesser extent, due to the limited availability, New Zealand research. It has addressed a number of concerns, such as the place of technology in education, the role of leadership and teachers, and the potential pedagogical implications of notebook use. The College notebook initiative has also been examined in the light of theory on educational change. Discussion of the future of the SKC notebook programme and suggestions of avenues for further research have been detailed. It has concluded by outlining, with a degree of critical self-reflection, the research limitations of the study. The next chapter will provide the key conclusions for the study.

Chapter 7

Conclusions

Introduction

This chapter presents conclusions based on the findings of this study and from previous research. It is deemed inappropriate to generalise too widely given the in-depth site specific nature of this case study. The primary objective of this research has been to acquire knowledge, insight and understanding of the SKC notebook programme with specific reference to those associated with the Year 9 notebook programme in 2000. It has been a descriptive study (Anderson, 1998) with the goal of providing researched evidence that may result in improvements to the College notebook programme in the future. The findings will also be of interest to those in other educational institutions who are considering implementing similar innovative ICT learning programmes.

It would be fair to conclude that staff, students and parents in general have a positive regard for the College notebook programme. Their responses may be for a variety of reasons related to their different perspectives and level of personal involvement in the notebook programme. While accepting that there will always be detractors to any innovative programme (Fullan, 2001a), and that support may not be unanimous, the College notebook programme continues to evolve and is increasingly becoming assimilated into an evolving ICT - enriched school culture.

Given the constrictions and limitations of time available for a single researcher the study has fulfilled its original research objectives as outlined in Chapter Two. In short, it has evaluated the College notebook programme and thus based on the findings of the research the following conclusions and recommendations are presented.

Main findings to emerge

The evidence from this research supports the following conclusions related to the SKC Year 9 student notebook programme as it operated in 2000:

- The student use of the notebook computer is associated with positive student attitudes.
- Notebook usage has resulted in improvement in students ICT skills and understandings and the presentation of student work.
- The parent community on the whole is very supportive of the notebook programme particularly for its perceived vocational advantages.
- The College staff participating in the notebook programme are generally positive and supportive of the integration of notebook computers into the learning environment.

While recognising that any attempt to summarise such a diverse range of data will have limitations, Table 7.1 present some of the key findings and observations of the notebook research at SKC.

Table 7-1 The strengths and weaknesses of the SKC notebook programme as perceived by key stakeholders

Sample Group	Strengths	Weaknesses
Staff	<ul style="list-style-type: none"> • New opportunities for delivery of learning • Motivational for some students • Better quality of written work for some students • Provides new opportunities for student centred learning 	<ul style="list-style-type: none"> • Time intensive • Frustration (e.g. unproductive time, non functional notebooks) • New classroom management skills needed
Students	<ul style="list-style-type: none"> • Better quality (presentation) of work • ICT skills are learnt and utilised • Intrinsically motivating for some students 	<ul style="list-style-type: none"> • Frustration (e.g. non functional notebooks, can slow down class work, 'lost' files) • Weight is an issue while in transit • Under-utilised in class
Parents	<ul style="list-style-type: none"> • New opportunities for learning • Motivational for some students • Vocational benefit of ICT understandings and skills 	<ul style="list-style-type: none"> • Difficult to monitor student work and progress • Under utilised • Possible negative impact on hand written work

As Table 7.1 illustrates, the key stakeholders recognise the strengths and benefits of the student notebook programme. Not surprisingly, these appear to be largely 'human' related educational benefits. Nevertheless, it is equally clear that these same stakeholders acknowledge weaknesses in the programme. Many of the perceived weaknesses could be considered to be directly technology related, and thus the College may be able to take steps to address and overcome these areas of concern. Some weaknesses however are systemic issues, e.g. perceived under-utilisation, and the findings of this study will provide a sound evidence base as justification for further improvements and refinement of the College notebook programme.

The question as to whether these weaknesses can be addressed effectively, taking into consideration the culture of SKC, and the range of divergent attitudes and personalities of the key stakeholders, will be an issue for the College to examine in the future.

Effective notebook education

The study found that a range of factors influence the effectiveness of a notebook programme, such as the SNAP initiative at SKC. Many of these factors, both positive and negative, are not unique or specific to a notebook programme, and would impact on any innovative programme within a school culture. With this in mind, Figure 7.1 illustrates some of key factors conducive to an effective notebook programme. These are based on the findings of this research, together with consideration of previous notebook related research.

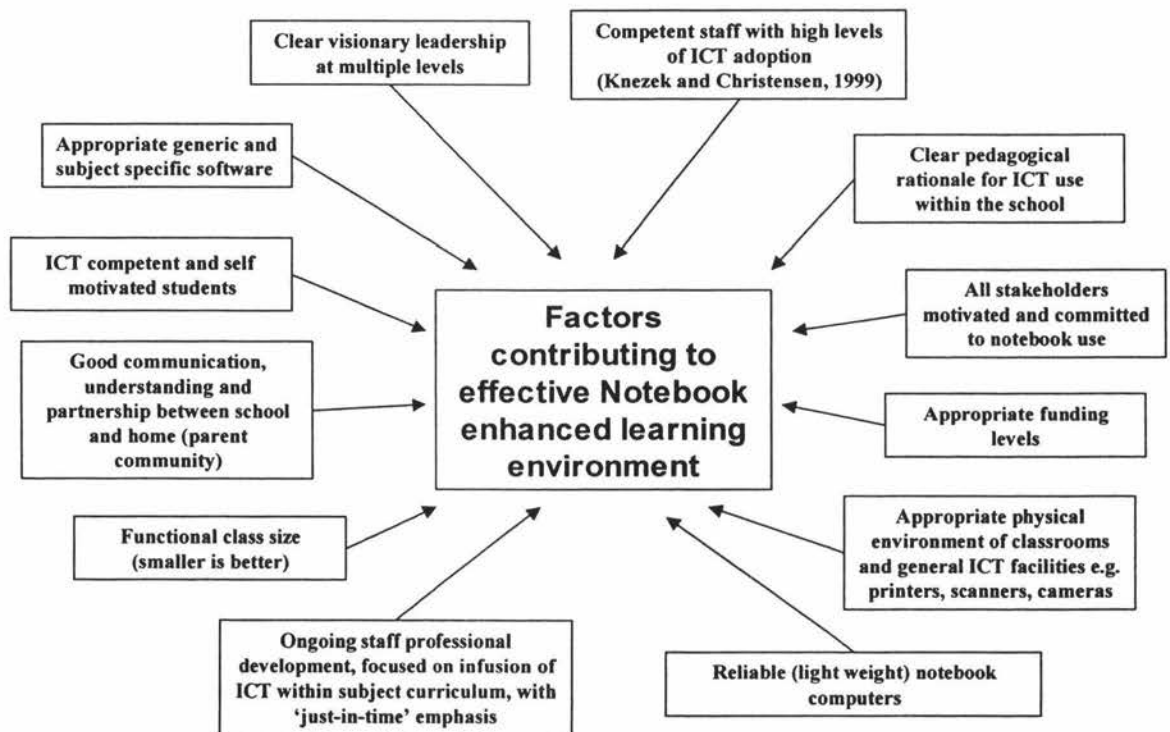


Figure 7-1 Factors contributing to an effective notebook enhanced learning environment

The interaction of factors presented in the above figure and quite possibly other factors, will have a major impact on the successful establishment of a notebook enhanced learning environment. No single factor in itself will determine the success or otherwise of the notebook programme. It is clear that a number of factors may be beyond the

direct control of those implementing the programme, for example, the manufacture and provision of reliable, robust and lightweight portable computers. Notably many of the factors are issues that need to be addressed at the senior management level, and at the institutional governance level, to ensure that any technology focused innovation has a greater likelihood of success.

In a similar vein, based on the findings of the research, the following diagram illustrates the potential barriers to the establishment and continuation of an effective notebook programme (see Figure 7.2).

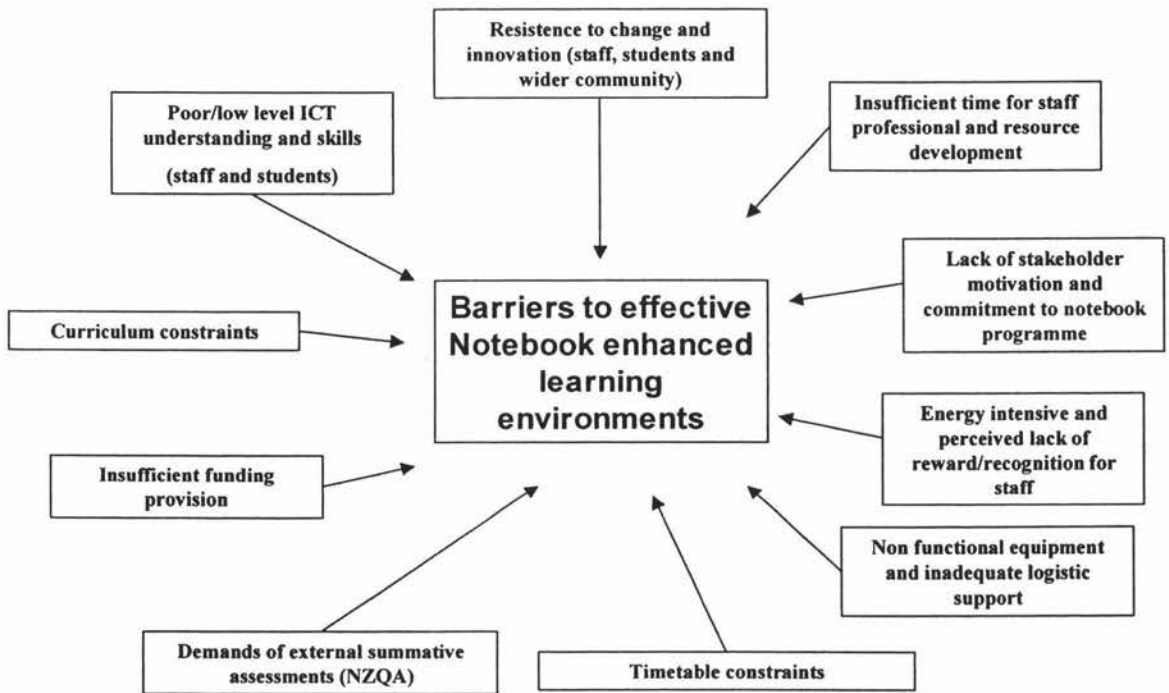


Figure 7-2 Barriers to establishing an effective notebook enhanced learning environment

Given the multiplicity of possible barriers to the establishment of an effective notebook enhanced learning environment, it is perhaps commendable that, as the findings of this study show, the SKC notebook programme has been successfully implemented in the past few years. An appreciation of both the positive factors (Figure 7.1) and the barriers (Figure 7.2) that may impact on an innovation such as the notebook programme, will enable planners to develop new programmes in the light of the SKC experience. In addition, an in-depth understanding of the factors will help those in leadership at SKC when revisiting and reviewing the notebook programme, and enable appropriate amendments and refinements to be put in place.

Institutionalisation of the notebook programme

Perhaps the greatest challenge will be to institutionalise the notebook programme within the College culture. A multi-dimensional innovation such as this will require commitment from all stakeholders, together with participant perseverance, energy and funding over a substantial time period (years) if it is to bring about meaningful and lasting change (Fullan, 2001a). Given the continuation of the notebook programme at the College, then it has the potential to result in further measurable improvements in the teaching and learning environment at SKC.

For the programme to continue to be successful a determined approach is needed to eliminate the weaknesses and reinforce the strengths. As it has been suggested:

Those educators who make the best use of these advancements (i.e. new technologies) may be those who look backwards – or at least look around – before leaping forward (Miller and Olson, 1994 : 138).

This research and its findings will enable the College administration to look back on 2001 and gain insights into the notebook programme at that time. The desire of the researcher is that these insights may assist in leading the College forward positively into the technology enriched learning environment of the 21st century classroom.

Thus with these sentiments in mind the following recommendations are made.

Recommendations

The following recommendations are based on the evidence collected and evaluated during the course of this study and they are presented in no particular order or priority.

(1) Student movement during the day

The reduction of student movement between classes with a greater emphasis on the use of home room teaching, particularly in the Middle School, would reduce time under-utilised while setting up and shutting down notebooks. It would be likely to decrease the risk of computer damage by reducing the movement of students. In addition, the

College could consider changing the number of teaching periods each day - that is, for example, five 55minutes periods, rather than the current six period day, and this would also reduce students daily movements.

(2) Staff professional development

Maintain and strengthen the emphasis on staff professional development related to the use and integration of ICT within a notebook learning environment. Ideally professional development should be school based in-service training where teachers are able to work with colleagues on their own notebooks with common software and curriculum objectives (e.g. Gilmore, 1992; cited in Johnston, 1996).

There should be encouragement for opportunities for intra and inter departmental discussions and sharing of successful 'best practice' materials and lesson plans that utilises notebook technology. There is a need for support at all levels within the College of a culture that encourages and recognises technological innovation as it relates to enhancing student learning (Cuban, Kirkpatrick and Peck, 2001). The specific allocation of professional development time/funding for departmental ICT resource production and sharing of effective classroom practice would be a positive initiative.

(3) Notebook use and special needs students

One potential challenge which has yet to arise at SKC and which may occur in the future, is how the College will address the challenges of notebook use for physically disabled students and students with special needs. Fine motor skills are associated with notebook use, as are the skills that focus on the sensory input of visual and auditory data when using notebook computers. Therefore, in the future there may arise a situation where the College administration will need to develop policies and practises which enable physically impaired students to participate fully and with equal learning opportunities, within the context of the College notebook programme.

(4) Ethical considerations and education

There needs to be proactive education and policy formulation regarding the ethics of notebook computer use and in particular the issue of copying and plagiarism of electronic information. The aim should be to ensure ethical behaviour by all (see Brock, 2001 for detailed discussion of this issue).

(5) Further research be undertaken

If the notebook programme is to develop effectively further research along the lines suggested in Chapter Six should be undertaken and documented by staff within the College. This thesis reflects the findings of a specific sample at a particular point in time. A culture of ongoing review and research into the functioning of the SKC notebook programme with an emphasis on ICT integration and the enhancement of the curriculum will have benefits for the programme and its participants.

(6) Continuing education

The support for the notebook programme is influenced by the levels of understanding of the way the College notebook programme functions. Continuing education of all stakeholders together with opportunities for reflective input would enhance the programme. As discussed as a suggestion for 'further research' in Chapter Six, there needs to be a sharing of the vision, of the notebook enhanced teaching and learning at the College. This must be in its broadest sense and also where necessary with specific detail to ensure all stakeholders have a comprehensive understanding and collective ownership of the programme.

Final thought

The researcher hopes that the findings of this study will be useful and have a positive impact on the notebook programme at SKC. In addition, the study will be of potential value to others involved in ICT innovation within schools both here in New Zealand and abroad.

Computers and in particular portable notebooks offer new and previously impossible avenues for enhancing teaching and learning within a school environment. They will not revolutionise education by themselves, however their increasing use may create pressure for and facilitate transformational change in education. The author agrees in principal with the opinion expressed by Schofield (1995) that:

...it is reasonable to expect that computer use will play a major role in reshaping education and that the potential for positive change is enormous (228).

The positive change brought about by the use of ICT in teaching and learning is increasing. With the seamless integration of ICT within the curriculum, and using computer hardware and software to their potential, the opportunities for enhancing learning through and with the use of notebook technology at SKC and elsewhere are great.

The future has a habit of becoming the present. Recently, the State of Maine has decided to implement the proposed state-wide notebook programme, as outlined in the introductory chapter of this thesis (Stager, 2000). This proposal is now one step closer to becoming a reality in the lives of every seventh grade student in Maine in the latter half of 2002 (King, 2002). It would appear that notebook technology is here to stay, and perhaps educators will in time need to recognise the 'writing on the screen'. The challenge will be to work towards harnessing this technology to effectively enhance the learning experiences of students in the classrooms of the new millennium and this research is 'one small byte' on that path.

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Appendices

APPENDIX A

Study permission letters – Trust Board / Headmaster

To the Saint Kentigern College Trust Board
Saint Kentigern College
Pakaranga
Auckland

To the Chairman
Dr. W.B. Goodfellow

26 January 2001

Dear Dr Goodfellow

I am writing to formally request permission from the Trust Board to undertake my thesis research focused on the notebook programme at Saint Kentigern College. This will enable me to complete my Masters in Educational Administration, at Massey University Albany, which I have been studying part time for the past two years.

As the Form 3 Dean at the College and a committed notebook teacher I am keen to use this research opportunity for the benefit of the college community and hence my focus on the notebook programme at the Form 3 level. I enclose for your perusal a copy of my research proposal, which I completed in 2000 as part of the Research Methods paper I undertook in preparation for this study. It will clearly outline (perhaps in too great a detail!) my proposed notebook case study research for 2001.

I am seeking the approval of both the Trust Board and the Headmaster before commencing my research in 2001. The ethical issues and considerations regarding staff and student participation in this study will be addressed in greater detail in consultation with the Headmaster.

I would also like to take this opportunity to seek financial support from the Trust Board for this research, as I believe it will have many benefits and will enhance our understanding and appreciation of the notebook programme at the College. The university enrolment costs alone are \$2912, and there will be photocopying and other additional expenses. The current Staff Professional Development funding budget does not (as I understand) have sufficient funds to cover these expenses, hence I wish like to approach the Trust Board to seek direct funding for this research.

The year 2000 was a significant one, with the introduction of the first 'across the year group' notebook programme at the Form 3 level and I believe my research will give us an opportunity to review and evaluate some of the benefits and concerns that have arisen as a result of this development. This information will enable us to further refine and improve the successful implementation a 'technology rich' learning environment at Saint Kentigern College.

Thank you for your consideration of my request. If you have any questions I would be more than happy to discuss this research in detail with you in person or by telephone.

Yours sincerely



Duncan McQueen



SAINT KENTIGERN
COLLEGE



28 March 2001

Mr D McQueen

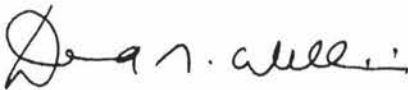

Dear Duncan

Re: Thesis Research

I am writing to inform you that the Saint Kentigern Trust Board have given their endorsement to your proposal to undertake research for your Masters Thesis at our college. They are most happy for you to begin your preliminary surveys and see this as a process that will benefit our school community as well as enhancing your own qualifications.

On behalf of the Trust Board I wish you well for the coming months, as I know from my own experience of completing a Thesis whilst working full time at the College this will be a very demanding time for you. Please let me know if I can add any further support to your efforts.

Yours sincerely



Rev David N Williams
HEADMASTER

APPENDIX B

General information sheet

Massey University Research

Computer Notebook Programme Research 2001 Information Sheet

This research is to be conducted by Mr Duncan McQueen as a member of the academic staff at the college (HOD General Science and Form 3 Dean). The project is undertaken with the approval and under the supervision of the College of Education Massey University. This research will form the basis of a thesis and will be the partial fulfilment of my studies for a Master of Education (Administration) degree, for which I have been studying over the past three years.

This research will focus on the Saint Kentigern College (SKC) computer notebook programme, with particular reference to the year 2000 Form 3 intake. This study will investigate and describe the scope and educational benefits of the Notebook programme as it is perceived by those groups associated with it, that is, the students, staff, and parents. This research will not in isolation resolve the issues raised regarding the use of Notebook computers in the classroom. It will however add to the knowledge base and understanding of this ICT innovation within a New Zealand educational context and enable us to develop a clearer way forward for the benefit of our educational community at SKC.

The research will involve questionnaires, in conjunction with an additional small sample of semi-structured personal interviews and/or group discussions with those involved in the Notebook programme at SKC, that is, the relevant student / staff / parents groups. The goal of the focus group discussions, will be to engender participant feedback regarding the quantitative data collected in the questionnaires, and to reflect and record general observations.

The study is to be undertaken with the approval and support of the Executive Principal Mr Warren Peat and the Saint Kentigern Trust Board. The purpose of the research has been outlined above and all participants need to be fully informed of their individual rights

(please read the list on the reverse side).

In accordance with Massey University protocol voluntary written informed consent of all parties must be obtained, stating your agreement to participate in the study.

Please read the attached **consent form**, which I would ask you to complete fully and return with your completed survey questionnaire if you are willing to participate in this study.

What will it involve ?

The randomly selected participants in the study will be asked to complete a written questionnaire (approximately 10 - 20 minutes) and some may agree to take part in additional group discussions on issues related to the Notebook programme.

May I thank you for taking the time to read this information and I hope you feel able to participate in this research project. If you have any questions or concerns please contact me in person, [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED].

Yours sincerely



Duncan McQueen
Saint Kentigern College

Supervisor Contact details:

Mark Brown
Dept of Learning and Teaching
College of Education
Massey University, Private bag 11 222
Palmerston North
Tel: (06) 356 9099

The Rights of Participants

It is voluntary

All participation is voluntary, and any participant may withdraw from the study at any time, and upon their request any data recorded which relates specifically to them will be destroyed.

Ask if you would like more information

At any stage participants may ask questions and/or seek further information and clarification regarding the nature and purpose of the study.

Don't answer questions if you don't want to

Participants have the right to decline to answer any question or questions which they would prefer not to answer. However I would encourage full completion of the written questionnaire.

It is private and confidential

The principle of confidentiality will operate to protect private and personal data from unnegotiated dissemination – that is : nothing will be reported, nor will your name mentioned without your specific agreement. In the final written thesis your comments will remain anonymous and it will not identify individuals without seeking and obtaining their personal approval.

Your written responses

The questionnaire responses will be stored in a secure location and will be only used for the purpose of the study and will be destroyed on completion of the research.

Audio tapes

Where participants agree to audio recordings (possibly during the interview phase of the study), these will be only used for the purpose of the study and will be erased on completion of the research.

How will I know the findings of the study?

Participants will be given access to a summary of the findings of the study when it is concluded. This may be in the form of an article in the College newsletter/magazine and/or a circular to all participants in the study.

If you are willing to take part in this research project please complete the attached Consent form and return it to the school office, or by post to:

Mr Duncan McQueen

[REDACTED]
[REDACTED]
[REDACTED]

20/05/01

APPENDIX C

Participant consent form

**Massey University
Research**

Notebook Research Study 2001

GENERAL CONSENT FORM

I have read the **Information Sheet** which has explained the details of the study to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand I have the right to withdraw from the study at any time and to decline to answer any particular questions.

I agree to provide information to the researcher on the understanding that my name will not be used without my permission. The information will be used only for this research and publications arising from this research project. On completion of the study my personal written questionnaire response will be destroyed.

I agree to participate in this study under the conditions set out in the **Information Sheet**.

Signed:

Name:

Date:

All students must also have parental /caregiver agreement permitting them to participate in the study. *(Please circle your response)*

I give / do not give approval for my son _____ *(Full name)* to participate in this study.

Parent/Caregiver :

Date:

Discussion groups:

Please indicate if you would be willing to participate in an informal discussion group at a later stage of the study *(by ticking the appropriate box)*.

Yes

No

APPENDIX D

Group discussion consent form

**Massey University
Research**

Computer Notebook Research Study 2001

DISCUSSION GROUP CONSENT FORM

I have read the **Information Sheet** and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand I have the right to withdraw from the study at any time and to decline to answer any particular questions.

I agree to provide information to the researcher on the understanding that my name will not be used without my permission. The information will be used only for this research and publications arising from this research project. On completion of the study my personal written questionnaire response will be destroyed.

I agree to participate in this study under the conditions set out in the **Information Sheet**.

I agree to participate in a **discussion group**.

I agree to the discussion being audio taped and I will endeavour not to disclose by name any other member(s) participating in the discussion group.

I also understand that I have the right to request that my own comments be removed from the transcript of the group discussion and that as a group we may request for the audiotape to be turned off or erased.

Signed:

Name:

Date:

APPENDIX E

Pre-test consent form

Research

Notebook Computer Study 2001 Pre-Test Trial

Thank you for taking the time to answer the following trial questionnaire. All information you provide will remain confidential and will **NOT** be used in the final survey, as it is purely a pre-test for the purposes of refining the survey questionnaire format, layout and content.

Once you have completed this Pre-Test survey Questionnaire, please complete the check sheet on the **reverse** of this page.

Please read the following and if you are willing to participate in this pre-test sign below.

I agree to participate in this pre-test on the understanding that my responses will remain confidential, and will not contribute in any way to the actual research study and in due course my completed survey form will be destroyed.

Signed:

Name:

Date:

APPENDIX F

Pre-test feedback form

Pre-test responses to the draft Survey Questionnaire.

Once you have completed the Questionnaire, please complete the following questions (**tick** one box for each question). Any additional feedback would also be appreciated.

Q1. I found the questionnaire;

Difficult to understand and complete

Okay to understand and complete

Easy to understand and complete

Q2. I could read and follow the instructions;

With difficulty

Without much difficulty

With no difficulty

Q3. The language (wording) used in the questionnaire was;

Difficult to understand

Okay to understand

Easy to understand

Q4. In total time the questionnaire took me about;

Less than 5 minutes

5 to 10 minutes

10 to 15 minutes

More than 15 minutes

Q5. Thinking about the questionnaire you have just completed, in your opinion were there any obvious faults, missing ideas, or any poor or silly questions ?

APPENDIX G

Staff questionnaire

Massey University Research
Notebook Computer Study 2001
Staff Survey



Thank you for taking the time to answer the following questionnaire.
All information provided will remain **confidential**. It will be used only for the purposes of this research, and the number on the form is purely for administration purposes.

Please attempt to answer **all** questions. Mark with **ticks** the appropriate box(es) or **circle** your responses, and write any comments you wish to make on the lines provided.

Q 1. (a) In what year did you **begin** to use a Notebook computer for **school** related work?
Circle the year.

1997 or earlier

1998

1999

2000

(b) Please list your main teaching subject(s) of your Form 3 Notebook class(es) in 2000

(c) Which of the following software programmes do you use **regularly** (at least once a week in connection with your school work). **Tick** as many boxes as appropriate.

Word processing (e.g. Microsoft Word)

Graphics/ drawing (e.g. Draw programmes)

Spreadsheets and graphing (e.g. Microsoft Excel)

Presentations (e.g. Microsoft Powerpoint)

(e.g. Inspiration)

Internet (e.g. Internet Explorer)

Email and Calendar (e.g. Microsoft Outlook)

Electronic Mark book

Other software programmes (please list) _____

Q 2. In terms of your Form 3 class(es) last year, how often did students use their Notebook computer **in class**? **Tick** one box only.

- All the time (every lesson)
- Regularly (most lessons a week)
- Occasionally (1 or 2 lessons a week)
- Rarely (once in a while)
- Never

In **2001** - In terms of time (quantity of use), How has the use by students of their Notebooks changed in your class(es)?

Circle your response of the 1 to 5 scale below.

- | A lot less use than last year | Same as last year | More than last year |
|--------------------------------------|--------------------------|----------------------------|
| 1 | 3 | 5 |

Q 3. Has student use of Notebooks within the classroom affected your **style of teaching**? **Tick** the appropriate response.

- Yes
- No
- Don't know

If you answered **yes**, please explain briefly how Notebook use has affected your style of teaching.

Q 4. Has the student Notebook use changed **your role as a teacher** in any of the following ways ? **Circle** on the 1 to 5 scale given below for each of the following statements.

Strongly disagree

Neutral

Strongly agree

1

2

3

4

5

(a) The teacher becomes more of a facilitator rather than director of learning.

1

2

3

4

5

(b) The teacher spends less time “lecturing” (less teacher centred instruction).

1

2

3

4

5

(c) The students spend more time collaborating with each other.

1

2

3

4

5

(d) The students use their Notebooks for greater independent work and learning.

1

2

3

4

5

Q 5. What kind of impact do you think the use of Notebooks has had on student thinking and learning processes? **Tick** one box only in each column.

S stream students

K stream students

Negative impact

No impact

Positive impact

No comment

Are there any comments you wish to make related to your responses to this question?

Q 6. Considering the students you have taught, in general, how do you think Notebook use has influenced them in each of the following areas?

Read the statements and **circle** the number which best describes your response.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

(a) The Notebook has helped students to organise their work more effectively.

1	2	3	4	5
----------	----------	----------	----------	----------

(b) The Notebook has helped students to increase their productivity.

1	2	3	4	5
----------	----------	----------	----------	----------

(c) The Notebook has saved students time in the classroom.

1	2	3	4	5
----------	----------	----------	----------	----------

(d) The Notebook has improved the quality of student work.

1	2	3	4	5
----------	----------	----------	----------	----------

(e) The Notebook has increased student motivation and interest in learning.

1	2	3	4	5
----------	----------	----------	----------	----------

Are there any comments you wish to make related to your response to this question?

Q 7. Have you adapted and/or modified your lesson plans/teaching to integrate the use of Notebook technology within your Notebook class(es).

Yes - A great deal

Yes - A little

No -

Q 8. (a) Approximately what percentage of the **class time** in your Form 3 notebook class(es) involved student use of Notebooks? **Circle** your response.

0 10 20 30 40 50 60 70 80 90 100

(b) Approximately what percentage of the **homework** for your Form 3 notebook class(es) involved using Notebook technology? **Circle** your response.

0 10 20 30 40 50 60 70 80 90 100

(c) Which of the following programs did the **students** use regularly (at least once a month) in your Form 3 Notebook class(es) in 2000. **Tick** as many boxes as appropriate.

Word processing (e.g. Microsoft Word)

Graphics/ drawing (e.g. Draw programs)

Spreadsheets and graphing (e.g. Microsoft Excel)

Presentations (e.g. Microsoft Powerpoint)

(e.g. Inspiration)

Internet (e.g. Internet Explorer)

Please list any other software programmes you may have regularly (at least once a month) used in your Notebook classes

Q 9. If you were able to choose, which kind of class would you prefer to work with? **Tick** the following possibility that best reflects your preferred choice.

A class where Notebooks are used regularly

A class where Notebooks are used occasionally

A class where Notebooks are used rarely or infrequently

A class without any Notebook use at all

Q 10. With regard to your own views about the SKC Notebook programme, indicate your response to the following statements. **Circle** your response on the scale provided.

How would you rate your **enthusiasm** for the use of Notebooks in classes?

Unenthusiastic			Neutral			Very enthusiastic
1	2	3	4	5	6	7

How would you rate your **support** for the Notebook programme?

Negative			Neutral			Positive
1	2	3	4	5	6	7

How **worthwhile** do you consider the Notebook programme?

Not worthwhile			Neutral			Very worthwhile
1	2	3	4	5	6	7

How **effective** do you consider the student Notebook programme?

Not effective			Neutral			Very effective
1	2	3	4	5	6	7

How **beneficial** to student learning is the use of Notebooks in class?

(a) For Higher ability students (e.g. S stream students)

No benefit			Moderate benefit			Great benefit
1	2	3	4	5	6	7

(b) For lower ability students (e.g. K stream students)

No benefit			Moderate benefit			Great benefit
1	2	3	4	5	6	7

How would you rate your own **ability to teach effectively** with a Notebook class?

Not effective			Satisfactory			Very effective
1	2	3	4	5	6	7

Q 11. (a) Looking back on the year 2000, are there any **issues** you feel the College needs to consider in relation to the Notebook programme at SKC? Also, please list any recurring **problems** you encountered with your Notebook class(es).

(b) Are there any **suggestions** or **ideas** you might have you would like share which may enable the College to improve the Notebook programme and make it more effective for the future?

*Thank you for taking the time to complete this survey questionnaire.
When the research has been completed you will be able to view a summary of the findings.*

APPENDIX H

Student questionnaire

Massey University Research
Notebook Computer Study 2001
Student Survey



Thank you for taking the time to answer the following questionnaire.

All information provided will remain **confidential** and will be used only for the purposes of this research.

Please attempt to answer **all** questions. Mark with **ticks** the appropriate box(es) or **circle** your responses, and write any comments you wish to make on the lines provided.

Q 1. In what year did you **begin** to use your Notebook computer **in lessons** ?

- | | | |
|---------------|--------------------------|----------------------------|
| 2000 (Form 3) | <input type="checkbox"/> | (Tick one box only) |
| 1999 (Form 2) | <input type="checkbox"/> | |
| 1998 (Form 1) | <input type="checkbox"/> | |

Q 2. In Form 3, how often did you use your Notebook computer **in your classes**?
(Tick **one** box only for each subject area)

	English	Maths	Science	Social Studies
All the time (in every lesson)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Regularly (every day)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Occasionally (most days in a week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rarely (once in a while)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Never	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q 3. In Form 3, how often did you use your Notebook computer **at home**?

- | | | |
|----------------------------------|--------------------------|----------------------------|
| Regularly (every week day) | <input type="checkbox"/> | (Tick one box only) |
| Frequently (most days in a week) | <input type="checkbox"/> | |
| Occasionally (once a week) | <input type="checkbox"/> | |
| Rarely (once in a while) | <input type="checkbox"/> | |
| Never | <input type="checkbox"/> | |

Continues/

Q 4. How do you think using a Notebook computer has affected the standard of your school work? (**Tick** only **one** of the following options.)

It has had a positive effect on my work

It has had little effect on my work

It has had no effect on my work

It has had a negative effect on my work

Is there any other comment you wish to make? _____

Q 5. For each of the core subjects listed below; what has been the **effect of your use** of a Notebook in these subjects? **Tick** the most appropriate response in each row.

	Negative effect	No effect	Positive effect	Don't know
English	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mathematics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social Studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Are there any other subject areas where your use of the Notebook has had an effect? Please list them below in the spaces provided. If none come to mind simply leave it blank.

Subject(s)	Effect (positive or negative)
_____	_____
_____	_____

Q 6. From the list please **rank in order** the **three most common uses** of your Notebook **in class**. Simply list the letters (for example: **B**)

C
E

A : Graphics/drawing,

B : Information gathering, (e.g. CD roms and/or using the Internet)

C : Information sorting,

D : Note taking,

E : Spreadsheets,

F : Subject specific/based software

(e.g. French vocab programme, Maths revision, etc.)

In Rank order : **First** (most common use) _____

Second _____

Third _____

If there is an important use not mentioned in the list above which you wish to record, please do so below. If none comes to mind simply leave it blank.

Another important use for me is _____

Q 7. How would you describe your **ability** when using the following types of software. In each case **circle** the most appropriate number.

Very Poor

1

“I always need help”

Poor

2

“I sometimes need help”

Average

3

“I rarely need help”

Good

4

“I never need help”

Very Good

5

“I can help other people, I’m an expert”

(a) Word processing (e.g. using Microsoft Word)

1

2

3

4

5

(b) Graphics/ drawing (e.g. using Draw programs)

1

2

3

4

5

(c) Spreadsheets and graphing (e.g. using Microsoft Excel)

1

2

3

4

5

(d) Presentations (e.g. using Microsoft Powerpoint)

1

2

3

4

5

Continues/

Q 8. How do you feel about using your Notebook in class during lessons?
Tick the statement which best describes your feelings.

I dislike using it

I don't mind using it

I like using it

I don't care – I have no opinion

Q 9. How would you describe your level of agreement or disagreement with the following statements. In each case **circle** the most appropriate number.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

(a) *I enjoy playing games on computers.*

1	2	3	4	5
----------	----------	----------	----------	----------

(b) *I prefer to use computers to do school work.*

1	2	3	4	5
----------	----------	----------	----------	----------

(c) *Computers make schoolwork more fun/interesting.*

1	2	3	4	5
----------	----------	----------	----------	----------

(d) *Computers make schoolwork easier to do.*

1	2	3	4	5
----------	----------	----------	----------	----------

(e) *Computers help me to improve the quality of my school work.*

1	2	3	4	5
----------	----------	----------	----------	----------

(f) *Computers help me understand my classes better.*

1	2	3	4	5
----------	----------	----------	----------	----------

Continues/

Q 10. (a) From the list below select the following skills that have been most directly affected **positively** by your use of the Notebook during your schooling?
Tick as many of the responses as you feel are appropriate.

- Note making on my own
- Note taking/recording in class
- Neat presentation of my work
- Correct spelling of my work
- Keeping my work organised
- Researching information
- Doing homework
- Other Please state _____

(b) From the same list below select which of the following skill has been most directly affected **negatively** by your use of the Notebook during your schooling?
Tick as many of the responses as you feel are appropriate.

- Note making on my own
- Note taking/recording in class
- Neat presentation of my work
- Correct spelling of my work
- Keeping my work organised
- Researching information
- Doing homework
- Other Please state _____

Q11. Do you think using a Notebook changed the way you learnt last year?
Tick your response.

- | | |
|------------|--------------------------|
| No | <input type="checkbox"/> |
| Not sure | <input type="checkbox"/> |
| Maybe | <input type="checkbox"/> |
| Yes | <input type="checkbox"/> |
| No comment | <input type="checkbox"/> |

Is there any comment you wish to make about how it has changed the way you learnt?

Q12. Which of the following possible Notebook computer problems (if any) did you experience in Form 3? **Tick** as many boxes as you want.

- | | |
|---------------------------------------|--------------------------|
| Lost files/folders | <input type="checkbox"/> |
| Software malfunctions/problems | <input type="checkbox"/> |
| Virus infections/damage | <input type="checkbox"/> |
| Screen failure or damage | <input type="checkbox"/> |
| Battery failure/fault | <input type="checkbox"/> |
| Mains adaptor failure/fault | <input type="checkbox"/> |
| Hard drive failure/faults | <input type="checkbox"/> |
| No faults or problems during the year | <input type="checkbox"/> |

Would you like to comment about any problems you encountered?

Q 13. Which of the following possible Notebook related problems (if any) were a concern to you personally last year ? **Tick** as many boxes as you want.

- | | |
|----------------------------------|--------------------------|
| Storage problems at school | <input type="checkbox"/> |
| Transport problems (e.g. on bus) | <input type="checkbox"/> |
| Carrying weight during school | <input type="checkbox"/> |
| Using the Notebook keyboard | <input type="checkbox"/> |
| Printing off my work | <input type="checkbox"/> |
| Revising for tests/exams | <input type="checkbox"/> |
| No real problems for me | <input type="checkbox"/> |

Would you like to comment about any other problems or issues you encountered using your Notebook?

Q 14. If you were able to choose; which kind of class would you prefer to work in? **Tick** one of the following statements that reflects your preferred choice.

- | | |
|---|--------------------------|
| A class where Notebooks are used regularly | <input type="checkbox"/> |
| A class where Notebooks are used occasionally | <input type="checkbox"/> |
| A class where Notebooks are used rarely or infrequently | <input type="checkbox"/> |
| A class without any Notebook use at all | <input type="checkbox"/> |

Q 15. Do you think having a Notebook computer in Form 3 was worthwhile? **Circle** your response on the 1 to 5 scale.

Not worthwhile		No view/Neutral		Very worthwhile
1	2	3	4	5

Continues/

Q 16. (a) Looking back on the year 2000 and your time in Form 3, are there any issues you feel the College needs to consider and look at in relation to the Notebook programme at SKC?

(b) Are there any suggestions or ideas you would like share which may enable the College to make the Notebook programme better and more effective in the future?

Q 17. Read the statements and **circle** the number that best describes your attitude or feelings to each of the following statements.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

(a) The Notebook has helped me to organise my **work more effectively**

1	2	3	4	5
----------	----------	----------	----------	----------

(b) The Notebook has helped me to increase the **amount of work I can do** (that is, my productivity)

1	2	3	4	5
----------	----------	----------	----------	----------

(c) Using my Notebook has **saved me time in the classroom**

1	2	3	4	5
----------	----------	----------	----------	----------

(d) Using my Notebook has **saved me time outside of class** (e.g. on homework)

1	2	3	4	5
----------	----------	----------	----------	----------

Continues/

Q 18. How effectively did your teachers use Notebook technology during your classroom experience in Form 3? **Circle** your response on the 1 to 5 scale.

Very poorly

As well as I expected

Very well

1

2

3

4

5

Q 19. Did some subjects and/or teachers make better use than others of Notebook technology?

Yes

No

Can't really say

If you answered **Yes** – in which subject(s) do you feel you made better use of your Notebook? (List as many as you like.)

Q 20. If asked for advice by a pupil considering joining the SKC Notebook programme, What would be your response? **Tick** the statement which best reflects your likely reply to a potential new pupil.

NO - Don't join up if you can avoid it

YES - Go for it, it's a good thing

DON'T KNOW -It's not that important, I really haven't got a firm view

Or in your own words, I would say to him? _____

If you answered either **NO** or **YES** to question 20 above,
Please write a sentence or two to explaining the reason for your answer.

Continues/

Finally, if there are any other comments you wish to make regarding this study into the Notebook programme at Saint Kentigern College, please do so in the space provided below.

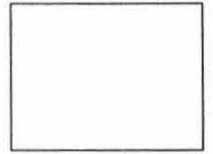
*Thank you for taking the time to complete this survey questionnaire.
When the research has been completed you will be able to view a summary of the findings.*

D.A.McQueen
Principal Researcher – August 2001

APPENDIX I

Parent questionnaire

**Massey University Research
Notebook Computer Study 2001
Parent Survey**



Thank you for taking the time to answer the following questionnaire.
All information provided will remain **confidential**. It will be used only for the purposes of this research, and the number on the form is purely for administration purposes.

Please attempt to answer **all** questions. Mark with **ticks** the appropriate box(es) or **circle** your responses, and write any comments you wish to make on the lines provided.

Q 1. Which year did your son **first** use his own Notebook computer. **Tick** one box only.

2000 (Form 3)

1999 (Form 2)

1998 (Form 1)

1997 or earlier (primary school)

Q 2. (a) In Form 3 how often did your son use his Notebook computer **at home**, for either school work or another use? **Tick** one box only.

Regularly (every week day)

Frequently (most days in a week)

Occasionally (once a week)

Rarely (once in a while)

Never

(b) Did your son make significant use of another computer (e.g. a desktop computer) at home to complete his school work? **Exclude** the use of another computer simply for printing off homework and other material.

Yes

No

continues/

Q 3. What influence did the fact that Saint Kentigern College had a Notebook programme in Form 3 have in your decision to enrol your son at the College ? **Tick** one box only.

A positive factor

A negative factor

No influence at all

My son already attended SKC (in Form 2)

Please make a comment below regarding this question, if you so wish:

Q 4. On the **1 to 5** scale given below, how do you see the involvement in a Notebook programme as benefiting your son? Please **circle** your response.

(a) Vocational benefit

Low
1

2

3

4

High
5

(b) Educational Benefit

Low
1

2

3

4

High
5

Is there any comment you wish to make related to this question?

continues/

Q 5. How do you think using a Notebook computer has affected the quality of your son's school work. **Tick** only **one** of the following options.

had a positive effect on his work

had little effect on his work

had no effect on his work

had a negative effect on his work

Q 6. If you had the choice, which kind of class environment would you prefer your son to work in ? Read the possibilities and **tick** the one that reflects your preferred choice.

a class where Notebooks are used regularly

a class where Notebooks are used occasionally

a class where Notebooks are used rarely or infrequently

a class with no Notebook use at all

Q 7. Please express your own views about the SKC Notebook programme, indicating your responses to the following questions. **Circle** your response on the scale provided.

(a) How would you rate your **enthusiasm** for the use of Notebooks in classes?

Unenthusiastic			Neutral			Very enthusiastic
1	2	3	4	5	6	7

(b) How would you rate your **support** for the student Notebook programme?

Negative			Neutral			Positive
1	2	3	4	5	6	7

continues/

(c) How **effective** do you consider the student Notebook programme?

Not effective			Neutral			Very effective
1	2	3	4	5	6	7

(d) How **beneficial** to students is the use of Notebook technology in learning?

No benefit			Moderate benefit			Great benefit
1	2	3	4	5	6	7

(e) How would you **rate your son's enthusiasm** for use of notebook technology?

Unenthusiastic			Neutral			Very enthusiastic
1	2	3	4	5	6	7

Q 8. (a) Please list any **positive** effects you have observed with regard to your son's learning last year which you would attribute to his use of a Notebook computer.

(b) Please list any **negative** effects you have observed with regard to your son's learning last year which you would attribute to his use of a Notebook computer.

continues/

Q 9. (a) Looking back on the year 2000, are there any **issues** you feel the College needs to consider in relation to the Notebook programme at SKC? Please list any recurring **problems** or **difficulties** you or your son encountered with his Notebook.

(b) Are there any **suggestions** or **ideas** you would like share which may enable the College to improve the Notebook programme and make it more effective in the future ?

Q 10. How would you describe your own knowledge and understanding of computers and Information Communication Technology (ICT) ?

Tick the statement which best describes you.

I have **no** knowledge or understanding of computers and ICT

I have **limited** knowledge and understanding of computers and ICT

I have a **reasonable** knowledge and understanding of computers and ICT

I have a **good** knowledge and understanding of computers and ICT

I have an **excellent** knowledge and understanding of computers and ICT

I would prefer not to answer this question

Thank you for taking the time to complete this survey questionnaire.

When the research has been completed you will be able to view a summary of the findings.

D.A.McQueen

Principal Researcher – July 2001

APPENDIX J

Sampling timeline

Research data collection

Time line

Draft surveys – Term 2 2001

The three survey instruments were initially peer reviewed in April to June by the following:

Walter Chieng	Director of Information Communication Technology SKC
Warwick Bell	Associate Principal SKC
Michael Green	Teacher in charge of Journalism SKC
Kevin Bishop	Head of Music SKC
Peter McQueen	Retired Senior Lecturer Auckland College of Education
Mark Brown	Supervisor Massey University

Pretest sampling - Term 2 2001

Parent survey	2 samples 22 May 2001
Staff survey	5 samples 30 May 2001
Student survey	25 5SV students 31 May 2001
	26 5SS students 7 June 2001

Sampling - Term 2 and 3 2001

Staff – 29 questionnaires were distributed 26 June 2001 (Final week of Term 2)

Reminder/thanks emails in Week 1 Term 3.

Closing date 27 July (ie: at the end of Week 2 Term 3)

A total of 26 out of 29 questionnaires distributed to all staff at the College who taught Year 9 classes in 2000, were returned completed with signed consent forms.

This equates to a **90%** response rate. Given that there were at the time of sampling 84 full and part time academic staff at the College, the completed staff questionnaire sample is approximately 31 % of the total staff population.

Parent – 67 questionnaires (to 62 families, as small number of parents had two legal guardians) were distributed by post 13 July 2001

Reminder/thanks letter posted 24 July.

Second reminder (with replacement questionnaires posted 5 August).

Final cut off for inclusion in the study – 13 August.

Total sample 49 out of the 65 questionnaires distributed were completed and returned.

This equates to a response rate of **75%**.

Student – 34 students completed the student questionnaires and consent forms during Period 0 on Monday 3 September in the College Library. Fourteen students involved in choir rehearsals were unable to attend and were subsequently surveyed on Tuesday and Wednesday 4 and 5 September in the Careers room.

Focus groups - Term 4 2001

Staff

Wednesday 17 October 4 Female and 1 Male staff

Friday 26 October 2 Male staff

Student

Friday 2 November A group of 12 students

APPENDIX K

Parent covering letter



Massey University

COLLEGE OF EDUCATION
Te Kupenga o Te Mātauranga

9 July 2001

Dear Parent/Guardian

I am writing to seek your cooperation to participate in a formal study of the Saint Kentigern College notebook programme. The Trust Board and Senior Management have agreed to my thesis research, which will involve a case study of the year 2000 Form 3 notebook programme.

As outlined in detail in the enclosed "information sheet" the research requires student, staff and parental input to ensure a fair and representative study is completed. Your family has been selected from the Form 4 student database to participate in this research project.

Please read the enclosed material (information sheet, consent form, and parent survey questionnaire) and I would ask that if you are willing to participate in the study, please complete the consent form, which also seeks your approval for your son to partake of the study in due course during term 3.

Once you have completed the parent survey questionnaire, which should take between 10-15 minutes, please return your questionnaire together with your signed consent form in the stamped addressed envelope provided, by Friday 27 July. The questionnaires are numbered simply for administrative purposes and as outlined on the information sheet the identities of all study participants will remain confidential.

If you have any questions and/or would like further information before collecting the questionnaire survey, please do not hesitate to contact me directly, and my contact details are on the enclosed information sheet.

May I take this opportunity to thank you in advance for your cooperation and support of this valuable research study. I believe the information gathered will be beneficial and may assist in further improvements and refinements of the college notebook programme.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Duncan McQueen', with a horizontal line underneath.

Duncan McQueen
HOD General Science & Form 3 Dean

APPENDIX L

Parent reminder letter

APPENDIX M

Second parent reminder letter

Dear Parent/Guardian

Re: Form 4 Notebook Survey 2001

This letter is to request your agreement /approval for your son to participate in the next phase of the research, namely the student survey and the optional follow up discussion groups. As yet I have not received your completed parent questionnaire, and I appreciate that some parents may prefer not to participate in the parent phase of the research project.

I have enclosed a copy of the consent form (identical to the one posted in the original mailer) and would ask that if you are willing for your son to take part in the study you sign and return it in the enclosed self addressed envelop.

If you are willing to participate in this formal research into the Notebook programme it is not too late to return your parent survey questionnaire (which should take between 10 to 15 minutes to complete), together with your signed consent form as soon as possible. If you have any questions and/or would like further information before completing the questionnaire survey, please do not hesitate to contact me directly (details below). If by chance you have mislaid your original survey questionnaire please do contact me and I will provide another copy by post or if you prefer by email, to enable you to participate in the study.

However may I stress the prime purpose of this letter is to seek your signed approval for your son to participate in the student phase of the research project.

May I take this opportunity to thank you in advance for your cooperation and support of this valuable research study. I firmly believe the data collected during this research will be highly beneficial and will assist in future developments of the College Notebook programme.

Yours sincerely



Duncan McQueen
Wishart House Leader
Head of General Science

Contact details:

[Redacted contact details]

APPENDIX N

Staff group discussion questions

General interview schedule for staff

Staff sample – semi structured focus group discussion

Welcome & introduction.

Explain once again the study, and the use of audio recording of the focus group discussions. Get Staff to agree to and sign consent form re discussion group participation.

Emphasise that the focus is on 2000 Year 9 intake, however any general comments will be appreciated. *Distribute summaries of questionnaire data.*

Starter questions

Re Q 3 “How do you think using Notebooks has altered your style of teaching?” (*see Summary of Staff comments*)

Q4 : Has Notebook use influenced any of these areas/roles ?
(*see questionnaire Q4 data*)

Q 5 : Do you feel these results re : S (higher ability) & K (mixed ability) stream differences are valid?
(*see graphical summary Q 5 and also Q10 re benefits of the programme*)

Q6 : Do you feel these results reflect the general pattern re influence of Notebooks on students (*see graphical summary 6 (a) – (e)*)

Q 9: “notebook vs non Notebook classes”
Do you believe the results regarding staff preference are representative (and the feelings of all staff - recognising this sample was only staff who took Y9 in 2000)

Q 10: Looking at the graphical information regarding “staff personal views about the SKC Notebook programme”

Are there any results you wish to comment on?
Re: enthusiasm, support, value, effectiveness,

Own ability to teach effectively within a Notebook class environment?

Q: Are there any general comments you wish to make ?

APPENDIX O

Student group discussion questions

General interview schedule for students

Student sample – semi structured focus group discussion

Welcome & introduction.

Explain once again the study, and the use of audio recording of the focus group discussions. Get Students to agree to and sign consent form re discussion group participation.

The focus is on your time in Year 9 in 2000 however any general comments will be appreciated. *Distribute summaries of questionnaire data.*

Starter questions

Q2& 3 :Are these figures as you would expect re Notebook use ?

Q4 . How has using a Notebook computer affected you and your work ? (has it had different effects in different subjects?)

Q6 : Would you agree on the three most common uses of the Notebook in class ? (eg: 1 Note taking, 2 Info gathering, 3 Information sorting)

Q8: How do you feel about using your Notebook in lessons ?

Lets consider the results of Q9, would you agree with these figures, do any of them surprise you ?

Q10 & 11 The positives and negatives of Notebook use

Q11 Many students felt Notebook use had changed the way they had learn .. In what ways do you think this is so ?

Q12 & 13 Problems with your machine ! (do you agree with these figures?)

Q14. If given the option would you want to be a Notebook class or not ?

Q15 – Lets consider these statements - any feedback / comments ?

Q18. Did your teachers make use of the Notebooks in your classes last year ? How effective was it?

Finally

Q: If I asked you each to answer the follow, what would you say & why ?

Presuming he had a choice - How would you advise a new student as to whether to join the Notebook programme or not

Q: Are there any general comments you wish to make ?

APPENDIX P

MUHEC Ethics application for the proposed research

Application to MUHEC
Re: Duncan A McQueen
Med Admin Thesis Research 187.893
Topic: Notebook technology - An ICT innovation

1. DESCRIPTION

Justification

There is an increasing emphasis and importance of Information Communication Technology (ICT) within the national educational context. This is a reflection of the international focus on the increasing use of notebook technology in education. This thesis research intends to make a significant contribution regarding future possible ICT programme developments with respect to enhancing successful learning strategies using notebook technology.

The aim of the research is to undertake a case study of the Saint Kentigern College (SKC) computer notebook programme, with particular reference to the year 2000 Form 3 intake, which will be considered a 'bounded system'. This study will describe the value and educational benefits of the notebook programme as it is perceived by those groups directly or indirectly associated with it, that is, the students, staff, and parents.

It will be a 'descriptive' research project, with the primary aim to acquire further knowledge and understanding of the notebook programme at Saint Kentigern College (Anderson, 1998).

The year 2000 witnessed the implementation of the first full year group notebook assisted learning programme for Form 3 (Year 9) at Saint Kentigern College. SKC in partnership with Toshiba New Zealand have during the past four years introduced the Student Notebook Access Plan (SNAP) at the college. The college administration has the expressed goal of having all students utilising notebook technology as a tool in their curriculum studies by 2003. SKC is one of the lead schools for this ICT innovation and takes an active role in the promotion and development of New Zealand based notebook programmes.

As Third Form Dean I have the responsibility for the overall academic programme of the students, and have regular contact with students, staff and parents, some of whom are unfamiliar with the college notebook programme and at times skeptical of the benefits and use of this ICT innovation within the classroom context. I am also a committed notebook teacher, and four of my five science groups this year (2001) are notebook classes. For these reasons I am keen to research and determine the benefits of this significant development at the college

Objectives

The objectives of this research will be to:

- (1) Survey students, staff and parents regarding the Saint Kentigern College (SKC) computer notebook programme.
- (2) Describe the perceptions of these groups.
- (3) Identify key issues and concerns.
- (4) Evaluate the 'effectiveness' of the notebook programme at SKC. Draw some considered conclusions regarding notebook programme in middle school education at SKC.

Procedures for recruiting participants and obtaining informed consent

The students will be randomly selected from within a stratified sample population, that is, the eight Form 4 (Year 10) class groups. This will be achieved by assigning each student in a class group with a number and randomly selecting from a numerical list, using a random number generator. Approximately 8 – 10 members per class will be selected. This will be repeated across all Form Four (Year 10) classes and it is expected the total sample will not exceed 75 students. These classes are, in part, banded according to ability and thus by stratified random sampling any potential bias may be reduced. The sample will exclude any new students who were not present at the college in Year 9.

The parents of Year 9 students will be selected (sample size yet to be determined). A list generated from the college database will be used and parents of the randomly selected students will be contacted by letter. The letter will outline the purpose of the research and seek their agreement (ie: informed consent) to participate and permit their son's participation in the study. If they respond positively, they will be sent a written questionnaire to complete.

The staff sample will be a randomly selected subgroup from the total college staff, which includes only those staff who taught either core curriculum (English, Mathematics, Science and Social Studies) or subject option classes (French, Japanese, Latin, Maori, Music and Drama) at the Year 9 level in 2000. At this stage a suggested sample size of 12 –15 staff is proposed. They will be asked to complete a questionnaire, with a number of identical questions to those in the student questionnaire, to permit comparison between the two groups, that is, the "providers" and the "users" in their responses to specific issues.

Procedures in which research participants will be involved

The research will involve questionnaires, in conjunction with an additional sample of semi-structured personal interviews and/or focus group discussions with those involved in the notebook programme at SKC eg; the relevant student / staff / parents groups. The goal of the

focus group discussions with students, will be to engender participant feedback regarding the quantitative data collected in the questionnaires, and to reflect and record general observations. This additional sampling method may assist in establishing the validation and reliability of the questionnaire data.

Procedures for handling information and material produced in the course of the research including raw data and final research report(s)

The information collected in the course of this research will be kept in a secure office, either at Saint Kentigern College, or in my private residence. The final thesis will be submitted to Massey University for assessment, and a personal copy will be retained and another additional copy passed on to the Headmaster / SKC Trust Board for their information and consideration.

Procedures for sharing information with research participants

A summary of the information gathered in the course of this research will hopefully be published in the regular College newsletter. Students, parents and / or staff may at any time ask to see the record of their own response. However the availability of detailed information rather than summary information will be subject to participant confidentiality and also any issues considered potentially 'commercially sensitive' may not be released into the public domain.

Arrangements for storage and security, return, disposal or destruction of data

The data collected will be stored in the study room of the private resident. Initially on the days of data collection at the study site, the data (primarily in the form of questionnaire responses and possibly audio tapes) will be stored in the shared office (with one coworker within the Science Department) of the researcher. This is locked when no staff member is present, and has restricted staff only entry.

No data will be returned to participants, unless specifically requested. On completion of the research, and after the examination of the thesis, and in consultation with the research supervisor all written records will be destroyed and audio tapes will be erased.

2. ETHICAL CONCERNS

2.1. Access to participants

The proposed research will occur at Saint Kentigern College (SKC) in Auckland New Zealand. SKC is an independent boys school, with a roll of approximate 1100 students, from Years 7 to 13. The proposed study will formally commence in March 2001, and will be completed by November 2001.

Potential participants are members of the SKC community and as such access will be largely occur on the college site. Parents will be contacted by post and/or telephone, and their participation will largely be by written questionnaires completed off site.

2.2. Informed consent

The study will be undertaken with the approval of the Headmaster and the Saint Kentigern Trust Board. All participants will be informed of their individual rights and the purpose of the research will be clearly explained. Anderson (1998) outlined six basic elements that must be respected when seeking permission from potential study participants, and these will be adopted in this research. Voluntary written informed consent of all parties stating their agreement to participate in the study will be obtained.

This informed consent will be reaffirmed specifically when permission is sought to audio-tape students involved in the small group discussion groups. The tapes will be used to aid the field notes recorded during the discussion groups and will not be directly transcribed. These tapes will be erased at the completion of the study.

2.3. Anonymity and confidentiality

All individual data collected will remain confidential, and any personal responses cited in the research project will be anonymous. This study maintains that “the principle of confidentiality will operate to protect private and personal data from unnegotiated dissemination” (Simons, 1989: 126).

2.4. Potential harm to participants

None is considered likely.

2.5. Potential harm to researcher(s)

None is considered likely.

2.6. Potential harm to the University

None is considered likely.

2.7. Participant’s right to decline to take part

All participants will have the right to decline to take part in this research. Their right to non participation, without prejudice, will be outlined in the written information sheet. Participants having agreed and signed the informed consent form, may at any time decline to participate any further, and may withdraw from the study. They may also request that any contributions they have made be removed from the study, and any related documents destroyed.

2.8. Uses of the information

The dissemination of data collected is another ethical issue, and this has yet to be addressed. In consultation with the Headmaster of the College and my Supervisor Mark Brown, the clarification of who will be entitled to view the completed research project will be determined. The question of control of the information will also be addressed, as conflict may arise as to who has the right to control the publicity of the completed report, and the intended audience(s) will be determined at the outset of the research.

However it is evident that one of the functions of this case study will be to provide information and feedback to the College administration related to the notebook programme currently being implemented at Saint Kentigern College. There is a recognised risk that the case study evaluation of the notebook programme may be “used for legitimisation and advocacy rather than critique and enrichment in the system” (Simons, 1989: 132). This is not the intention of this study, for as we look ahead to the next decade the role and significance that ICT will play seems set to increase. Thus a specific site based case study will generate information that will have great benefits for future developments and refinements of the notebook programme at SKC. It may also have broader applications to other educational institutions considering implementing similar technological rich learning programmes.

2.9. Conflict of interest/Conflict of roles

As both the researcher of, and also a participant in the notebook programme as a classroom teacher and as the Form 3 Dean, my professional and research roles could conceivably have an influence on the material collected. While recognising this factor I do not believe that my roles and responsibilities within the college will have a significant impact on the data collected. However it is essential to be aware of the dual roles that I will have within the context of this study. There will be a degree of tacit knowledge, that as a member of the community in which the research is to take place, I will bring to this project some prior knowledge and personal attitudes. This acknowledgement of my multiple roles and influences is essential in the research progress, for as Merriam (1998) states it is important to clarify the position of the researcher at the start of any study.

2.10. Other ethical concerns

None have been considered likely at this stage of the research.

3. LEGAL CONCERNS

3.1. Legislation

- 3.1.1.** Intellectual Property legislation e.g. Copyright Act 1994
Not applicable
- 3.1.2.** Human Rights Act 1993
This is applicable in terms of the relationship between the researcher and any and all participants involved in the research process.
- 3.1.3.** Privacy Act 1993
This is applicable in terms of the relationship between the researcher and any and all participants involved in the research process.
- 3.1.4.** Health and Safety in Employment Act 1992
Not applicable
- 3.1.5.** Accident Insurance Act 1998
Not applicable
- 3.1.6.** Employment Relations Act 2000
Not applicable

3.2. Other legal issues

None considered relevant at this stage

4. CULTURAL CONCERNS

This research will involve individuals of a number of ethnic groups. Sensitivity will be needed to ensure cultural customs and protocols are observed and respected. However the main focus of the research is technology related and as such has little social impact relative to differing cultural perspectives.

5. OTHER ETHICAL BODIES RELEVANT TO THIS RESEARCH

5.1. Ethics committees

This research proposal has not been referred to any other ethics committees.

5.2. Professional codes

This research is not subject to any other professional codes.

6. OTHER RELEVANT ISSUES

No issues other than those outlined in the information supplied, require discussion at this stage.

APPENDIX Q

**Massey University College of Education Ethics
Committee approval**

Massey University College of Education

College Ethics Committee

RESEARCH PROPOSAL REVIEW

Name of Applicant(s) Duncan McQueen

Title of Research A case study of a student notebook programme

THE PROPOSAL IS:

- Approved without change
 - Approved with minor amendments (as listed at Amendments below)
 - Not approved until completion of amendments (as listed at Amendments below)
- Submit to MUHEC

AMENDMENTS

NOTES

Replaces original approval certificate dated 30.05.01

REVIEWER

Name Joy Cullen **Contact telephone number** (██████████)

Signature (*received via email*) **Date** 12.12.01