"Are Schools ready to go Online?"

A study that examines the current state of Information and Communication Technologies in secondary schools and explores the possibility of the introduction of a more flexible educational structure though online technology.

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STATEMENT OF ORIGINALITY

I hereby certify that the work embodied in this thesis is the result of original research. This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Abstract

This study investigated the extent to which secondary schools utilised online technologies and eLearning within the curriculum. It explored computer technology practices and perceptions of students and teachers as well as the technology development strategies deployed by principals in ten secondary schools. The learning content of each school's web page was also examined. It was intended that the study's findings would add to current research about student and teacher computer practices, the integration of ICT with pedagogy and the current state of eLearning practice within schools.

The research was conducted using a case study methodology for each of the ten schools and collectively, utilising both quantitative and qualitative approaches. This enabled a holistic interpretation of the data, and was followed by a documentary analysis of the learning content in each school's web presence. This analysis required the development of a rubric (called the eFactor) which was used to categorise and evaluate each school's web learning content.

The data analysis findings were compared with earlier and current research about computer technology use to identify patterns of similarity and difference between existing research and this study. Similarity was found with students being more frequent users of the Internet than their teachers (Avery et al., 2007) as well as being more adept at using a wider range of computer technology than most of their teachers (Negroponte, 1995; Trinidad et al., 2005). Confirmation too that older members of the teaching staff were more reluctant to use computer technology and less inclined to nominate any educational value for that technology (Cuban, 2001).

However, other factors have emerged that may influence school computer technology utilisation and online learning practice. Across the sample of schools, there appeared to be little difference in the nature and extent of female and male student computer use for school-related purposes. One of the most compelling findings was that schools with more comprehensive technology and learning strategies, actively fostered by the school leadership, had the greatest interactive learning presence on their web pages. Schools with the least amount of interactive web presence preferred to focus strategies on achieving technology competence and usually in just one software application.

The criteria established for the documentary analysis of each school's web presence provided a score (the eFactor) allocated to each school according to that school's use of its webpage for learning. The case study findings were also able to identify

common practices and strategies of schools which enabled the establishment of three school groups based on the eFactor being low, medium a or high. The case studies also discriminated between the practices of the schools within each of the groups thereby enabling a clear distinction about the allocations of schools to the three groups.

Schools' adoption of an effective online learning presence requires the development of Information Communications Technology with curriculum pedagogy and is the basis for further research. This study has provided clarification on how Internet learning can be classified thereby enabling a guideline for the development of effective learning tasks. The study has also established a link between the type of technology strategies implemented in a school and the online learning presence of that school. The deployment of multiple technology strategies with pedagogical underpinnings contributes to the diversity of eLearning and the awareness of a wider learning environment.

Chapter One: Introduction and Overview of the Study

1.0 Background to the study

The unprecedented growth of technology has been a significant characteristic of the last fifty years. Technological development has impacted on the fabric of human interaction and existence and it has been developing according to its specified use from military to broader civilian applications. The use of the personal computer has grown dramatically from its genesis as an unsophisticated data reader. Computer use today is viewed as an essential ingredient to remaining competitive and resulting in increased productivity and efficiency (ILO, 2000). Countries such as Canada, the United Kingdom and the United States recorded, in 2005, that approximately 75% of their populations use computers at home, school or work (Pew Global, 2006). Education is one of the many strata of a nation's development where the permeation of computer technologies has impacted. The adoption of a technology footing within the education sector by government is part of the overall national development strategy to be competitive and invest in a knowledge future. The implementation of computer technology in education and the potential for its growth has only been limited by the capacity of individuals, organisations and countries to acquire and deploy the necessary technology skills, resources and strategies.

Since the early eighties, developed nations and organisations such as the European Union and the United Nations have recognized the importance of Information Communications Technology (ICT). These organisations and their member countries mobilised human and financial resources to plan, strategise and develop the growth potential of countries using ICT (Rodriguez, 2004). Legislation, such as the 'High Performance Computing Act, 1991 by the United States (Chapman & Rotenberg, 1995), was enacted by these countries to channel bureaucracy and business into the use of ICT. Government leaders accredit the modern information society 'as the driving force behind the development of modern nations' (IDEA, 2001). The ability of ICT to permeate every sphere of a nation's infrastructure is acknowledged by a report entitled 'The global information economy' (1997). The report, commissioned by the Australian Government, stated that the rapid development and diffusion of communication and information technologies have the potential to affect all economic sectors, organisational and work structures, public services and cultural activities. At the core of such national infrastructures for knowledge-based economies is an authentic education sector comprising 'all three elements of the knowledge triangle (education, research and innovation)' (G8Russia, 2006).

The education sector, as an integral part of national development, recognised the importance of technology and its potential impact on learning. Seymour Papert (1980), amongst others, said that the computer was a vehicle to assist the learner in acquiring a new image of themselves. Yet the assimilation of technology into educational practice has been varied in nature. Whilst there has been substantive growth in the acquisition of hardware by schools in developed countries, the infusion of technology in the learning process could be described as haphazard. Education instrumentalities have invested in a plethora of different strategies to implement and sustain effective practice of ICT in education (Pearson, 2006). Yet the implementation strategies seem to fail in their purpose to enhance the quality of learning by the adoption of ICT. The approach to technology implementation has been fragmented, (Hanson & Holmberg, 2003), and has not adequately addressed processes to enhance the learning outcomes by the use of ICT. Planning meetings by regulatory authorities are seemingly circuitous as they keep referring back to the central question of how to engage ICT effectively.

The scope for technology to enhance current education practice is limited only by the vision of education policy makers and the systems construed to deliver the vision at the school level. Computer technology has become a standard in literacy (Horton, 2008), as a premise to knowledge and economic wealth. Computer technology with its associated online environment presents new opportunities for education systems as it did with global businesses and governments. By harnessing computer technologies, school systems are able to expand the curriculum and redefine school operating systems. There are instances in distance education and schools, such as Hellerup in Denmark (Carney, 2006), where online use is one of the mainstays of the learning paradigm and re-configured traditional schooling. For the students there are benefits when schools engage with the new technology developments. Whether it is through devices such as mobile phones or ipods or using social online networking, school students are very familiar with these modes of technology and communication. They find the associated interactivity and connectedness stimulating and fulfilling (Prensky, 2001). More importantly learning gain trends have been have been identified when computer technologies and the Internet have been utilised in a strategic manner in schools (Ramboll Management, 2006). The impact of computer technologies and the Internet on the school sector is gauged by that sector's ability to infuse the education practice with technology. As school systems struggle with the rudiments of computer technologies they are unlikely to fully reap the benefits of functionality, dynamism and flexibility that the Internet has to offer.

1.1 Research direction

Schools' use of the Internet, in a specific Australian context, forms the research basis for the study reported here. There has been a significant shift in the nature of computer use in education and the Internet from its original premise of instructing students in programming skills (Livingstone & Bovill, 2001). Internet development has grown apace and its use has expanded considerably in recent years compelling a re-evaluation of its applicability by various education groups. Education planners shifted to recognising the Internet as a tool with potential to enhance teaching (Gibson & Oberg, 2004), to the realisation that it is a complex environment with various levels of interaction. Engaging with such an environment forms part of the challenge facing school educators in the design and execution of Internet strategies for schools and their populations.

Corroboration for this line of inquiry can be found in literature pertaining to the contribution and impact of computers to learning. The Adelaide Declaration (MYCEETYA,1999) recognised that for young people there are current and expanding opportunities for learning in a complex society. The environment for learning should be associated with the prevailing information medium (Spender & Stewart, 2002), which dovetails with the significance of keeping pace with the rapidly developing global information economy (Way, 2002). Yet for a variety of reasons computer technology is used primarily as either an information gathering tool (OECD, 2004), or as a word processor (Taylor, 2004) in schools.

At the foundation of this research into schools' use of the Internet are the students' and teachers' perceptions of computer use and the associated skill levels. The student uses of computer applications are compared to teachers' perceived skill and utilisation of computer applications for learning at school as well as teacher perceptions about the effectiveness of using computer applications for student learning. Elements of student and teacher perceptions and reported computer technology usage will be examined to determine the nature of the constructs used to form the research design of this study.

1.1.2 Factors impacting on Research Direction

Some of the reasons restricting the use of technology in schools (Blumenfield et al., 2003; OECD, 2004) are teacher capability, school culture, technology infrastructure and organisational constraints. In effect many causes operate together and a better way to infuse technology into the learning process may be found in understanding the multi dimensional possibilities of the technologies and utilising a range of technologies through a learner centred environment (Trinidad, 2003). For this strategy to be successful, school leaderships need to be proactive to implement technology effectively through a learning environment. School leaders should have a clear understanding of integrating technology through learning and proactively intervene to ensure a successful and sustainable implementation (Schiller, 2002). Rios & Neergaard (1995) state the need for coupling the introduction of new technology to organisational development and corporate strategy. An integral approach is required considering all contributing factors.

At the core of a school's operation is the learning environment provided for its students with their different abilities and learning styles. Catering for and to the many dimensions of learning involves multiple conceptual, procedural, societal and technical variables (Jones, 1997). Yet there has been a trend to comprehend technology in the singular and for education systems and schools to provide one technology solution for learning. As Ehrmann (2000) intimates, schools have been promised a new and improved vision only to experience the next version in disappointment. The practice of teachers and school executives to focus on technology as a single entity has affected school technology planning and influenced teacher understanding about the use of technology for the learning curriculum. It is the intent of this study to supplement existing evidence about teacher skill, application and perception levels of computing technology as well as providing some insight to the decisions of school leaderships affecting schools' strategic technology direction. Teachers' computer technology perception and practice are compared with students' perception and practice and analysed to determine differences between the practices.

This study is founded on the premise that technology is more than a singular concept. The word technology is in itself amorphous describing a large collection of hardware and software. Using the term 'hardware' one could be alluding to a DVD drive, LCD screens or the storage space in a hard drive. Equally with 'software', it could range from word processing to multi media applications. More important is the selection of the appropriate technology for the learning situation rather than labeling technology as computers and simply allowing students to work in a computer laboratory. Malouf (2000) emphasizes the necessity of selecting the correct tool because of the potential benefits in productivity and creativity. In order to affect and effect learning, Lamb (2002) suggests that the multimedia learning environment should be founded on selection, utilisation, management and evaluation. The implementation of such an environment was illustrated in a case study at Bendigo Senior Secondary College (Toomey, Elkin-Smyth & Nicolson, 2000). The study, part of an OECD/CERI ICT program conducting a review into ICT and the quality of learning, examined management change process and implementation of Information Communications Technology at the college for the period 1994 – 1999. The study found that ICT had been the stimulus and recurrent catalyst for change at the college. The school technology strategy, modified through a committee process including the leadership, changed their curriculum delivery to that of project-based learning. The strategy also encouraged the use of a broad range of ICT applications including multimedia. There was recognition about the potency of technology to affect learning and allow the learner to explore a learning environment.

The adoption of a broader range of ICT strategies and applications into the curriculum has the potential to utilise students' capability in and access to technology to enable a wider combination of education solutions. The concept of student proficiency in a broad range of computer applications is wider than the skills competencies set by some education authorities such as the NSW Board of Studies (2001). These competencies are based on word processing, spreadsheet, database and presentation software. The Board of Studies has mapped the competencies to the most appropriate Key Learning Area, to assist teachers, and matched that mapping with a particular syllabus reference. These competencies set as benchmarks by this authority and others do not include the multimedia applications or some of the online applications argued by Lamb (2002) as engaging students in the learning process. The primary outcome for students should be proficiency in using ICT tools so they can create, develop and communicate information (DfES, 2004). It was noted by the English authority that using ICT created the opportunity of meeting student learning needs, characteristics and learning styles.

Finally to effect change in schools' technology practice, there is a need to acknowledge widely that the physical boundaries of learning have changed. Distance education has provided signposts to the virtual learning environment (Wilson, 2001). The virtual environment can facilitate learning at any place and any time. It changes the culture of the classroom learning environment (Meredyth, Russell, Blackwood, Thomas & Wise, 1999) and challenges the notion of traditional school times. The online environment has the potential to promote a more flexible school structure to incorporate the individual needs of students and utilise teacher expertise to greater advantage.

1.2 Purpose and Contribution of this Study

This study proposes to further the research in the field of teachers' and students' perceptions and use of computer technology in secondary schools. The aim of creating a stimulating learning environment in schools with computer technology integration has remained at the forefront of educational planning. Surveys and research (Khine & Fisher, 2003; OECD, 2004) point to the disparity between teacher and student computer use as one of the major inhibiting factors preventing the successful implementation of technology. More research about the differences between the two groups is needed in order to develop sustainable strategies for the integration of technologies in schools. The decisions of school leadership on technology strategy and implementation impact on teacher computer use at school. The underpinning principle driving the school's technology policy (Kleiman, 2000) remains the critical component to the success of the technology implementation and the inclusion of the teachers and students in that strategy.

The study also intends to further research into schools' strategic use of the Internet as a delivery platform for the school curriculum. Whilst Internet use is the most popular computer application (OECD, 2004), that use is limited to information gathering. The online environment presents institutions with the opportunity to diversify current practice. Students currently engage in that environment (Marat, 2007), whereas teachers are reluctant to employ the online resource as part of their teaching strategy. There is some necessity to investigate factors that prevent the utilisation of an online environment that engages students in the learning process.

The study is founded on a number of propositions that will assist defining the parameters of this study.

- The student's knowledge and familiarity of Information Communication Technology differs from teacher's knowledge and utilisation of the same technology
- One of the main inhibitors to teachers acquiring new technology skills is their lack of understanding about technology assisting the learning process
- The technology direction of each school is impacted by school leaders' cognizance of the role technology plays in learning
- Each school's current use of the Internet as a learning portal is affected by the perception of the school leaders and teachers.

These propositions lying within a contextual framework of computer technology enhancing the learning process assisted in forming the main research questions. These questions, which are elaborated in Chapter Four (pp. 57 - 59), are founded on three areas; the student and teacher skill with online resources, the effectiveness of teacher developed online tasks and current school deployment of learning resources online.

The research questions are answered by a mixed method technique focusing on the case studies of ten schools incorporating quantitative and qualitative analysis at both the individual school level and across the sample of schools as a whole. The analysis allows the formation of variables describing student and teacher interaction with ICT and the resulting analysis model is detailed in Chapter Four (p.66). The analysis further investigates the nature of relationships between the variables to describe any impact on online learning. The research questions also investigate the current conception and definition of online learning for education. The adequacy of such definitions are evaluated in light of the current context and applied to each school setting. The applications allow the assessment of each school's individual online presence and determines whether any relationship exists to student, teacher or principal perceptions.

1.3 Significance of the research

The study lies in supplements existing information about the views of teachers, students and school principals in relation to computer technology use and practice. Whilst the study is set in Sydney Catholic Secondary schools the data and subsequent analyses derived from the project augments the information available to the school education community. The study also refines existing definitions about online learning for education and schools in particular and links online learning with a newly-developed rubric to discern the amount of interactive learning in individual school settings. There continue to be studies examining the types of computer applications used in schools but, to the best of the researcher's knowledge, this study extrapolating the views of computer use to an online environment where the nature of the environment has been assessed and categorised has not been undertaken. There have been studies (Barker,2001; Clark, 2001; Trinidad, 2003; Paris, 2004), which are mentioned in Chapter Two and Three, that examine the impact of the online environment on schools but do not examine the type of material that has been posted for students to use.

The study also provides data about the access to computers away from school for students, their use and the extent to which those computers are connected to the Internet. The research supplements available data about student computer use patterns away from school and at school and the effect that school programs may have on that use. The study also provides data about teachers' perceptions on their level of computer skills. More importantly the research provides information about how teachers relate computer utilisation to learning. Such an understanding then extrapolates to the level of computer use at school by teachers as well as the possible impact on the Key Learning Area for that teacher. Finally information is provided about the web presence of each school in relation to learning and the contributing factors for that presence.

This study intends, with its findings, to raise awareness of the current factors affecting Information Communication Technology use in this secondary school system. It is intended that the findings will inform the type of support and resourcing that systems can provide for schools within their jurisdictions. At the individual school level principals can be mentored or receive advice on tailoring school technology programs to meet the training requirements for teachers and the learning needs of the students. Education authorities, too, need guidelines when planning technology strategies as it is from these strategies that principals are required to achieve technology targets that focus more on competencies rather than learning implications (Dinham & Scott, 2002; Owens, 2004). The development of a more explicit rubric for e-learning, presents a model upon which schools can evaluate the learning posted on school websites as well as providing a guide to enhance teachers' skills in the development of online material. The overriding goal for this research is to contribute to the effective use of technology for student learning so that the learning delivery is infused with the technology that students are familiar with and engage them in challenging and productive learning.

1.4 Structural outline of this dissertation

Following this chapter, a review of the literature is presented in the next two chapters. Chapter Two focuses on the concept of computer technology and its impact at various levels of society. Chapter Three discusses the implication of the online environment generally, then narrows the focus to the school sector with particular emphasis on key stakeholders within the sector.

The mixed method design of the study is outlined in Chapter Four which describes the research methods used to analyse the teacher, student and principal data from the participating schools. This chapter also details how the quantitative and qualitative nature of the research combine in the case study approach adopted. The results for the student and teacher surveys are presented in Chapter Five as a preface to the regression analyses linking six constructs formed from that same data. The concept of the eFactor is introduced in this chapter. The eFactor was developed to assist in the evaluation of the learning presence of each participating school's web presence. Certain learning characteristics of each school's web presence were matched to the eFactor rubric and the subsequent evaluation enabled the schools be placed into three groups according to their eFactor.

Chapters Six to Eight examine each of the participating schools as a case study according to the eFactor grouping with the low eFactor group discussed in Chapter Six, medium eFactor group in Chapter Seven and high eFactor group in Chapter Eight. The students' and teachers' analysis models are discussed for each school and the characteristics of each eFactor group are summarized at the conclusion of each chapter. The results from the interviews with principals supplied corroborative data for the features, trends and strategies present in each school and overall grouping.

The concluding Chapter Nine responds to and discusses the main research questions. The analysis results are discussed in light of the specific research questions detailed in Chapter Four. Conclusions are drawn considering analysis results and the literature reviewed in Chapters Two and Three. The implication of the eFactor is discussed for the education sector and for further research. The limitations of the study are discussed, the potential for further research outlined and a summary of this research including external validity and usability of the results provided. Detailed appendices follow this chapter providing analysis information and documentation relating to this study.

Chapter Two Computer Technology Use at School

2.1 Introduction

This chapter is the first of two reviewing the literature surrounding computer technology, the online environment and learning for schools. The purpose of the review in this chapter is to ascertain the impact of computer technology in general and more specifically the online environment on learning in the school context in Chapter Three. Both chapters commence with computer and online technology in a global context, particularly in corporations and governments before focusing on education. The influences of computer and online technology on the corporate and government sectors is of interest to the education sector as it impacts on the way technology has been introduced and developed in schools. In this chapter the emergence of computer technology and its effect on schools as well as proposed developments are described and discussed with particular reference to computer technology's effect on learning.

The technology boom has been acknowledged as a contributing factor to the growth in prosperity for many corporations and national economies. The technology strategies deployed by these corporations and countries have been dissected and analysed by other countries and businesses wanting to replicate that economic success. Using technology to deliver training over long distances, facilitating meetings and streamlining work practices are just some of the strategies identified. Governments, too, recognised the need to adopt a technology platform as part of their infrastructure and copied the business technology model to renovate their information systems and operations.

Governments also recognised the importance of technology underpinning a sound education platform and building a knowledge economy. They set targets for education authorities to achieve in the adoption of a computer technology platform. Education authorities utilised a variety of traditional and business training models in their efforts to skill the teaching profession and resource schools. The training models first utilised by education authorities were based on models similar to those employed by corporations. The most common models were based on a traditional distance learning format whereby paper-based instruction manuals were transferred to an electronic format or a skills learning format based on acquiring expertise with technology skills but with each skill independent of the other. Evaluations of these models found that targets set were not being achieved and led to an examination of not only the training methods but a deeper investigation into the central education paradigms and reasons why technology was important in the school context. This investigation of training methodologies and outcomes led in turn to the development of a new approach for the implementation of computer technology in schools. The new approach reflected a new way of thinking about the integration of computer technology into the learning platform of schools, its use by students and teachers and the adoption of a variety of communication and collaborative methods in the training schedule. The migration to the new professional learning approach is indicative of the ever changing evolution of technology and the consequential changes.

2.2 Impact of computer technology in a global environment

Computer networks, Information Communications Technology, the Internet and digital age are all terms that reflect an evolution and thinking about computer technology and its place in the global paradigm. The past and present technology impact on universal endeavors is well documented (Negroponte, 1995; Tapscott, 1998; Jacobs & Yudkin, 2003; Carr, 2008), along with predictions and recommendations for future research, investment and implementation of computerised technologies. These impacts are evident with changes to everyday business activities and practices (Straub & Watson, 2001), business methodology and performance (Wade & Holland, 2004) and the global effect from which education is not immune (Friedman, 2005).

National rhetoric closely links a country's economic success with sound technology infrastructure and investment. A variety of indicators suggest that countries measure success in the growth of knowledge management through information communication technology. In 2003, the World Summit for the Information Society acknowledged the ability of Information Communication Technologies to develop and promote dialogue within and among nations, to increase productivity and generate economic growth (WSIS, 2003). The United States of America uses technology as one of the 9 factors to rank its 50 states for their competitiveness (Haughton et al, 2001). Evidence exists that links dynamic national growth with a country's ability to implement new technologies (Dowric, 2002), with development of new ICTs driving changes in the economy (Wegerif, 2002). Countries such as Singapore credit their current status as a prosperous economy largely to the restructure of their Education and Information Technology infrastructures (Singapore Department of Statistics, 2004). The complete overhaul of the Singaporean infrastructure was implemented in three stages. Each stage was carefully planned and managed with clearly envisaged goals and outcomes. The result of a technically advanced environment is testament to the far-sighted investment in Information Communication Technologies (Cronin and Davenport,

1993) which, combined with an education strategy, has promoted Singapore's sustainability in this field.

Australia has also examined the practices of government and business. In 1997 the Federal Government commissioned Professor Peter Goldsworthy to examine the relationship between ICT and the economy. The subsequent report (Commonwealth Government of Australia, 1997) stated that the rapid development and diffusion of communication and information technologies and the emergence of interactive multimedia applications has the potential to affect all economic sectors, organisational and work structures, public services, cultural and social activities. The report also highlighted the crucial role of incorporating the technologies into the education sector. Goldsworthy particularly emphasised the need to train key personnel to imprint technology successfully in the many layers of education as an investment in the country's future.

Rapid development and vast investment in national economies, Ultralab (2004) argues, require governments to be proactive in the education sector with similar investment. There is a need to recognise that education is part of the infrastructure required for national development and adequate attention for the development of a suitable educational framework is vital. Inadequate investment in the education sector, including ICT development, has the capacity to inhibit economic growth. The United Nations Economic Commission (2003) highlighted the necessity for nations to embrace the need for a sound educational backbone as a prerequisite for achieving economic success. Global competitiveness has transformed and/or strengthened governmental stakes in the framework of learning with a particular emphasis on deploying ICT.

2.3 Computers and learning

The development of an ICT-infused learning framework in an educational authority and its eventual roll out has been the pursuit of governments and their education authorities for the last decade. In the United Kingdom for example, one of the government's key initiatives/policies was the ICT in Schools program (BECTA, 2006). This was formerly the National Grid for Learning (NGfL) program launched in 1998. The program focused on three key areas:

- Stimulating the development of digital content relevant to the UK education system that would be available online and offline. An Internet portal would also be developed to house this content
- Ensuring that schools and other educational institutions have the appropriate infrastructure to access and use these resources effectively

- Providing appropriate training opportunities for teachers to utilise the technologies and resources in their normal practice

These goals are typical of policies developed by countries with substantive economic presence. The Californian State Board of Education (2001) has policies with similar goals and is representative of authorities that link technology plans and funding across the United States. The State required the districts to revise their technology plans in accordance with the State's Education Technology Planning. At the heart of the plan was the aim to improve academic achievement and improve teacher effectiveness. France was another typical national example but additionally focused on using technologies that were increasingly commonplace and on a broader range of teaching and learning methods (EducNet, 2004). The policy made France one of the few countries to recognise that its policy should allow for the continual emergence of technology trends.

Similar policies were developed in Australia. Australia's current national policy for integrating technology and education was published in 'Learning in an Online World' (EdNA, 2000). At the heart of this policy was the adoption of an effective learning medium to implement and effectively utilise the technologies. The notion that learning takes place in the prevailing medium is complicated when considering Information Communication Technology. ICT is regarded as one of main drivers for change in the field of education and is perceived differently by the teachers and the students, however the learning medium does depend on both student and teacher perspectives (Kearns, 2004).

Governments have policies and strategies that are continuing to develop a focus on the framework of learning that includes infrastructure and hardware resourcing. The policies, however, pay particular attention to how the knowledge of the individual can be enhanced by the skill mastery of the technologies. The policies, as they have been developed, introduced and revised, have either been embedded in legislation or developed as blueprints for a nation's future. The policies have given rise to the development and implementation of many technology practices within schools.

2.4 The Development of a Computer Framework for Schools

The current state of technology and learning in schools is multifarious and subject to the pragmatic nature of systems and the expertise of key personnel. Some argue that schools are still operating in an industrial revolution model of education where there is an adherence to traditional modes of teaching with the print media as the dominant platform (Spender & Stewart, 2001). Fullan (1991) observes that the current school organisation was designed for an earlier period for conditions that are no longer valid. Beare (2001) is more succinct in discussing the constraining nature of the classroom environment, almost personifying the four walls of the classroom as four gaolers of learning. Education is currently confined to a learning exploration defined by a system's comfort zone. The contributing factors to the current state of technology and learning are many and varied. Mumtaz (2000) has identified the following factors as key to framing the current state of technology.

- access to resources
- quality of software and hardware
- ease of use
- incentives to change
- support and collegiality within schools
- school systems and government policy
- commitment to professional learning
- background to formal computer training

In examining the above factors, support within the school as well as the incentive to change would be pivotal in motivating teachers to trial/adopt technology. The findings from a qualitative case study in four Canadian schools (Granger et al., 2002), found that the successful adoption of new technology practice within the four schools stemmed from principals who encouraged their teachers to further their own learning as well as to develop collaborative relationships. The study also found that pedagogically sound implementation of technology practice was highly useful. Mumtaz (2000) concurs and identifies that teacher beliefs about pedagogy underpinning ICT as the crucial element in the successful adoption of a sound education technology platform.

The successful implementation of technology practice within schools by underpinning technology strategies with a pedagogical rationale confirms earlier work by Kulik (1994). Kulik undertook a longitudinal study and analysed school computer programs operating over a ten-year period from 1982 to 1991. The findings showed that whilst students liked and enjoyed the classes that used computers more, the computer programs were mostly drill and practice. This lower order use of the machines did not add anything significantly new to the learning process. Computers used at this level appears to indicate that little thought has been given to how computers would enhance learning in particular contexts and thereby benefit the students. The superficiality of such computer use does little to exploit the potential of computer technology. This view reinforces Snoeyink and Ertner's (2001) belief that experienced teachers need to understand the flexibility of using computers and the sophistication of computer applications before they utilise computer technology in the learning process. The range of practice and beliefs about the use of ICT confirm the stance by Taylor (1999), Burt & Taylor (2003) and Williams (2003) that there are two mainstreams of thought about the use of ICT. Apart from the place of ICT as a subject in the curriculum, ICT is used to either augment traditional teaching practice or to strategically enhance aspects of the learning environment.

There have been many attempts to incorporate computer technologies in the education programs of a school's curriculum. In the 1960s and 1970s it was fashionable to equate learning as computer processes and learners as intelligent systems (Watkins, 2001). Studies over the last decade by governments and associated academic institutions have taken different directions in attempting to address various inhibiting factors. These studies, however, have a common theme in trying to identify the most effective way of instigating technology as one of the main learning platforms.

Educational organisations have addressed the issue of incorporating technology into learning further by focusing national and global attention on conferences and the proceedings that result from them. BECTA hosted a conference in 2001 focusing on ICT in research. One of the main points that the conference highlighted was the nature of the UK curriculum in restricting the dynamic use of technology and its potential to increase motivation (Sebba, 2001). Also in 2001, the STaR report (CEO Forum, 2001) emphasised that American schools were still considering whether to use technologies as part of the learning process rather than acquiring the knowledge and skill to use the technology. The STaR report also stated that one of the greatest inhibitors to the incorporation of technology was the persistence of educational authorities in developing methods to measure the effect of technology against outmoded goals and outcomes. The methods, particularly targets, tend to be counter productive when used in isolation (Duckett, 2001), and not part of a continual assessment process founded on relevant and current educational outcomes.

2.5 The Implication for Computers and Learning

Part of the difficulty as school systems modify to adopt this technology is what David Reynolds (2001) calls the conservative nature of the educational institutions. Several factors contribute to that cloying nature including the traditional culture of school, as part of the social fabric, that permeates the very nature of the classroom (Cuban, 1986). School organisation, too, can impede the transition with restraints on professional development (Cohen, 1988), uninformed management, and the use of ICT as an add-on rather than an integrated approach. Another difficulty is the perception that technology is just a tool. The 2001 school guidelines for the

Californian Department of education, for example state that, 'With technology there are the tools and machines that save time on student record keeping, present course material more dramatically and provide more individual instruction and time on task' (p.3). This definition and prevailing culture demonstrate an inability to encompass the interactive nature of the new technologies and the propensity to become mired in digital mindtraps (Graham, 2000). More importantly, however, it hampers and distracts the energies of educators to plan appropriately for contemporary paradigms.

By harnessing the interactive nature of technology, Bransford, Brown & Cocking (1999) found that it was easier to create an environment where students can learn by doing, receive feedback, and continually refine their understanding. The process of learning in and beyond the classroom can be enriched for students as they have access to new and different forms of information. This philosophy has significant implications for the current generation of children. This generation has grown up immersed in a world of computers, associated peripherals and other information technologies (National Academy of Science, 1995; Negroponte, 1995). They can interact, transform and manipulate information in a non-linear sense as contrasted to the linear communication modes of the previous generation. The vibrancy and presence of new technologies are part of the current students' culture and change their expectations about modes of communication and interaction.

New technologies have also expanded the possibilities for the delivery of learning incorporating the very nature of the technology interactivity. Hall and Bannon (2006) comment that ubiquitous computer technology, employing interactive techniques, can stimulate active participation, involvement and learning. Their paper explored a design process developed for a museum where the technology utilised collaboration, engagement, active interpretation and the material available on site. The technologies have broadened the opportunities available to establish learning programs designed to meet changing societal realities (Brown & Duguid, 1995). This type of technology practice widens the dimension of the student's educational experience.

Key to the adoption of effective technology practice is shifting from a method of teaching where the teacher imparts all knowledge, to one of children learning and carefully managed teacher professional development. The ten-year study by Apple, Classrooms of tomorrow (ACOT, 1998), demonstrated the effect of such an adoption. The commencement of the project saw a frustration by teachers, maintaining traditional beliefs, in using the technology owing to minimal assistance and guidelines. These teachers adopted a lecture style practice as their way of adjusting to the use of computers (Trinidad, 2003). The project achieved success when a staged approach was implemented with exposure to models of good practice and collaborative networks. This approach specifically addressed teacher understanding of the nature of the learning change, what the project purported to achieve and the necessary steps required to obtain a satisfactory result. These stages are crucial in allowing teachers to assimilate the changes and Fullan (1991) argues that the failure to address these steps/stages has been a tangible barrier to educational reform.

The need to address technology reform in education has also prompted a re-examination of the teacher perspective. Whilst acknowledging that teachers must have a deep understanding of information ICT subject knowledge there also needs to be a similar understanding of pedagogy (Ingvarson, 1998). Pedagogical practice, involving technology, incorporates facilitating a course combining the use of various technologies with learning strategies designed to motivate the student. It is important to recognise that efforts to incorporate ICT into teaching and learning are not primarily concerned with the technical or operational dimension of the medium (Bigum, 2001). Rather it should be nurturing a model of learning where new patterns of thinking are encouraged and there is an opportunity to create the desired results (Senge, 1990). Recent research has shown how technologies have impacted positively upon the transfer of knowledge (Lehtinen, 2003). The ACOT program, whilst reporting great frustration on the part of teachers (Tierney, 1996), also reported significant positive perceptions by students of their learning. In 1997 Ultralab, a division of the East Anglia University, implemented the Tesco Schools Net Server (TSN2K). This project was daring in its approach for its time as, instead of filling the server with swathes of content, it was programmed with a realm of learning challenges for students (European Union, 2006). Ultralab argued that the Internet already had the capability to swamp users with content should that be needed. Whilst the project has since been justified in terms of national recognition for its outstanding success, it confronted the traditional view of top-down education and allowed innovative learning strategies some scope.

A project with similar aims was trialed in the Australian state of Victoria. The Navigator Schools Project was launched in 1995 involving four primary and three secondary schools. The Victorian government allocated \$10 million to the seven schools of which secondary schools received \$8.875million. Each school matched this funding with 4 to 7 per cent of their global budget for equipment upgrades, recurrent expenditure and staff professional development (Navigator Schools

Project 1997). There were three main conditions stipulated for funding by the state government. The schools agreed to adhere to the objectives of the project, provide extensive professional development for their staff and make the benefits of their work available to the Department of Education. The project reported that the impact on students and teachers was substantial. There was a paradigm shift in teaching practice. Teachers were required to move from a traditional method of delivery and were also required to undertake technology training in order to deliver the courses and provide feedback to students. Also the model of schooling underwent change. With electronic means of communication as well as students being able to do their work at home rather than go to school, the structure of the school became more flexible.

The evaluative findings for the Navigator Schools Project were adopted as the model for technology integration in all government schools in Victoria.
The success of this project, as supported by the findings (Clarkson, Dunbar & Toomey 1999), was due to the thorough planning, resourcing and implementation infrastructure. The implication for any school or system wishing to adopt such technology and educational infrastructure is that the system implementation would not have worked as well if one of the essential development or deployment components had been missing. There was also the realisation that part of the project's success was the focus on learning enhancement as one of the central components of the project strategy.

Complementary to the learning focus was the realisation that technology was embedded in the educational process to deliver quality outcomes for student learning. The recognition that such a partnership was essential to the adoption of a viable technology platform in education was dawning. A report stressing the need for this approach was delivered to the Queensland government in April 1999 describing the application of new technologies to enhance learning outcomes for students. One of the findings concludes 'that there are three effects when the technology is used appropriately; there is a positive effect on achievement, student attitudes and classroom interaction patterns' (Page, 2003). The effect of seamlessly infusing technology with the learning process created an optimum learning environment for school students.

The New Zealand Ministry of Education which was developing new strategies to incorporate technology into the education curriculum, shared the same view. Their draft strategy distributed for comment identified that the integration of ICT into teaching and learning across the curriculum was crucial in progressing and achieving further gains. The resulting feedback led to a change in the Ministry's policy for technology and learning. The following learning vision statement was incorporated into all schools' learning policy statements:

> 'Enriching the learning environment through the use of ICT is a continuum, a journey that takes us through learning about ICT, learning with ICT and learning through ICT' (NZ Ministry of Education, 2003).

For governments, education sectors and schools at the local level to realise the potential they have at their disposal, Bransford et al (1999) claim that part of the strategy is to change the current climate for learning. In a report entitled 'No Child Left Behind', the University of the State of New York (2002) recognised technology as a key element in school infrastructure. It further stated that technology:

> 'Can provide research-based professional development on an ongoing basis to teachers in a variety of locations to help improve teaching and learning. For example, studies of educational technology effectiveness report that teacher expertise in using technology can substantially increase the learning gains associated with using the technology' (p.129).

The challenge for bureaucracies and schools was to translate the rhetoric into actual practice.

2.6 Changing the Nature of Computer Use for Schools

Changing practice and the culture operating within schools and their systems lies at the heart of the migration from a traditional paradigm of learning to a more contemporary platform using technology. It is a daunting task for education systems, schools, administrators and school principals to implement the change due to the very immediacy, accountability and publicity of ICT at various levels of social awareness.

In 1998 the United Kingdom launched the 'National Grid for Learning' as a major drive to implement ICT reform. This project was allocated significant funding as well as being given a high priority. The project resulted in a significant impact across all areas of the curriculum with a positive relationship, in all but one subject (Modern Foreign Languages), reported between the level of ICT use and the academic improvement of the students. The education department published the reported learning improvement as a relative gain score (DfES, 2001). Positive learning behaviours such as peer mentoring, increased motivation and autonomous learning were observed in test schools. The Department of Education (DfEE 2000, DfES 2001, 2002, 2003) published bulletins indicating that the level of technology use was increasing. It must be said that the teachers played a minimal role in establishing or informing the direction of this project which was largely ordained by the education authority. However, the teachers did specifically map the use of technology to specific curriculum outcomes, thereby acknowledging a pedagogical construct where aspects of learning were selected to be delivered/enhanced by the use of technology.

Achieving similar technology outcomes, the United States outlined five national ICT goals;

- All students will have access to information technology in their classrooms, schools, communities and homes
- All teachers will use technology effectively to help students achieve high academic standards
- All students will have technology and information literacy skills
- Research and evaluation will improve the next generation of technology application for teaching and learning
- Digital content and networked applications will transform teaching and learning (U.S. Department of Education, 2000, P33)

Whilst these goals were part of an eLearning strategy, they do emphasise the necessity of a rich technology environment, including interaction and not simply resources. The U.S. Department of Education also commissioned or funded initiatives to provide leadership or assistance to states and communities to reach these goals. Many other countries have provided a range of educational solutions and initiatives to encourage various regional governments and education authorities to adopt and promote the use of ICT.

2.6.1 Funding Policy and Implementations in Australia

Similar to the governments of other developed countries, the Australian government made a commitment to reform ICT practice in schools by increasing the availability of hardware and training provision to springboard solutions to the inadequate adoption of ICT. In a submission presented to the Ministerial Council on Education, Employment, Training and Youth Affairs, the national government stated that the quality of Australian education is a critical component in national, economic and social development and that an effective ICT program is integral to quality education (MYCEETYA, 2002). The same submission alluded to strategic approaches employed by State Governments and the Commonwealth Government and Territories to encourage the deployment of technology in the education curriculum. Commonwealth funding was provided for the states to establish computer acquisition programs for schools and technology training programs for teacher (MYCEETYA, 2002). The same report forecasted a change to the funding strategy which was modified to a content generation model supported by a joint investment of $68 million funded by all government for a period of five years (2001-2005).

The various State Governments in Australia employed different modes of delivery for this funding model and supplemented their individual strategies with their own funding. It would be time consuming to document all the funding plans and programs for each state, yet to portray the diverse nature of those plans and programs required some examples will be detailed. Two project examples have been selected, one each from New South Wales and South Australia, to illustrate the diverse nature of the planning approaches.

For New South Wales Government schools, 77 000 new computers have been provided over the period 1997 – 2000. Also for the period 1998 – 2000 there was an 800% increase in internet traffic and a 12 fold increase in the number of computers connected to the internet, (Council on the Cost and Quality of Government, 2001). For the period 2001 - 2002 the Government committed to replace 90 000 computers and add another 25 000 to the system. There was also a commitment of $10 million to assist the training of teachers to use the technology in the classroom over a two-year period, (Commonwealth Government, 2001 - 2002). The budget for 2002 - 2003 allocated $247 million over four years for a new broadband system to speed access to the Internet for students and teachers. It was planned that bandwidth in schools and TAFEs would be progressively upgraded, with a target of 85 per cent of schools and TAFEs to be connected by December 2003. Over four years $82 million, for 1.33 million NSW students and teachers, would be spent for new e-learning accounts that included email and individual websites. Coinciding with the new eLearning infrastructure it was planned that each school would get support to implement the programs. An extra $24 million over four years was to be spent on school-based technical support and training, with experts sent to every NSW government school to review the school's local area network and provide local technical assistance. Network management training would be provided to nominated staff in every school. A pilot program involving 200 schools was instigated that aimed at developing an improved model of technical support, with School Principals and IT Coordinators closely involved with the planning and the implementation. Funding was allocated to train teachers under the Technology in Learning and Training (TILT) program and continue the Computers in Schools Program over the next four years (NSW Government, 2002 - 2003). The current education budget for technology has increased to $30 million over the next four years (NSW Government, 2007). Across the various states and territories of Australia, there were similar scenarios about implementing policy.

The policies outlined above were limited in their success due to the inconsistent delivery of resources and infrastructure as well as varying interpretations of the program expectations (Dwyer, 2004). Current policies continue to have limited success. The present Australian Prime Minister made a pre-election promise in 2007, reported in various news media, to give every senior secondary student a computer (Winterford, 2007). All schools, whether government or private, would be able to access up to AU$1 million for the supply of computers and the necessary infrastructure. The NSW Government raised objections to this form of funding stating that there were many hidden costs such as installation and maintenance that the Australian Federal Government had not either considered or allocated funding for. The wrangling between the federal and state governments about resourcing the scheme led to certain schools applying for the funding separately and other schools having the funding withheld (Victorian Government, 2008).

In South Australia, the Department of Education and Training sought to establish a template school by funding the establishment of a technology rich school for the use of other school campuses in that state. Dubbed the Technology School of the Future, this school is equipped with many technologies not available to other schools (DETE, 2003). This facility is regarded as the largest provider of 'hands on' teacher training in school use of computers in Australia. The school has specialist technology in every curriculum area and there were, at the initial stage, 11 computer laboratories available for use. Some of the services provided by the school are:

- Adult professional development courses
- Customised solutions to local ICT issues and problems
- Facilitation of educational research on the use of ICT
- Evaluation of hardware and software in schools and preschools

(Government of South Australia, 2004)

A particular resource is the availability of skilled ICT trainers in all curriculum areas. The expertise of these trainers is then available for teachers to use when they book the facility for long or short term tasks. The availability of these services on one site has made this a unique resource for Australia.

Although the South Australian government funding program adopted a plan that did focus on a large hardware upgrade as well as teacher training, there was little in the plan that sought to join the two funding strands. The planned strategies did not include successfully implementing the deployment and use of the new computers by teachers with newly developed skills. The Technology School of the Future remained the single training centre for teachers and specialist programs across the state. These two examples serve to illustrate the many technology practices in existence and the absence of a cohesive approach to developing an integrated focus of technology and learning.

2.7 The Implication for Computer Users

The current technology phenomenon consumes much attention with planning, personnel and budgets in the current education landscape with a plethora of policies and arguments about the implementation of ICT. These policies and arguments have been presented earlier in this chapter together with the various delivery and implementation modes. Coupled with these strands are the difficulties and challenges experienced at every level of the education system when considering the deployment of computer-related policy objectives. There are similarities in the arguments and justifications expressed as well as the difficulties experienced and these issues will be discussed later. However, the crux of these strategies, theories and evidence, one could argue, should be a compelling notion to authenticate the impact that technology has on the end users - the students and the teachers.

The implementation of technology-infused learning strategies has been hampered by short-term solutions such as teachers' acquiring a technology skill and schools receiving new hardware that meets current but not future growth requirements. A recent report by the OECD (2004) on lifelong learning stated that access to learning technologies opened up a range of opportunities for making learning more effective. It further argued that for senior students it was particularly relevant as they would be able to accrue and employ the type of techniques for accessing and processing knowledge once they had left school. Whilst the report details essential elements in the use of technologies in the education setting, the report does not reveal a more fundamental understanding of the sustained interplay between technology and learning.

A literature review on informal learning with technology outside school (Sefton-Green, 2004) points to the immersion of children in ICT-related activities outside school. The review also alludes to the dichotomy between the education sector's and students' definitions of technology. The review suggests that educators should take more account of students' dexterity with technology. Students bring into the school setting their experience of ICT use at home (Marsh & Millard, 2003), with the probability that they have access to a far greater range of applications than at their particular school. The students' adoption of the 'just in time' use of technology is a learning experience where students can utilise the convenience and immanence of the technology. The student experience with technology differs from the traditional classroom setting that teachers use to deliver the technology. The differing understandings and uses of technologies explain some of the challenges faced in the implementation of ICT in schools.

The view that students utilise the immediacy of the technology is supported by a study undertaken in 17 English schools by the University of Lancaster (Passey, Roger, Machel & McHugh, 2004). The study, using qualitative and quantitative methods, found that there was a positive effect in using ICT with the students, however, that effect was limited in its impact. The findings suggested that ICT was helping to draw students into more positive modes of motivation and the secondary teachers interviewed indicated that ICT positively impacted on student interest and attitude towards school work. The types of ICT activity most commonly reported by the students were the Internet (largely for researching), writing and publishing software, and presentation software. The first two items have featured prominently in such studies for quite a few years.

Three separate sets of data displayed in Table 2.1 indicate a pattern of use confirming little change in the popularity of Internet use and word processing over time. In 1998, the University of Michigan (Hess, 1998) surveyed prospective music students about their use of computers at school. The 2000 data are taken from a survey of Canadian secondary school students (Turnbull & Lawrence, 2000) and the 2003 data come from a survey of 15 year old Australian school students (PISA, 2003).

Table 2.1 Comparison data of computer use

	1998 Michigan	**2000 Canada**	**2003 Australia**
Word Processing	83%	63%	70%
Internet	69%	80%	74%
Games	33%	n/a	50%

This pattern of computer activity is replicated across other developed nations with the OECD Program of International Student Assessment providing data for the member countries (OECD, 2000). These activities confirmed the focus of teacher ICT use as research, writing and presentation. The use of the Internet as a research tool and word processing for presentation suggests that teachers are using ICT in a passive rather than interactive manner, whereas students are using the range of technologies to produce and engage. Teacher preoccupation with a passive use of technology, Dimock, Burns and Heath (2001) suggest, is a result of focusing too much on skills training for conceptually simple applications, part of the show-and-tell suite of applications. In order to utilise the technology strategies that maximize students' engagement and are familiar to students there is a need to change the use of computer application and methodology. To encourage teachers to adopt a new technology approach Hedberg (2002) suggested the technology strategies should involve collaboration and problem solving that link to pedagogically sound learning practice that is conceptually familiar to teachers.

2.7.1 Teachers using ICT

Part of the task of engaging teachers with ICT is to understand the amount of familiarity with ICT that teachers have. The range of familiarity fluctuates from those who for many reasons have not adopted technology to those who use the computer daily, even if it is only at a process level or a level suggested by policy competencies in each school's technology strategy. In a survey of teachers the National Science Foundation of America (2002) found that the most common barriers to the implementation of technology were not having enough computers in the school (78%), lack of release time to learn how to use the computers (82%) and lack of time in the timetable for students to use the computers (80%).

Huang and Hsu (2004) further investigated teacher barriers to the use of ICT with a study of 141 science teachers in Taiwan. Their research examined how internal and external factors affected teacher attitudes in their use of ICT in teaching. Teacher attitudes were defined as anxiety, beliefs and attitudes. Teachers' computer knowledge, interest, time for learning and application as well as the usefulness to learning were defined as internal and school climate, resources, school policy and ICT training were categorised as external. To demonstrate how the factors affected attitudes a multiple linear regression analysis was employed. The results showed that all the internal factors had an affect on at least one of the teacher attitudes with interest in ICT affecting all three. Of the external factors only climate was a significant factor thereby implying that it was more important and effective to encourage the use of ICT by linking the use of ICT with learning in the school rather than concentrate on policy and training opportunities.

In Western Australia the focus on teachers incorporating technology was enhanced with a purpose-built school designed to use the current technology. SevenOaks senior secondary college was constructed in 2001 and aimed to provide a learning environment with an innovative technology focus. The school had an extensive ICT infrastructure with a fundamental objective of integrating ICT into the education program. A unique aspect of the launch of this school was the simultaneous commencement of a qualitative study into the effectiveness of ICT in the learning process and its impact on students and teachers at the school. The study was funded by the Australian Research Council strategic partnership with an industry research and training grant.

The education program aimed to provide for the students' different learning styles. The timetable was flexible, the day was extended and students were able to access their work in a range of settings from school to home. The ICT infrastructure was fully integrated and allowed the teachers to use a sophisticated platform for administration and to create and manage each student's learning program. The teachers were specifically trained and encouraged to incorporate the technology into the learning platform. To measure the effectiveness of this structure and its interaction on the students and teachers, the research study observed four teachers, conducted semi-structured interviews with 34 year 11 students and one formal interview with the person responsible for the management of ICT systems in the school. The study found that the students enjoyed schooling more, and that they used the computers particularly for Internet researching, word processing and accessing course information (Trinidad et al., 2001).

The small number of findings reported here reflects a larger body of research about the intention or desire of teachers to infuse ICT with their teaching (Conrad, 2002; Martin & Taylor, 2004; Laferreire, 2006). However, Trinidad (2003) reported from the United Kingdom and USA, that little had changed in the previous 15 years with regard to teachers' use of technology in secondary education. This seeming inability of the majority of teachers to utilise ICT in teaching cognitive processes such as reasoning, analysing and conceptualising cannot be traced to a single root cause. In order to implement such ICT use one must consider the allocation of training time, the implementation of new strategies in education programs and evaluating the programs. However, as evidenced by the studies undertaken by the various statutory bodies teachers are accumulating ICT skills. Time is therefore allocated in some form to teachers to allow them the opportunity to acquire these skills. Perhaps it is the tension, as Hennessy and Deaney (2003) suggested, between national curriculum requirements and the teacher's pedagogical beliefs as well as the anxiety experienced by some teachers in using computers. It would seem that national curriculums have an over-emphasis on a mastery of ICT skills rather than meshing ICT with various learning processes in the particular curriculum. The integration of ICT should be a gradual, reflective process for teachers that would also alleviate the anxiety of those teachers who find technology daunting and eventually adopting a process where teachers would be encouraged to utilise technology as part of the learning process (North, 2005). The process of implementing ICT into school practice and the curriculum is not a simple one, being influenced by a complex mix of factors with effective practice as one of the hallmarks of any such strategy (Hennessy & Deaney, 2003).

2.8 Conclusion

Society has seen the introduction, implementation and influence of information communication technologies across a broad sphere of corporate and government development (European Commission, 2000). The successful adoption of technology in financial and government circles has led to the recognition of technology's implicit place in education as integral to the development of each nation's knowledge economy. Government legislation and education department policy worldwide have attempted to assure ICT of its place and success in the school system. However, the documented examples from Australia, Canada, the United Kingdom and the United States demonstrated that rhetoric in legislation and policy did not ensure that technology's absorption into the school framework achieved the anticipated outcomes.

The challenge for education systems and all involved in the educative process is the means by which ICT is available and utilised for effectiveness. According to Bundy (2002), this means examining how school systems, teachers and students understand and interact in the information environment. The development of technology in schools also requires the consideration of future possibilities for the development of long-term strategies. At the macro level, such planning requires a greater appreciation of the work of Peter Senge and Michael Fullan in systems thinking that promote whole school change and continuous learning (Filsel & Barnes, 2003). Part of the school change necessitates a professional development program for teachers promoting the pedagogical approach that effective learning will determine how ICT is used in the school environment. Using ICT to enhance effective learning requires harnessing technologies such as games (Sohn, 2004) and multimedia such as podcasting (Chen, 2005). As Foo, Ho and Hedberg (2004) observed, there is a difference between students' physical and cognitive engagement on a task and teacher needs to ensure that the mechanics involved in using ICT do not deter the students from achieving the learning goals. In this statement lies the key for it must be acknowledged that there are difficulties in perpetuating an ICT environment. The European Commission (2004) noted the diversity of policy and practice and the problems of the digital divide with access to financial resources for infrastructure (Keeks, 1999; Norris, 2001;Warschauer, 2003). However, the main thrust of this research focused on how technology enhances education and on how organisations such as the European Commission advocate countries strive to implement better quality education through the integration of ICT.

Technology will not change education by the mere fact that it is present or being used in the school (Fox, 2002). However, the strategic use of technology has the potential to affect education in revolutionary ways (Hardin & Ziebert, 1998). The research has shown that whilst there are notable examples of exemplary practice linking ICT and learning practice, it has also shown that countries, states and regions have not been able to transpose those examples as standardised practice across their systems. The adoption of a whole systems approach requires the establishment of a school policy where stakeholders can understand the intricate linkages possible between ICT and pedagogy coupled with realistic strategies to deploy the policy and sustain it through practice.

The implementation of such a policy for educational institutions influences the adoption of an online delivery for those organisations, which is explored in the following chapter. The growth of computer-based learning to include the Internet and the online environment has been an evolution influenced by the educational organisations' use of computers. The viability and influence of Internet use and the online platform is described in Chapter Three and detailed in a format similar to this chapter with a discussion about corporate and government sectors before the focus is narrowed to education. The phenomenon of the online platform is explored before examining the concept of learning using the online platform, eLearning. The components of an effective eLearning delivery are considered for the education sector generally and schools in particular. The chapter concludes with some possible future directions for eLearning and the ramifications for the school sector.

Chapter Three Literature Review – Online use

3.1 Introduction

This chapter provides a definition and foundation for the establishment and use of online platforms starting first with the global online use by government and industry then juxtaposing that platform to an educational context. The successful use of the Internet in government and corporate circles in countries such as Singapore has provided a blueprint for other instrumentalities and organisations to follow. Global examples are provided that illustrate the success that governments and corporations have had with different Internet strategies and applications. The importance of an Internet presence is amplified for these organisations when competing on a fiscal or political platform. The Internet platform in an Australian context for government and business is also explored for similarities in infrastructure to the global template as well as the influence it has played in guiding the education agenda. The Amsterdam Conference (Virtual Platform, 2005) argued that there are close ties between education, economic and industry policies. The successful deployment of internet-based strategies in both government and economic ventures has provided a mandate for governments to direct education authorities to utilise web-based platforms when planning the organization and delivery of their education programs.

The previous chapter highlighted how the adoption of computer technologies led to advancement in economic and government sectors' productivity and practice. The chapter also concluded with an insight into business and governments' incorporation of an online platform potentially enabling modification of organisation and practice. Similarly in the previous chapter it also described how education utilised computer technology in the learning process. This chapter describes how corporations and governments were able to take advantage of the flexibility of the Internet and then details the models and criteria used by education to incorporate a web presence as part of its overall strategy. Integral to the discussion is an exploration of how the adoption of an Internet platform can affect the practices of educational institutions and the learning methodologies of the students. Certain examples from the tertiary sector have been cited showing some of the flexibility that the Internet has afforded these institutions. This flexibility is manifested in the way that tertiary institutions offer courses and incorporates the concept of a diversified curriculum illustrating some of the inherent adaptability that a web platform provides for schools (D'Antoni, 2007). Examples where this type of curriculum has been initiated are detailed to illustrate various aspects from implementation to the aims and anticipated outcomes of such a curriculum with its online component. These examples will also point to some of the current research prevalent at the various times of implementation. The various quoted examples juxtaposed with the current research illustrate the challenge facing the education community, especially the school sector, in utilising the benefits of the online environment

One of the earliest recognised advantages of the Internet was the access to a wide range of information repositories. Terms such as 'Information Superhighway' are used to describe the gateway/portal to the vast information resource that the Internet provides. The ability to move, manipulate, store, innovate and control content has captured the attention of many governments, corporations, institutions and individuals. These various entities are eager to exert some influence on the direction and impact that the Internet may and should have, thereby establishing a presence in the virtual world.

In the discussion surrounding direction, utilisation and impact of the Internet, the various participants in the online environment should be recognised. The people who could participate in an online environment are identified as any person who has access to a personal, public or work-related Internet capable device. The inducement or necessity to interact with an online presence varies according to the users' need to access or interact with the content available through the web presence. Selection of particular web sites would also vary according to specific need and the design and interactivity of the web page. The different levels of stakeholder involvement and operation are apparent in areas such as skill training of personnel, the adoption of a web presence and the strategic use of the Internet. Government policy, commercial incentive and intellectual gain are some of the different influences on stakeholders and, whilst these influences may share common objectives and outcomes, they will not necessarily be all the same. The undeniable success experienced in corporate and government sectors in using the Internet has prompted other organisations to mimic the infrastructure of the successful sectors to develop their own Internet infrastructure. The attempt to adopt similar training and benchmarking practices has hindered the development and deployment of specific Internet strategies and objectives for those organisations.

Education's use and development of the Internet is one such casualty as it adopted a variety of traditional and business model deployments in training platforms and results-focused agenda. These training platforms of skill development and competency benchmarks failed to acknowledge the dynamic of the technology it purported to use. Training to develop competence rather than recognise the intellectual consequence has delayed the effective use of the Internet by education authorities and teachers in the learning programs attempting to engage children at school. Programs assisting teachers in the use of technology must associate the vital education purpose with the new technology (Fenrich, 2005; Green, Lankshear & Snyder, 2000), in order for the training to be sustained. The collective voice of researchers, quality educators, organisations such as the OECD and most importantly the children in schools have forced an evaluation of the use of Internet practices. Educational authorities are investigating various strategies in deploying the Internet to infuse learning and enhance the curriculum structure of schools.

The conclusion to this chapter focuses on the different strategies being explored by schools and associated authorities in the effective use of the Internet as a conduit to the delivery of school-based education. Part of the intention is to highlight some of the new technologies that may impact on the educational scene. However, the summation concentrates more on the interrelationships between ICT and the delivery of education, because it is the forging of links between ICT and education (MYCEETYA, 2002, p.17), that schools and systems need to consider in terms of direction, resources and training if they are going to implement these futures.

3.2 The Online Platform

Since its inception the Internet has been influential in affecting interactive and interchange processes in many layers of human society. Through the Internet, the non-linear system that may connect you to different places or repositories (Carrucan, Crewe, Matthews & Matthews, 1996), the user is provided with instantaneous access to current and relevant information that has been hitherto unavailable. Negroponte (1995, p7) wrote that ‘on demand information will dominate digital life. We will ask implicitly and explicitly for what we want and when we want it.’ The immediacy of the Internet and almost instant gratification of user demand has generated a pattern of consumption interest to organisations and governments alike, wanting to harvest the success of the Internet medium. This consumerism has lead to likening the Internet to a commodity service used for the support and success of other commercial services (The Internet Society, 2004). The Society further adds that the service and support has been greatly accelerated by the rapid adoption of browsers and World Wide Web technology to furnish the demand. The corporate sector has been quick to examine optimum ways to exploit the Internet. Firms such as Cisco Systems, Dell Computers and General Electric have reported impressive dividends by making the Internet a key element in their strategies and business models (Barua, Konana, Whinston & Yin, 2005). In the first quarter of 2006, a Eurostat survey found that over 50% of European Union households had access to the Internet and in countries such as Sweden and Lithuania it was approximately 80% (European Commission, 2007). It further found that nearly 90% of EU enterprises used the Internet to market their goods. These websites also offered other information and services such as price lists and catalogues (46%), customer support (24%) and customised page for repeat clients (18%). According to Barua et al. (2005), companies that have shifted to an online platform have transformed their 'bricks and mortar' operations into e-business organisations. The lucrative nature of the platform has been its own incentive and in some ways corporations choose to ignore the platform at their peril. A monetary value on the e-market has been estimated by the IDC at reaching $23.7 billion (U.S.) by 2006. This Internet technology is regarded as one of the keystones of contemporary global success and it is the culture in which children of today's developed world are immersed.

The attainment of such promising success with their e-market strategies has lead many corporations to examine their practice with a view to streamlining and refining strategies. Of interest to the education sector were the efforts by business in adapting their training programs to an eLearning platform. The success of eLearning training programs in overcoming spatial and time constraints (Poehlein, 1996) has led to the strong support for the use of this training solution. Another key advantage to the adoption of online training solutions was the obvious fiscal savings which was seen as a strong motivator in the context of a corporate global budget (Bell, Bush, Nicholson, O'Brien & Tran, 2002).

Combinations of spatial and fiscal constraints have also prompted the education sector to make some inroads into eLearning. The challenges of distance education have been met and facilitated by an eLearning delivery. The nature of open and distance education in the last decade, according to Wilson and Stacey (2004), has been changed by the new technologies in providing a means for learners and teachers to interact with one another despite their geographical locations. The virtual schools also make available a whole new world of courses from obscure electives to advanced placement classes (George Lucas Educational Foundation, 2005). There is also the notion of a virtual curriculum which enriches the curriculum of established schools by allowing the availability of courses not offered at the school. These partnerships internationalise the curriculum as well as sharing and reducing costs for individual institutions (Bates, 2002).

These virtual schools or the virtual curriculum have been established ostensibly to provide the backbone for distance learning. They have also opened a strategic window for mainstream education to follow and adopt on a larger scale. Education has always been associated with the three Rs but that analogy is being challenged by the three Ws. Similar to the consumer model, the greatest impact of the World Wide Web is the gateway to an endless information resource and the immediacy of this resource to the school systems. The almost instantaneous access is advantageous for students being able to utilise the large amounts of international information (Chapman, 2002). However, access to vast information repositories is just one facet of the Internet which is overlooked by many teachers (Delacruz, 2004). There are other variables to consider such as interaction diversity, operational flexibility and curriculum enhancement that are possible in an online environment. The challenge for educators and schools is in harnessing that range of Internet functionality in a meaningful learning context. The potential of the technology is recognised (Strigel, ChanMow & Va'a, 2007; Elliott, 2004), in the quest to enable schools to unlock that potential.

3.3 Using the Internet as a Learning Platform

The advent of Internet technology in the education sector brought speculation and expectation about change to the learning landscape. Forecasting 'anytime schooling', the Web provides the opportunity to conquer distance and time enabling communication and engagement with other schools across the country or countries in a synergistic format. Using the Web as a conduit, phas the capability to transform education. From blogs to wikis the Internet provides a flexible array of interaction capabilities suited to the requirements of education courses and users. There is also the potential to enhance the quality of the learning experience (Grabe & Grabe, 2004; Bates, 1997), by creating a flexible environment tailored to suit the curriculum requirements and learning ability of the student. Learning via the Internet, is seen as the means of empowering and engaging learners (JISC, 2004).

The initial development of learning via the Internet however, it could be argued, was anything but interactive and empowering for the learner. Before the Internet, those organisations involved with distance learning packaged course units and distributed the paper-based modules to the intended recipients. These traditional modes of distance learning were adapted for eLearning with the content of the web delivery organised according to the tradition of posting lecture notes and materials (Downes, 2004). There was almost a complete absence of interaction as many instructors were reluctant to change their way of practice due to their unfamiliarity with the technology application (Anderson & Middleton, 2002). The transposition of text-based material to the virtual platform was their way of coping with the challenge of a web platform and having to consider matters from email to discussion boards. It is also plausible to consider that posting text-based material on a web site would be cheaper for organisations rather than having to employ a web developer to design specific interactive material. Bérchervaise and Chomley (1998) argue that copyright laws involving intellectual property and associated royalty costs as well as development costs stifle effective web deployments. An Australian report (DEST, 2001) examining the country's future with educational technology confirms cost factors and teachers' lack of readiness but also identifies poor or lack of digital access as contributing factors.

Some learning deliveries via the Internet modeled the organisation of distance learning with packages that were distributed to the intended recipients. The predominantly text or paper-based material was organised sequentially into units usually following a weekly timeline. This material was either delivered completely online or concurrently with seminars to a cohort of students who were responsible to a teacher/lecturer. These courses followed specific criteria and the course assessments were to be completed in a set period of time. This type of learning has attracted some criticism as the structure, including the amount of interactivity, represented the antithesis of what has become effective eLearning or effective learning in general. The passive delivery lacked strategies to engage the student in interactive, collaborative learning. In essence the technology was used as a faster version of the postal service. Bérchervaise and Chomley (1998) label this type of elearning as a poor substitute for paper handouts from an innovative teacher. Whilst this model of eLearning still exists, other models have developed with different amounts of technology interaction. Online learning content does not just involve the use of text based content but multimedia and simulations as well (Mason, 2005; Driscoll, 2002). The amount of engagement with the eLearning material is very much dependent upon the strategic interaction established between the learner and the institution and it is this criterion that forms the basis for eLearning model definition.

Roberts and Jones (2000) defined four models of eLearning; naïve, standard, evolutionary and radical, with the amount of interaction defining the benchmarks between the four groups. They postulated that the naïve model was the most widely used and it was simply posting lecture notes on the web, there being no formal electronic communication between student and teacher or student and student. The standard model was differentiated by allowing a significant degree of communication. The evolutionary model content, interaction and structure progressively develops depending upon the anonymous feedback from the students. The radical model, as the title suggests, departs from the traditional framework of the classroom and lectures. This model allows the students to shape their learning by forming learning circles with other students engaging in the problem/research required and teachers are placed in a consultative role providing assistance when requested. These models, whilst capturing the type of learning taking place, do not adequately define the tension between the learning, the skill of the presenter and the organisational parameters. An alternative model places all the types of learning into one category called 'enabling learning'.

A framework was developed for Curtin University (Shortland-Jones & Barrett, 2004), showing how the learning platform catered for student centred learning. This framework was developed as the result of a previous review that categorised the development of Curtin's developing learning platform. The summative rating, Figure 3.1, shows the status at that time of the learning at Curtin.

1. Lone Rangers
2. Central Project Grants
3. Rapid Uncoordinated Expansion

Curtin Status

4. Focus/Policies/Funding
5. Quality and Sustainability (Bates, 2003)

Figure 3.1: The Status of Evolution of Online Learning Development at Curtin in 2003

The above process model demonstrates that, whilst eLearning may have been prevalent and increasing, it was still established on the principles of those wishing to promulgate eLearning practice. Without a coordinated policy about online learning, it is likely that different principles would govern the online learning for different faculties and possibly be counterproductive for the institution. Further research on the learning development led Shortland-Jones and Barrett (2004) to divide the learning in the 'enabling environment' (Figure 3.2) into three main areas; flexible learning, online learning and distance education. There was also a fourth category of open learning where the students access courses from other universities but is not expanded here because it involves the learning platforms of other institutions. The fourth category is noted due to the viability of using eLearning to expand a secondary school's curriculum by gaining access to other schools' curricula for their students.

In the model, the traditional mode of using the Internet as a postal service for the transmission of text material is acknowledged by the inclusion of distance education. The other two categories, flexible learning and online learning, allow for a greater dynamic utilising collaboration and flexible assessment strategies. The authors do not make a distinction about the amount of face-to-face teaching that is replaced or whether the courses are completely online but rather stress that the platform should be seamless with the entire suite of university courses. These concepts parallel the knowledge construction and the development stages in Salmon's 5 stage model for e-moderation (Salmon, 2003). These stages depict the learning activity, collaboration and interaction. Salmon links the stage criteria with technology use and qualifies the amount of technology use with nature of the task and the technology skill of the user.

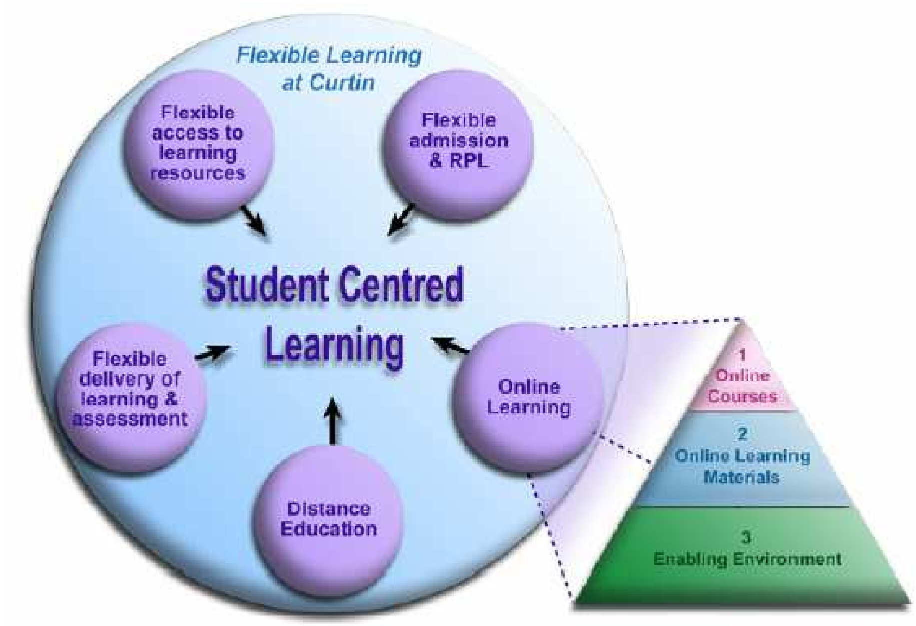


Figure 3.2: Flexible Learning Model at Curtin University

Many factors underpin the adoption of a particular technology model in education from the advances in ICT to the changing nature of the learner. Using the previous consumer analogy one could suggest that the demands of the learner should be paramount in influencing an institution's adoption, development and delivery of ICT solutions. Before considering the adoption of an eLearning model, one should consider the readiness of the organisation to implement such a model. Elements such as available technology, willingness to adopt, ability to deliver and leadership support are factors that will determine the success of implementation and sustainability. Psycharis (2005) organised these elements into three groups to determine e-readiness; resources, education and environment. Whilst resources can translate to availability of immediate technology to institutions or the funds to invest in the technology for any type of online learning, Psycharis does qualify the other two groups. In education and environment, the nature of the learner is considered as well as the willingness of teachers and administrations to support that approach to eLearning. The key element is to ensure that the learner is meaningfully engaged, not just occupied, by numerous tasks that may while away time but not necessarily stimulate the learner. The eLearning content should catalyse the learning processes of the student (Hemphill, 2006), thereby challenging the individual's intellectual cability, utilising the flexibility of the Internet, rather than allowing a mass-produced completion of task.

3.4 Effective eLearning

Various institutions and researchers have been investigating ways to infuse the current eLearning practice with the appropriate pedagogy. Increasingly this approach is acknowledged as more reflective of teaching practice rather than technical competence (Calvani, Cartelli, Fini & Ranieri, 2008). Impediments to the infusion of effective pedagogy with eLearning are varied and have been previously identified as cost in developing material, cost for appropriate infrastructure, inadequate administrative direction and teachers lacking the appropriate technological skills. Whilst acknowledging these impediments as substantial barriers, it is also pertinent to adequately define the nature of pedagogy for effective eLearning practice. The pedagogy to underpin effective eLearning delivery are those areas of practice synonymous with effective learning and teaching. These practices involve providing material that is appropriate and stimulating for the learner, specific tasks to discuss and a timeline for that discussion as well as the ability to collaboratively work through experiments, problems and simulations. Assessment is also a matter for consideration and part of those assessment processes would be to include peer review and comment on the solutions.

In outlining issues central to online teaching, Mason (1998) argues that collaborative learning is one of the keystones of effective eLearning. The key goal in exemplary eLearning practice should be the same as in exemplary learning practice: how to engage the students in an optimum manner. In fact, comparing the student assessment as a result of effective eLearning practice with those from effective learning practice should produce results that are comparable. An experiment testing this notion was commenced in the University of Verona in 2002 (Favretto, Caramia and Guardini, 2005). The aim of the experiment was to describe and measure the learning levels of attendees and eLearners. Whilst acknowledging that the characteristics of the participants were important in the ultimate findings, nonetheless the comparison between the proficiency test marks of online and classroom students highlighted that on average the marks of the elearners were just as good if not better. These results provide some evidence that the practice of eLearning does not inhibit student learning when it is delivered within an adequate infrastructure.

A combination of government guidelines, educational target data as well as the demand for virtual learning simultaneously ensures and assures administrators that investment and practice with technology and the Internet platform is warranted. The adoption of eLearning, however, requires practitioners to integrate sound learning principles in their use of online environment applications. The Internet will not replace human interaction or collaboration, rather it will be another vehicle for it. Interaction, usability and relevance (Downes, 2004) should form the hallmarks of a viable eLearning program. The program has the further possibility of being tailored to individual leaner profiles thereby enhancing the relevance and motivating the individual user (Creanor, Trinder, Gowan & Howells, 2006). The sustainability of eLearning does depend upon the adoption of new models of teaching and learning leading to new ways of knowledge construction (Cartelli et al., 2008). The emergence of Web 2.0 has further enhanced mobility and interaction providing technologies that simultaneously promote collaboration and sharing as well as being relatively inexpensive. Web 2.0's success is based on user needs for content creation, communication and collaboration (Bidarra & Cardoso, 2007). The ability to engage with relevant, stimulating material on a user-friendly platform provides an authenticity to captivate the learner and motivate further engagement.

The possibilities to be achieved with effective eLearning practice have motivated and/or compelled educational institutions, driven by governments and social demand, to persevere with its implementation. The context of the current world scenario coupled with the various ways in which people learn are persuasive reasons for educational institutions to offer courses that satisfy the needs of the learner. It should also provide the institutions with some conviction that the courses will provide adequate training for future lifelong goals.

3.5 Online Learning in Practice

As previously outlined, there are many factors contributing to the uptake of online learning by countries in an educational framework and then by the various academic institutions within those countries. Geographical size, investment in infrastructure and commitment to training all create a continuum of development and productivity on which world nations find themselves. Countries that have invested heavily in information technology infrastructure as well as sponsoring initiatives to promote eLearning find that there has been a high uptake of the eLearning platform in terms of the amount of use and, probably more importantly, the interactive nature of the uploaded content. The UK's Electronic Publishing Services (2005) used OECD data to identify Sweden as one such example and placed Sweden at the top of the eLearning-ready nations. The report categorised the readiness as the 'ability to generate, disseminate and use digital information for the betterment of the country's economic activity'. At the tertiary level the report nominates the Swedish Net University as an organisation typifying good eLearning practice. The University operates as a repository of eLearning content and acts as a coordinating point for the individual universities across Sweden. This eLearning solution for the tertiary sector is made possible through the planning strategies funded and implemented by the Swedish government.

Citing again the tertiary sector, various universities develop strategies to promote and enhance the eLearning opportunities within their organisations. Universities have realised that that an effective eLearning structure within the University can increase the number of students able to participate in their courses. It is an acknowledgement that in developed countries there is an increasing number of students progressing into further education as well as a growing number of adults returning to the education system (Rajasingham, 2005). The Australian University Teaching Committee submission on the 'Centrality of Leaning' (2002, p.2) also commented on the 'rapid penetration of eLearning into education and training institutions…seeking to capitalize on its promise of increasing access to learning opportunities as well as enhancing the quality of learning outcomes.'

When considering the motivation of students to attend universities of their choice and study selected courses, it would be presumptuous to consider these students captive to an educational delivery that neglects learning needs. From an eLearning paradigm, universities have considered various strategies to assist in the effective delivery, uptake and achievement of these courses. The University of Pretoria employs educational consultants to assist university staff to modify existing content as well as create and deliver new eLearning content. Two of the key responsibilities of these consultants are

- To advise on the design of the learning materials that optmise learner interaction and engagement therewith,
- To advise on techniques to enhance online communication between learner and facilitator and between the learners

Another example from Hong Kong is the e3learning project (Hodgeson & Lam, 2004). This project not only provides IT technical support but more importantly provides production and evaluation services for the teachers. Whilst more examples could be cited, the main focus is the importance with which eLearning is starting to be viewed by various tertiary administrations and is endorsed by the greater access for tertiary staff to eLearning advisers (Currier, Barton, O'Beirne & Ryan, 2004). Successful eLearning schemes within the tertiary sector are the result of a willingness and means of senior administrators to plan, budget and strategically underpin these successful programs.

3.5.1 Online Learning Practice in the School Sector

The type of eLearning taking place in the school sector has some obvious similarities with the tertiary sector including the difficulties in implementation and adoption of such programs. If anything, given the sheer size of the school sector, issues experienced in the tertiary sector would certainly be magnified. Acknowledging the current level and practice of teachers' ICT skills as well as existing school infrastructures, already highlighted in Chapter Two, then eLearning could well follow traditional forms of learning. Russell (2006) defines the majority of school-based eLearning as conventional with students physically meeting their teachers in a designated classroom with online facilities. The majority of the work takes places in the classroom with some of the work completed in the home setting or away from school. Many eLearning schemes and initiatives are established to support this type of learning. The European School Net was established by 26 education ministries as a response to the growing content of the international portal to build a network to service the growing communities and to foster innovation (Christensen, Lundin, Triay & Lehtonen, 2002). Schools use the Internet through an exchange which acts as a portal to repositories of learning. Early examples of projects include:

- Netd@ys Europe – An initiative promoting the use of new media in the areas of education and culture culminating in the showcasing of online and offline events
- Celebrate – A project based on what electronic content may look like in the future. The project includes the provision of an online database that will include learning objects for education

More recent examples of projects show a greater diversity in interaction and use of technology:

- iClass - A project designed to develop a series of resources designed to meet the learning needs of the individual.

- Inspire - This site enables access to the most recently developed resources in mathematics, science and technology. (European Union, 2008)

In an Australian context, the structure is similar to the European model as the programs supplement or enhance the learning taking place in the classroom. The Department of Education Science and Training (2004) cited various programs and initiatives that have eLearning as part of the program structure or are preparing for eLearning:

- The Real Game program
- VICONE , Victoria's high speed network
- Western Australia's telecommunications services project
- DECSIT The Australian Capitol Territory's initiative to provide a fast reliable online service to the staff, students and the community
- The interactive distance learning venture between the Northern Territory, New South Wales and Sing Tel/OPTUS
- E-magine the Tasmanian centre of excellence in Online learning

These examples are all based on a classroom context but with a propensity to change as school strategies and infrastructures change and teacher ICT skills are enhanced.

The migration to a virtual campus where students can use online education for some or all their classes is not easily realised in the 'normal school context'. For students who rely completely on distance education, the virtual school has become a reality where the necessary infrastructure has been put in place. It has also enabled these students to have access to a wide curriculum with a level of resourcing that assists the students in this mode of learning. To Clark and Berge (2003), the virtual school represents a natural evolution from several traditions of distance learning and technology use in schools. Many of the traditional administrative structures common to virtual schools are recognisable in the independent study traditions of distance learning. To describe the nature of virtual schools, Clark (2001) undertook a survey of 33 virtual schools. His findings showed that the most frequently stated objective was access to an expanded curriculum. Similar to previous forms of distance education, the virtual school provides courses for students that they could not otherwise take and generated enough interest and momentum for such schools to continue. Other scenarios are very much dependant on teacher skills, school infrastructure, access and funding. Russell (2006) stated that, in Europe as a whole, virtual school education is not prevalent but is more common in North America. The types of virtual school range from places where there are no school buildings to systems where the students do most of their learning outside the school but meet at school mainly for the social interaction. The UK has a system of virtual schools for disadvantaged students with Notschool.net developed out of Ultralab (1998) as one of the best known examples and one that is still continuing successfully. This project had similarities to one project commenced in 1996 around flexible and online learning in the Australian state of Tasmania. It is outlined in some detail to profile the scope of the flexibility as well as displaying a merger between the distance education component and the traditional education environment. This project focused on the flexibility of the curriculum and engaged learning through the online environment and moved away from transposing distance education material to an electronic format.

The Tasmanian system established an online platform in an attempt to satisfy the learning needs of its distance students but also incorporated other types of students not traditionally covered by a distance education authority.

> 'The Tasmanian Open Learning Service (TOLS) provides an educational program to approximately 250 students from kindergarten to year 10 who are unable to attend school due to geographical isolation, medical or psychological difficulties, behavioural reasons, pregnancy or because they are traveling. TOLS also provides a limited service to other schools that do not have access to a teacher in a particular subject area.' (Tasmania Online, 2000)

The service had three components as its core; the online classroom, a cross-school delivery and the e-learning exchange. The online classroom delivery was flexible. Students were either taking part in off-line activities, normal class, or being involved in other schools collaborative projects. Students also had the choice of taking part in various online deliveries or being part of a class where a teacher delivered the program to other schools. In a report to the National Materials Development Network (2001) it was indicated that the three components combined to deliver effective learning in the appropriate context affirming the notion of ICT's anytime, anywhere education.

Whilst it is possible to list other examples in different countries with other variations of online learning, the examples given above serve to demonstrate some of the flexible components possible with online delivery. The documented examples have had varying degrees of success with the various implementations. However, there does not appear to be a broad engagement with eLearning by schools or school education authorities despite the success that eLearning has delivered even with limited implementation. The Commission of the European Communities (2002) stated that it was well on its way to connecting all schools to the Internet and training teachers to an acceptable technology skill. However, the report also stated that much more needed to be achieved in the area of integrating ICT into education and providing a better eLearning framework. The same effect that ICT embedded learning has in meeting the needs of the individual can be translated to the eLearning platform. Siemens (2002) refers to education systems not meeting the needs of lifelong learners. Learners need to be able to access material that meet their needs when they want it in the continuum of lifelong learning and an effective eLearning platform can offer that. Cartelli (2005) also refers to the need for negotiation between stakeholders in developing the platforms that meet their needs. It is how knowledge is represented in conjunction with the mode and media chosen that is a vital aspect of knowledge construction (Jewitt, 2008). In future directions the challenge perhaps will be not to manufacture a laptop for less than $100 (US) (MIT Media Lab, 2005) but to engage learners on an effective electronic platform. The future scenarios with eLearning will need to incorporate changes in infrastructure but primarily on the learning it will facilitate rather than the access to material.

3.6 Future Directions

Given the speed with which the Internet has developed, it is difficult to predict scenarios for institutions' infrastructure development. The developments in Internet technology though are dependent on the popularity of the uptake of the developments and it is this area that may be useful to explore. Email is an apt example when adjudging the effectiveness of its use. A report by an American Consortium of Schools (2004), states that email was limited in its effectiveness as a communications tool as only some people in organisations had access to it. Email is now recognised as a standardised communications tool by most organisations (Gauntlett & Horsley, 2004). However, the school aged population has moved to using other applications such as twitter and facebook because email cannot accurately communicate the immediacy and intent of the communication (Alexander & Levine, 2008). These variations in communications use typify the dichotomy between teachers' and students' purppose in the use of the various communication tools. The development of learning platforms should consider not only the impact on the learner and the learning organisation but also the process of innovation (Crook et al., 2008).

Many educational authorities are exploring and trialing new technologies with a view to broader implementation. These technologies are designed to further capture the imagination of the learner and make learning more relevant. Two innovations that BECTA (2006) are researching are the 'Ambient Web' and 'Mobile Bristol'. The Ambient Web is exploring the idea of creating a media-scape. Using location technology such as GPS, it will overlay a digital landscape onto a physical environment. BECTA cites the 'Savannah Project' by Futurelab where the school playground is transformed into a savannah landscape enabling students to digitally explore geographic and scientific phenomena. Mobile Bristol looks at access to educational content services and support from home or while on the move, basically at a time and place to suit the learner. The types of devices that are able to accomplish this task are increasing, blurring the boundaries between mobile and fixed services. UNESCO, amongst others, is exploring the use of game theory as a learning setting for students to investigate historical events (Chakaveh, Werning & Geuer, 2006). This research explores the concept that peer-to-peer teaching reinforces mastery combined with computer simulations in which the students can immerse themselves in the experience and utilise problem solving strategies to achieve an endpoint. The research also provides an example where an environment rich in stimulation with meaningful outcomes has captivated students and teachers and encouraged further exploration of technology and learning.

Further discourse about other ICT/eLearning innovations will highlight learning possibilities for school education as well as the various infrastructure needs necessary to support such directions. As each electronic mechanism is invented or trialed, benefits to the learner are detailed and ways in which broadscale implementation can be achieved are disseminated. However, it is not the innovation so much as the environment in which the eLearning takes place where the greatest potential for learning possibilities lies. Crucial to maximising the possibilities will be changes to the learning environment and how that will impact on greater accessibility to eLearning content, and use thereof, by the learners. Watkins (2005) argues that part of the success for the future of eLearning will be in developing new skills and habits. Another component of successful eLearning evolution and development is that current practice, as it has been defined, will be rendered obsolete. Wentling et al (2000) discuss the notion where the learner and the instructor will be working in a technology-rich environment but the environment is not the focal point. It will have reached a point where the demarcation between working and learning will have some flexibility. The infrastructure will have responded to the learning diversity.

3.7 Conclusion

This chapter has drawn some eLearning comparisons between government, corporations and the academic sectors. The streamlined success of the corporate eLearning structure was outlined along with the move by governments to copy those structures for their own infrastructures. The corporate model could not, however, be successfully utilised in an education sector due to the curriculum criteria and the learning interaction required by the learner in schools. The nexus between governments and education through funding has been portrayed with an explanation and examples of some of the different strategies used.

Some time was devoted to justifying the need for governments to position themselves in a global economy along with corporations. Part of that justification was examining the part that the Internet and World Wide Web played in achieving such economic success to illustrate the potential of the online environment and how it can be harnessed with the appropriate infrastructure. Examples were given of the increases in corporate profit margins and how that led large companies to examine other benefits that the Web might provide. The cost cuts obtained by transferring training to an electronic environment were sufficient motivation for corporations to implement this new form of training successfully. Of note were the efforts by corporations to address each stage of the training process to ensure an optimum delivery. This in turn provided sufficient impetus for governments to examine education practice, not ostensibly for profit but how to utilise the Web for a more effective education environment to promote a knowledge economy. Hence there was some discussion about governmental agendas and education policy.

The education sector, in this discussion, was divided into two spheres; secondary and tertiary. Work had been accomplished, in varying degrees, to initiate eLearning in both sectors and the discussion focused on a range of deployments from the digital conversion of paper-based content to innovative practice. Some of the historical development was given as it was pertinent to understanding the current state of both sectors as well as establishing common elements in the establishment of eLearning. Whilst this study does focus on secondary education one should realise its connectedness to the university sector and practices in both may impinge on each other.

In considering an online component for university, it was found that teacher skill and cost were major factors in the early and current implementation of eLearning. The posting of coursework as entirely text based material was a reflection on the lack of skill of teachers in posting the material and also a lack of understanding about effective e-Practice. The continuation of such practice is largely due to the inability of universities to fund sufficient support for teachers posting material and the development of such material to engage the learner. There are universities, however, that have rationalised funding to deliver more appropriate eLearning courses following a realisation that adding eLearning components to courses can dramatically increase enrolments for the university. The types of support that the universities were able to provide were; appropriate assistance for teachers and students, necessary infrastructure components and in some cases devices to assist in receiving eLearning content.

The school sector was also faced with similar dilemmas exacerbated by the increased number of schools and students in comparison to the tertiary sector. A focus on teachers acquiring skill competency, inadequate funding and inadequate infrastructure were again highlighted along with the absence of an overall eLearning strategy and pedagogy. Various examples were provided detailing strategies used by schools and organisations that were successful in implementing eLearning. These strategies had one element in common in that the fundamental focus was virtual communication with a learning paradigm. However, the approach has been haphazard and piecemeal despite research and reports identifying the need and urgency for interactivity with the eLearning platform. There were encouraging signs, however, with research now identifying common strategies across different platforms that show success. The identified strategies, such as collaboration and using higher order thinking, are being targeted for new programs currently in development.

It would seem that for an effective eLearning platform several factors must combine in a cohesive and informed domain. Sufficient funds need to be provided to ensure effective infrastructure as well as supporting the teachers not in skills but in pedagogy as well. Organisational leadership should be sufficiently informed, assisted and directed by education authorities to implement a uniform and effective eLearning platform. Educational systems need to develop and implement flexible platforms that will cater for the needs of today’s learners.

The present research project into ten schools in one education system unfolds over the next six chapters. The technology and online perceptions and practices of students and teachers in those ten schools are analysed along with the technology strategies of the schools as portrayed by the principals of those schools. The analyses initially examine student and teacher data as two distinct groups before treating each school as individual case studies seeking identifying characteristics.

As patterns and trends emerge in the analyses, they are compared and justified with aspects of similar focus in the research literature. Substantiation for the practices in the ten schools is sought not only amongst similar schools but in the wider education community and other volume technology users.

Part of the analyses also highlights the redevelopment of the stages of learning identified in an eLearning delivery. Current definitions amongst the education sector are explained and dissected as a precursor to the redeveloped eLearning stages. These new stages are justified with the learning focus established in the research literature and that learning extrapolated to an online environment. The reconceptualisation of eLearning adds further definition to the trends and definitions outlined in the two literature review chapters.

Chapter Four Methodology

4.1 Introduction and Study Focus

This chapter connects the literature reviewed in the previous two chapters with the intent of the study and the approach used to meet this intent. The methodology used to gather data that are analysed to enable responses to the research questions defining the direction of the study is described. The selection of the research samples of students, teachers and principals that provided the data are also described. The data was harvested from two questionnaires, one each for students and teachers and from interviews conducted with the school principals. The design of the questionnaire and interview questions follows as well as the details of the administration of the questionnaires. The results of the analyses are described in subsequent chapters.

The literature related to the impact of technology, particularly computers and the Internet, on the educational community underpins this study's focus. This research takes place in a secondary school context and examines the technology perceptions and practices of students and teachers in ten secondary schools.

An objective of research is to broaden the knowledge base for practitioners by providing further substantive information about their area of practice (Pare & Elam, 1998). There are several key aspects, outlined in section 4.2, underpinning this research design which enable the researcher to provide meaningful direction for the chosen field of study. In this case the research and its findings aim to further inform members of the education community about the effect of computer technologies on education practice and student learning.

The research project was designed to capture perceptions and descriptions of the various interactions of students, teachers and principals with technology. Accordingly the methodology was designed around the case study approach centering on the student and teacher positions, which are specific to their individual school. The case study allows the research themes to remain central to the study whilst conducting a closer investigation of the perspectives of students and teachers within each school.

4.2 Research Direction and Questions

The following three questions reflect the principal concern of the study which is to examine the current state of Information Communication Technologies use within schools and to explore of the feasibility of an online learning environment in that context. The online environment provides an opportunity for the education sector to engage technology-confident students with a flexible curriculum and a stimulating learning delivery. To investigate whether schools are ready for online learning the research thrust revolves around these three key questions:

1. Do students and teachers believe they have the skills to use online resources?
2. Are teachers setting effective learning tasks for an eLearning environment?
3. How are schools currently employing online learning resources?

The three main questions lead to the development of supporting questions listed below. The first question deals with teachers' perception of the value of using technology in the school/learning context. Teacher perception is vital as it will strongly influence the use of computer technology in the schools for the students. These perceptions will also be linked to examining the impact that computer technology may have on learning and education (see sub-questions 5 to 8).

1. What is the relationship between teachers' self-perception of their computing skills and the integration of computer technologies into education programs?

The data used to answer this question enabled examination of any link between a teacher proficiency rating in the use of a group of particular computer applications and the use of those applications by students at school.

The next two questions deal with teacher training, teacher computer practice as well as structures that schools have established to facilitate these issues.

2. What infrastructure has been established at schools to assist teachers in (a) increasing their information technology skills and (b) integrating technology into their teaching?

In answering this question, the data provided information about the existing state of technology practice within the school as well as an insight into the succession strategies for technological enhancement within the school. Technology practice was measured by the frequency of student and teacher use of school computers identified in the questionnaire. Teacher application proficiency and usage, also identified in the questionnaire, were augmented by school-instituted programs to focus on particular technologies. Information about technological enhancement was sought through interview with the school principals. School technology development practices were also identified for both infrastructure enhancements and teacher professional development in ICT.

3. If the school has an infrastructure of networked computers, (a) what influences were responsible for its establishment and (b) what goals were serviced by establishing that infrastructure?

This question sought to capture a perspective on the development of the computer system in the schools. The information about the development and growth of computer laboratories, computer spaces and types of networks was sought from the interview with the principals. It also involved an examination of the principles underpinning the development of the computer networks. Establishing an overview of schools' infrastructures enabled evaluation of the suitability of school infrastructure for school technology plans and student and teacher access.

The next question seeks to discriminate the use of the computer by students to determine whether there are any factors affecting how computers are used.

4. Is student age or gender related to
   (a) their level of computer skill or
   (b) their interest in using computers?

This question sought to examine any differences in age and gender responses by the students in their use of the computer at home or in their interest in using computers at a school level. The age differences were identified using the year level structure in schools. Gender differences in coeducational schools were also identified within each co-educational school as well as in the comparison of results between the single-sex schools. Different influences affecting the choice of computer application or frequency of computer use may impact on the success of technology programs within schools.

There is some research evidence to suggest that computer technology can enhance learning and build effective bridges between students and their intended learning (Interactive Education Project, 2004). The purpose of the next two questions is to provide information about linkages between computer use and enhanced learning or achievement.

5. (a) Is there a perception amongst (i) teachers and/or (ii) students that computer based programs will improve student achievement.
   (b) Is this view consistent across all types of schools namely single sex, co-educational and secondary school in years 7 to 10.

Student and teacher perceptions were gathered about the use of computers affecting learning, assessment and future education courses intended. These perceptions were examined for their positive and negative orientations and consistency. The examination also included the student perception by type of school to determine if this influenced those perceptions.

6. What impact, if any, do students perceive that online learning can have on their education?

There is an undeniable global trend towards adopting and maintaining a significant online presence for many types of transactions. Education is part of that trend with different educational institutions adopting some type of online learning. Student perceptions of the concept of online learning were surveyed to capture both their ability to manage the environment and the pragmatics of accessing that learning platform.

The next question focuses on determining each school's progress towards an online platform. This also relates to question eight in determining how schools have develop policy and directed resources to acquire computer technology and implement the direction they wish to proceed with it.

7. Is there any evidence of an online delivery of educational services in schools or a movement towards one?

Responses from interviews with the school principals assisted in completing the technology picture about online educational delivery for each school. The principals' responses together with previously developed online learning categories from the literature review and from a detailed investigation of each school's web presence were used to develop a learning categorisation for school online environments. The measure developed, called the eFactor, enabled an overall summation about the actual state of online learning in each of the secondary schools. The responses from individual principals about online delivery varied as it was influenced by the principal's understanding of an online environment as well as their personal opinion of the Internet. The principal's response was also seen to reflect the policies and perspectives of the particular education system as the principals' assume the authority of the system in their own schools and are obligated to enact their policies.

8. (a) Do School Principals or (b) participants from the case study schools, see any advantage or disadvantage in adopting a greater investment in the use of computer technologies in the learning process?

The material used to form an impression about the school direction in the use of technology was taken from the interview with the principal of each school and a documentary analysis of each school's web presence. The principal responses were examined for any particular trend or planned direction in the use of technologies. Each school's web page was examined and every learning item was analysed according to the criteria developed to define the eFactor. The information from both sources provided evidence about the school direction in utilising this form of technology.

4.3 Research Design

In order to select the optimum methodological approach it was necessary to consider and incorporate the various elements that would interact in the research setting. The selection of a particular methodological approach is pivotal as it influences how a researcher approaches a research question and guides their research (Giorgi & Giorgi, 2003). The school paradigm with its own particular setting as well as the various realities of students, teachers and principals, requires an approach that encapsulates how those realities operate within a school context. Adopting such an approach enables a deeper appreciation of the human interaction at the very core of research setting and a biographical construct of each individual school (Stake, 1995).

Case studies usually involve qualitative research methods as they allow researchers the opportunity to examine more closely the subjects of the study. Baker (2000, p. 8) maintains that qualitative methods provide critical insight into the perspectives of the subjects of the study. However, within and across case studies quantitative methods are often used to provide descriptive statistics, scale development and investigation of correlational relationships. It is justified in this case as it allows the researcher and the intended audience the ability to develop a richer understanding of the complexities between teacher and student perceptions, the impact of technological development and the implications for an online presence. This is what Mingers (2001) identifies as the position where research situations are seen as complex and multi-dimensional and would benefit from a range of methods to capture as much as possible the views of the students and teachers involved in this research.

The students, teachers and schools are described by detailing the results of the descriptive statistics in the quantitative analysis applied to the surveys administered. The data generated from the analysis provide information about location and availability of computers as well as the range of computer application practices across the samples. The analysis model involved testing the strength of the relationship between a set of defined constructs and the impact of those constructs on the learning present in the schools' web pages. The pre-determined constructs in the model were measured by scales derived from factor analysis.

In order to test the relationships between the constructs in the model, linear regression analysis was used to explain the impact of the independent variables on a range of dependent variables culminating in the eFactor. Multiple linear regression enables researchers to establish whether and to what extent the independent variables explain variance in the dependent variables. In this study, the relationships between the constructs were tested initially across all schools and then within each individual school. However, in schools where the teacher sample was less than 20, it was considered that the results of a multiple regression analysis would be unstable and simple correlation analyses were used at the teacher level to provide indicators of the strengths of bivariate relationships between the constructs for those schools. The last stage of the analysis model involving the evaluation of the learning content is described in the development of the eFactor.

4.3.1 Development of the eFactor

The analyses measured the cumulative impact of the independent variables on the learning presence contained in the school web pages. This entailed the development of a set of criteria which were brought together to form an index, called the eFactor, to categorise the learning components on each individual school's web presence. The process of categorisation, the weighting applied to each category and the number of postings is treated in depth in Chapter Five but the development and formation of the categories is outlined in the following paragraphs.

Previous eLearning models outlined in Chapter Three used in secondary education, described the learning as a mixture of blended styles with varying amounts of face-to-face teaching and material that was fully online. Blended learning was treated as a singular category without discriminating between the amount and type of face-to-face teaching. An effective eLearning model should allow for pedagogical strategies (Goodyear et al., 2001), as well as encompassing the experience created for the learner (Britain & Liber, 2000). Part of an eLearning model should also incorporate possible bias such as a teacher's preference to use didactic material, as implied by Chickering and Ehrmann (1998). This adds layers to the level of posting such material that needs to be qualified in terms the pedagogical experience.
Curtin University (2005) portrays the different levels of online learning as a four staged developmental continuum shown in Figure 4.1.

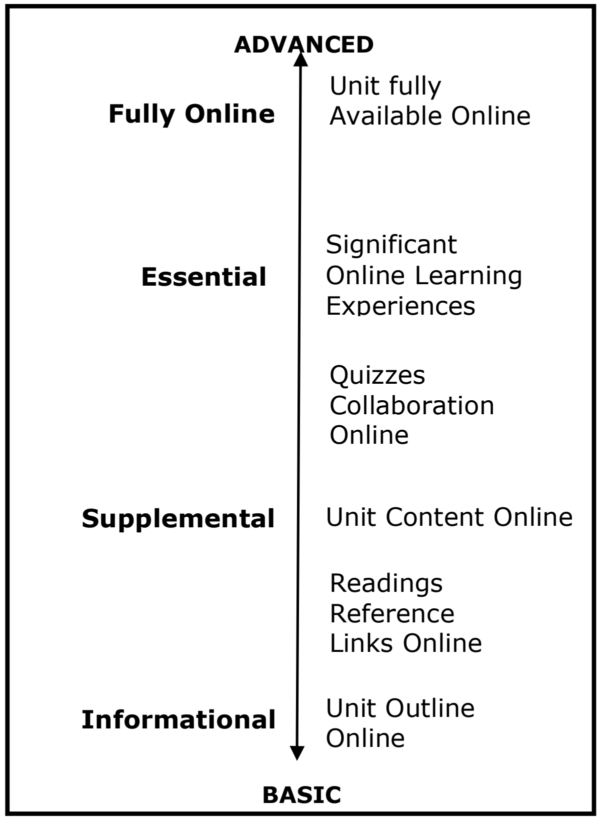


Figure 4.1 Curtin University eLearning Model

The appealing aspect of this model is the development of the components that comprise each category and the effort to place those components according to the level of their online interaction. There is also consideration for the primacy of the course material by rating the material from informational to essential, because this grading pairs a learning experience with an amount of online interaction. Hindering the adoption of this model, however, is the lack of clarity in the 'Essential' category with its 'significant online learning experience'. The Curtin University description of this component states 'that it is essential that students use the site in order to complete the unit'. This description is vague as it fails to qualify the term significant online learning experience. The amount of interaction that could take place is therefore variable, relegating the visit to perhaps the retrieval of a single piece of information, and is contradictory to the timeline description. It also could be argued that the posting of 'Unit Content' and 'Unit Outline' be considered at the same level of interaction.

Seimens (2005) was both more expansive and generic in describing eLearning as seen in Figure 4.2 which is adapted from his mind map.

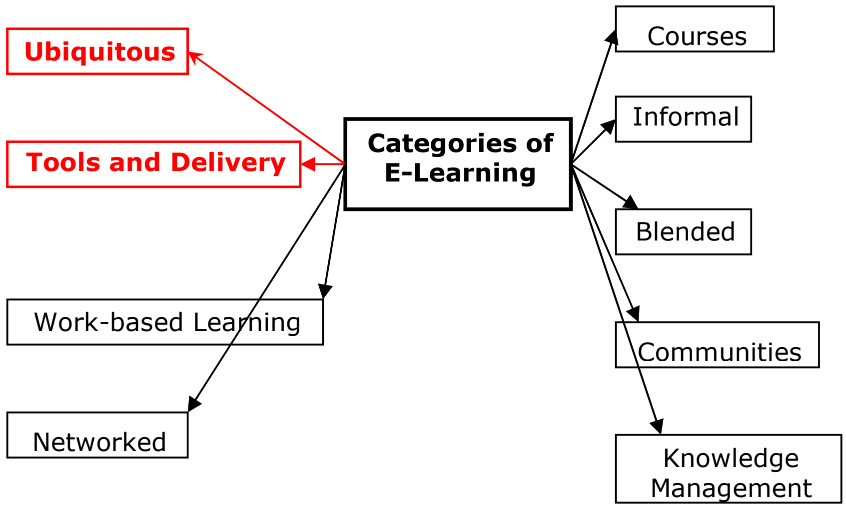


Figure 4.2 Seimens Categories of eLearning

Seimen's model provides a global picture linking those components of management, resources and types of learning that are involved in the delivery of eLearning. The model's greatest asset is the clarity with which Seimens captures all the elements for eLearning delivery with the model divided into sub-categories by separating 'Ubiquitous' and 'Tools and Delivery' from the learning effect. Seimen's network is a complete package examining the learning dynamic, course structures, the learning paradigm and its effects in a wider environment. Unfortunately for the purposes of this research, this model's approach, with its outreach to a wider society, is too broad. The model has elements of infrastructure requirements, involvement of wider education community programs and a social commentary section that do not concentrate on the learning contained within the programs. The category of courses is a description of the courses delivered and two categories of informal and blended do refer to a type of learning but these do not discriminate sufficiently in describing the learning for each category or the differences in the learning between the categories. The category of communities refers to the groups of learners involved in the learning and work-based learning further extends the parameters where virtual learning can reach and happen. The other categories refer to either administration or infrastructure domains.

The determination of an eLearning platform, or Learning Management System (eg. Blackboard or CNet) is dependent upon the available resources, the wider community as well as the skill of the personnel. These layers add a level of complication when examining the purpose of the eLearning material in isolation. The OECD (2005), when examining eLearning in tertiary education, developed four categories of eLearning:

- Web Supplemented-focus: putting course outline and lecture notes online

- Web Dependent-focus: requiring students to use the internet for online discussion, assessment or project but there is little reduction in classroom time
- Mixed Modal-focus: online assessment, discussions and projects replaces classroom time
- Fully Online-focus: students undertake a course fully outside scheduled time or off campus

These categories do significantly discriminate between the amount of physical presence in the learning as well as the 'web interactivity'. However, the categories do not adequately distinguish between the learning purpose of material posted in the supplementary category.

This last problem can be overcome if one uses some of the differentiations in the Curtin model. The Curtin University categories of 'Informational' and 'Supplemental' distinguish between such items of administrative material, supplementary readings and weblinks. The progression from 'Essential' to 'Fully Online' introduces collaboration and the notion of class time being replaced with online material. The Curtin continuum does discriminate between defined learning purposes and general resources. The expansion of the supplementary category to administration, auxiliary, reference, preparatory and directed distinguishes between the supplementary readings, syllabus documents and administrative material as well as the purpose of the material. Categories of 'dependent' and 'variable interactive' discriminate between the amount of collaboration and the amount of class time these postings may substitute for. The categories, called eFactor categories, are outlined with examples in Table 4.1.

Table 4.1: eFactor Categories

Category	Examples
Administration	Downloadable school forms
Auxiliary	Learning related content
Reference	Links to syllabus and external assessment material
Preparatory	Organised electronic preparative learning
Directed	Links to material to be completed for school tasks
Dependent	Modularised unit replacing some of the class time
Variable Interactive	As in dependent but allows for collaboration and feedback

Using the eFactor as dependent variable, the model described in Section 4.4 below was analysed using multiple linear regression, with the independent variables being the six constructs detailed in the following sections. Separate analyses were undertaken to determine the strengths of the relationships that exist between the variables in the model for both students and teachers.

4.3.2 Case Study components

Each school had a different approach to the incorporation of technology and its use within the school by students and teachers. Hence each school is used as an individual case study. The analysis of the student and teacher questionnaires, incorporating the unique school data into the student and teacher models and analysing the models using correlation and multiple regression, is characterised as the quantitative component, and the interviews with principals as qualitative. The adoption of the quantitative and qualitative strands in the case study methodology enables any analysis trends derived from the overall analysis for all schools to be compared to distinctive analysis trends found in the individual schools. Similarities or differences in trends would be examined for its probable cause and how the trend in the individual school or group of schools would impact on or contribute to the overall analysis. A collation of the research methods is provided in Table 4.2.

Table 4.2 Collation of Research Methods

Method	Data Type	Approach
Interview with Principals	Qualitative	Interpretive
Analysis of Student and Teacher Perceptions	Quantitative	Survey
Analysis of Web Presence	Documentary and Quantitative	Documentary Analysis

The interweaving of quantitative and qualitative methods occurs in the development of the Case Study profiles and is demonstrated in Figure 4.3. Combining the quantitative and qualitative methods does not have to occur at any particular time but at the most appropriate time (Rocco, Bliss, Gallagher and Perez-Prado, 2003). The combinations outlined in Figure 4.3 not only enhance the depiction of the case study schools but also allow a meaningful mapping to the levels of online learning. This combination of the different research methods allows for a check on the validity of the study as argued by Cohen & Manion (1994, pp. 236-238). The final analyses from both research methods allows for greater depth of interpretation and understanding to ultimately answer the research questions that have been developed.

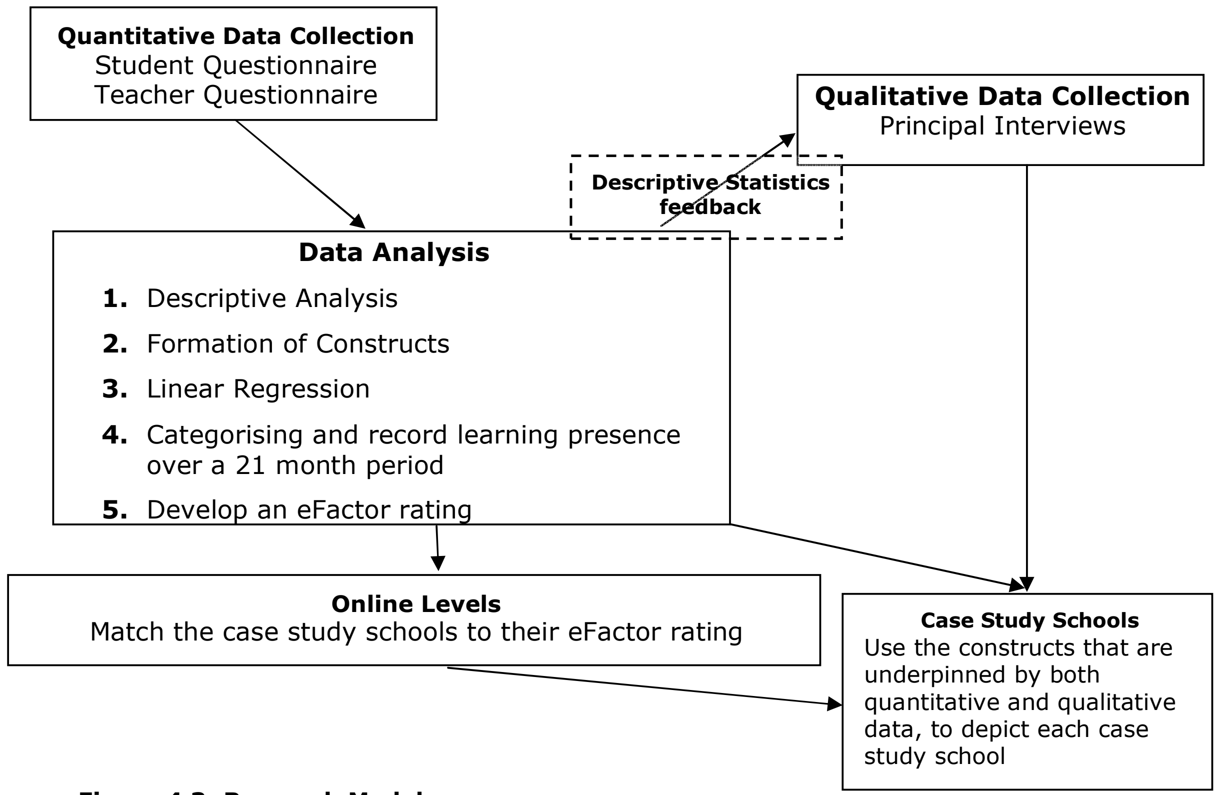


Figure 4.3: Research Model

4.4 Design of the Questionnaires

The quantitative data used to inform the research collected from two questionnaires, one each for the students and teachers. The design of the questionnaires was coordinated to provide matching information about the use of technology within the school. For both students and teachers the instruments were required to be concise and able to be completed quickly. It is the use of concise language as well as an easily understood format that will maximise the response of the questionnaires (Australian Bureau of Statistics, 2004). It was anticipated that students would complete their questions during an administration period, as this would have the least impact on the students' academic program. This period was considered an opportune moment to 'capture' the entire year group but it also highlighted the necessity of a concise form as the time span was short, perhaps as short as 15 minutes. A multitude of events usually occurs during this time and it is also the time when the attendance roll is taken.

Finding and anticipating a common time period for teachers was not as straight forward. In most cases common time was either at briefing time or meal breaks and, as teachers have different times during the day when they are not teaching, it would be logistically difficult to coordinate. The strategy adopted for teachers was to give them a definite number of days to complete the survey rather than try to have the survey completed in a day thereby compounding daily work pressures for some teachers. Teachers were given a time to submit their completed questionnaire, which was two weeks after they initially received the form.

Time and work pressures placed certain parameters on the design of the questionnaire. A necessary criterion was to maximise the number of questions requiring the respondent to tick or circle a box. A pilot phase was used to test the questionnaire design criteria. The initial student survey contained 54 questions. Of those only four questions required a written response. Similarly for the initial teacher survey, there were 57 questions but only three required a written response.

The final consideration in the design and distribution of the questionnaire was to maximise the completion and return of the surveys, thereby providing the critical mass of data needed for reliable analysis as recommended by Portney & Watkins (2000, pp.79-87). Of the various factors already outlined, time was considered the most crucial. Ballantyne and Cummings (1999) argue that an allocation of time provides a strong encouragement for participants to complete surveys with some measure of reliability. With the provision of time for the students, it was hoped that this would be a major incentive. The teacher's response rate also reflects this statement with the number of returns from the teachers who were given the option of completing the survey at meetings representing nearly the full complement of staff as compared with the fewer returns from teachers who completed the survey in their own time. Another incentive considered was that interest in computers and the Internet would increase the inclination to complete the questionnaire. The prevailing literature by researchers such as Trinidad et al. (2005) in their investigation of online learning environments gives some assurance that this topic is of interest to both students and teachers.

4.4.1 Student Questionnaire Design

The aim of the student questionnaire was to gather junior secondary school student perceptions about their access to and use of the computer both at school and outside school. The questionnaire was divided into four sections;

1. Demographic information on year level and gender to determine differences, if any, in the use of computers
2. Access and frequency of use on *away from school computer*s and the nature of use
3. Frequency of use and the nature of school computer use
4. Student perceptions on interaction with teachers in using computers, impact on learning and opinion about online based learning.

The design of the questionnaire needed to incorporate an appropriate level of language for the intended students, be easy to complete in a short space of time but have the capacity to provide suitable data to form reliable scales. These scales would then be used in a model which forms the basis of the research. It was intended that the first two criteria, language and time, be tested at a pilot school and modifications would be made according to the observations of the researcher.

The last criterion was addressed by using a five-point Likert scale for some of the questions. This offered the students the response categories of strongly agree, agree, undecided, disagree and strongly disagree. The consideration to use a five point scale acknowledged the jeopardy that researchers such as Moser and Kalton (1972, p.344) contend of the risk in suggesting a non-committal answer to the respondent. There is also the danger that the inclusion of a neutral category will reduce the variability and therefore lower the scale reliability (Anderson & Bourke, 2000, p. 94). However, the decision to use a five point scale is based on Likert's original premise in establishing the scale; the survey should represent the real distribution of attitudes (Likert, 1932, p.52). As Brown (1988) comments, it is difficult to know whether in removing a neutral category, respondents choose a '2' or '3' in a four-point scale because it is closest to the middle/neutral category. The student questionnaire consisted of 11 main questions, with some of these questions split into sub-categories so there were 54 questions in total. The questionnaire was broadly divided into three groups of items; computer use outside of school, computer use at school and the effect of computers on learning. The questions can be found in Appendix 1 with response totals, as percentages, listed for the options in each question.

4.4.2 Computer Use Outside of School

This grouping refers to the first three questions of the questionnaire as well as an item from the personal information section. In the personal information section, data were sought about the amount of access that students have to computers away from school and what computer applications they use. Question 1 examined student use of generic computer applications on the *away from school computer*. The applications referred to ranged from games to word processing to multi-media. In most cases brand names were omitted with the exception of Microsoft's powerpoint as it was felt that students would have difficulty understanding the generic label of presentation software. It allowed a snapshot to be developed of student use and whether age or gender had any impact in the use of certain applications. Students were given the opportunity to list any applications they felt were not represented in this question. Question 2 qualified the amount of time that students were able to use these computers from 'All of the time' to 'None of the time'. These questions are a response to the speculation discussed previously about access impeding computer use. The last question in this grouping seeks to quantify whether any of the use of the *away from school computer* was for school purposes. The identified use of the *away from school computer* for school purposes does in part explain some of the use for word processing and presentation applications as well as suplementing for some application use on the school computers.

4.4.3 Computer Use at School

The next grouping of questions 4 to 7 refer to the students' use of the computer at school. Question 4 asks whether there were any reasons preventing the use of computers by individual students or particular year levels. There could be several reasons for this such as limited computer resources for the entire school population thereby necessitating access being restricted to particular years only. There is also the possibility that certain students may be barred from using the computer because of school discipline infringements. Question 5 seeks to classify computer usage by KLA level. This question includes the timetabled use of the computer facilities for the duration of a topic as well as the occasional use of the facilities and the library for certain applications and Internet research. This will provide some data as to the permeation of ICT across the curriculum and the motivation of students to get to available computers such as in the library. Related to gaining access to computers in the school, question 6 sought to gauge whether there was any accommodation or encouragement for the use of laptops by students in the school setting or if there were any laptop programs operating within the school. If there were any such programs, this would have reduced the need to access specific computing facilities within the school. The last question in the grouping examines the type of computer application use in schools, enabling comparisons with the student's own home computer use and some parallels with teachers' choice of computer application used at school.

4.4.4 Computers and Learning

The final grouping of questions, questions 8 to 11, sought to gauge the interrelationship of computers with learning which has been identified as a key element in effective online learning. Question 8, made up of 19 components, examined student perception about various learning issues such as interest and motivation, expectation to use a computer, influence in choice of subjects and effect on achievement. This question used the five-point response scale outlined earlier. The responses from some sub-questions of question 8 were used to answer research questions 4, 5 & 6 and these are listed in Table 4.3 below.

Table 4.3: Contribution of Question 8 to the Research Questions	
Question 8 Sub questions	Research Question
(a) Generally I enjoy lessons that use computers, (b) I understand lessons better if computers are used, (c) I pay better attention in class if computers are used, (e) I am more likely to choose subjects that use computers, (i) I chose subjects that use computers because I am good at computers	4. Does student age or gender have any relation to (a) their level of computer skill or (b) their interest in using computers?
(h) I tend to get more marks if I use computers in my subjects	5(a) Is there a perception amongst (i) teachers or (ii) students that computer based programs will improve student achievement.
(n) Subjects that are offered over the Internet offer more subject choice, (o) I would have trouble with subjects that are offered over the Internet, (p) I would have more time to do other things if I studied subjects over the Internet, (q) I would find studying subjects over the Internet hard because the teacher would not always be present to help me, (r) I would find studying subjects over the Internet difficult because I cannot always get to an Internet computer, (s) I would do well at studying subjects over the Internet because I am good at computers	6 .What impact, if any, do students perceive that online learning can have on their education?

Students were asked in Question 10 to comment on the impact of computers in any subject area they studied. This was one of the few free response questions and students were encouraged to write either positive or negative comments. Students were also asked to comment on whether they would prefer to use the school computers or the computer away from school, reflecting issues about access to computers as well as the specification of computers to make the use of either machine desirable. Question 11 was the final question and sought to establish whether there were any impediments from a home infrastructure or personal work habits to prevent student from undertaking school work online at home.

4.5 Student Constructs

The data collected from the student questionnaires were refined through factor and reliability analyses to measures of the six constructs hypothesised; Computer Use, Computer Applications, Relevance, Positive Learning, Readiness for Online and Online Usefulness. The questions that were used to form the individual constructs are found in Appendix 15. These constructs are described in the following paragraphs and the relationships between the constructs are analysed through a process of multiple linear regression and described in Chapter Five. These relationships underpin the individual case studies as well as the overall model and depict a pattern of computer technology use within the schools.

4.5.1 Computer Use

The aim of this construct was to determine the actual computer use that took place. It was intended to differentiate the computer use for other subjects away from computer classes where you would expect a computer to be used as well as including computer use in the library. This provided the basis for examining whether teachers are programming the use of computer technology at school as part of a sequence of lessons as compared to the occasional use of computers by a class. It illustrated a strategic use of computers by the individual teacher as a subset of a school plan. Student motivation to use computers in their own time at school was also identified, highlighting any desire by the students to access computer technology. There are anticipated links to relevance where the usage pattern of school computers may affect the choice of subjects that involve computers and the positive learning construct where the use of the computers may impact on attitudes, understanding and enjoyment of school subject material. A relationship to online usefulness is also expected where access to information as well as curriculum agendas maps a link from the use of the computer at school to the use of the information contained or generated by the school computer or on the school website.

4.5.2 Computer Applications

The aim of this construct was to summarise a usage pattern of computer applications on school computers by the students, enabling a match with applications that students would use on the *away from school computer*. It also enabled a comparison with the teacher's skill in the use of computer applications. Any comparison would show whether teacher skill in certain computer applications had any bearing on that teacher's decision for students to use the applications and the effect that this may have on the learning environment including online learning. The relationships with this construct that are anticipated are Relevance, which examined whether the usage pattern has any effect on the past and future choices of subjects and whether there was any difference between the year level choices and gender choice. The other expected relationships are Positive Learning which examined whether there was any link to the use of applications in schools and behavioral attributes such as attitude, enjoyment and understanding that contribute to a positive learning environment. There was also Online Readiness, which examined the access to the computer applications that are used at school and the comparability with the applications that are stored on the student's own home computer

4.5.3 Relevance

This construct examined how computers affected students' subject choices both currently and for future studies. In current research on middle school students in the USA, Spires (2007), found that students wanted to use the technology tools they used outside the school in school learning. The construct also took into consideration factors such as any parental influence about the importance of using technology and positive assessment as a result of using technology. There is an expected relationship to Online Readiness which examined the link of relevance of choice to an online context. Making subjects available online as well as the availability of online feedback or online interaction with others could impact on student choice. There was also a relationship with Online Usefulness which examined whether the Relevance of using computers can be enhanced by an online component or platform.

4.5.4 Positive Learning

This construct examined the effect that computers may have on motivating students to learn, stimulating the student's interest and whether it has any effect on the student's enjoyment of their subjects. The questions used to form the construct examined the effect of any particular subject on enjoyment, looking at particular curriculum strands, as well as programs within subjects. There is an anticipated relationship with Online Readiness which measured the perceptions of motivation or enjoyment with learning via computers an in an online environment. There was also consideration for issues such as individual motivation or ability to complete work with decreased or no supervision. The relationship with Online Usefulness is examined through the flexibility of an online environment to enhance positive learning.

4.5.5 Online Readiness and Online Usefulness

The construct of Online Readiness examined access issues that would be experienced by the student both at home and at school. It determined whether access to online courses in either environment would be difficult for the students. It also examined issues dealing a student's ability to organise and work with decreased amounts of supervision.

By comparison, the construct of Online Usefulness examined student perceptions of current computer practice amongst teachers in schools in their use of the internet platform. The pattern of teacher practice was examined for its effect on students studying in an online environment. It also gauged whether students have considered issues such as time and choice with the use of online subjects.

4.6 Teacher Questionnaire Design

The function of the teacher questionnaire (see Appendix 2) was to gather secondary school teacher perceptions about their access and frequency of access to the computer both at school and outside school. The instrument also sought to determine a pattern of teacher usage of computers, a personal skill rating in the use of computer applications as well as the applicability and desirability of utilising computers in the learning process. Establishing a pattern of teacher usage enabled a comparison with the student responses.

Similar to the student questionnaire, the design of the teacher questionnaire needed to incorporate features so that it was easy to complete and unambiguous in its language thereby providing suitable data to form reliable scales. These scales would then be used in a model which forms the basis of the research. The design of the teacher questionnaire was tested in a pilot school and remained unchanged for the actual study. The scaling methods were facilitated by the use of a five-point Likert scale. The rationale for using that type of Likert scale has previously been given in the Student Section 4.4.

The teacher questionnaire consisted of 19 questions broadly divided into four groups. The first group of questions sought general information about teachers in each school (Q1), total number of years at current school (Q2), gender (Q3), and the key learning area that teachers were predominantly teaching in, (Q4), the computer environment at home and at school, computer skill level and the relationship between computers and computer related applications and learning. The demographic information served to build the profile of each case study school, the remaining information was absorbed in the formation of the constructs for the model.

4.6.1 Computer Environment

The next group of 10 questions sought to examine computer ownership, computer use and school computer practice. Question 5 dealt with teacher's ownership of a computer at home with a possible comparison to student access to a computer away from school and Question 7 determined whether the computer was connected to the Internet. Two questions dealt with the usage of the home computer with Question 6 examining the frequency of home computer use and Question 8 differentiating Internet usage between home and school purposes. Access to and use of a school computer was measured by Questions 9 and 10 respectively enabling some comparison with home computer use. Question 11 sought to qualify Question 10 by determining the ratio of school computers to general teaching staff. Question 12 quantified the amount of time the teachers used those computers for school related purposes such as lesson preparation, administrative tasks or preparing class material.

The last group of questions in this category examined data management, network and training structures. Question 13 examined the network organisation of the school, where the student and teacher files could be stored and shared and Question 14 determined whether that intranet was available off campus. Teacher practice in transporting data is assessed in Question 15 with a range of methods including email, compact disc and taking a paper copy. Question 16 sought to determine whether there were key people responsible in the school for maintaining the school network, websites and training of staff in specific computer applications in particular key learning areas. The acknowledged presence of these people is tied to the overall school development plan obtained from the school principal.

4.6.2 Computer Skill Level

Teachers were asked to rate their skill in using certain computer applications in Question 17. The five-point scale ranged from very good to never used. The applications mentioned in the questionnaire either stemmed from the fact that all of the case study schools used Microsoft Office as the standard application platform as well as the main ICT competencies targeted by the NSW Board of Studies (2001) for years 7 to 10. The data from this question will in part contribute to the answer of research question 1.

4.6.3 Computers and Learning

Teachers' perceptions about the effect of computer technology on student motivation, student learning, teacher practice and school infrastructure are assessed in Question 18 (see Appendix 2). A five-point Likert scale was used, with responses measuring from 'strongly agree' to 'strongly disagree'.

Table 4.4: Contribution of Question 18 to the Research Question Answers

Question 18 sub questions	Research Question
(e) Teachers want to integrate computer technology into their teaching. (g) Students benefit from the integration of computer technology into your KLA. (q) Teachers want to use computer technology in their teaching. 17. Please indicate how good you are at using the following software; 19. If you have used the following facets of computer technology, how do you rate them in terms of stimulating student's interest?	1. What is the relationship between teachers' computer skills and the integration of computer technologies into education programs?
(m) Teachers need more funded computer technology training to be effective with that technology.	2. What infrastructure has been established at schools to assist teachers in (a) increasing their information technology skills and (b) integrating technology into their teaching?
(c) Students are submitting better quality assignments when they use computer technology. (d) Students are gaining better exam results due to the integration of computer technology into the curriculum.	5(a) Is there a perception amongst teachers that computer based programs will improve student achievement.

Question 19 measures teacher perceptions about the effect of certain computer applications in stimulating student interest. Teachers were asked to use a five-point rating scale from 'very good' to 'none'. The teachers were asked to comment only on the applications they had used and a blank response indicated the teacher had not used the application. The sub questions of Question 18 form in part the answers to several of the research questions. These questions are listed in Table 4.4 above.

4.7 Teacher Constructs

Using the same process described in the development of the student constructs, the data collected from the teacher questionnaires were refined through factor and reliability analyses to form measures of the six constructs hypothesised; Computer Use, Computer Applications, Relevance, Positive Learning, Readiness for Online and Online Usefulness. The questions selected to form the constructs are located in Appendix 9. A description of the constructs follows in the next five paragraphs with anticipated relationships to the other constructs outlined where possible. These relationships underpin the individual case studies and overall research model and depict a pattern of computer technology use within and across schools.

4.7.1 Computer Use

This construct examined how teachers had accommodated computer use as part of their work ethic. The questions used to form the construct ascertained teacher's current computer practice in managing data, access to technology assistance and established a benchmark of teacher opinion about their willingness to incorporate computer technology into their teaching practice. It was expected that the familiarity that teachers have with the technology would be reflected in some application of technology use in the classroom. However, whether teachers utilise all their technology skills in their teaching practice depends upon the perceived relevance of that technology to student learning. The examination of the relationship to relevance in the willingness of teachers to use different facets of computer technologies may be reflected in teachers' current skill level and their willingness to increase that skill level. The link to positive learning would examine the use of computers in key learning areas contributing towards a positive learning environment. The relationship to online usefulness would be examined in the access to computers off campus as well as access to information repositories.

4.7.2 Computer Applications

Teachers' skill level in their utilisation of computer applications was gauged. Teacher's own ratings were used to compile the skill level and the particular applications were chosen for their commonality on personal computers at school and at home. It was expected that the teachers' skill levels in applications would impact on the applications that students use in the school and in curriculum projects. The link to relevance will be dependant on the teachers' skill and confidence level in the use of the applications and how the applications are used with the students. The relationship to Positive Learning was examined by linking the skill level in applications with the perceived value of using those applications for student learning. The link to Online Readiness examined whether the skill in using computer applications has any impact on a school's or the teacher's readiness to operate in an online environment.

4.7.3 Relevance

This construct examined teacher perception about whether different application use created more student interest. The teacher perception of the relevance of computer technology in the curriculum is expected to be found not only in the frequency of particular applications use but also the applications that teachers had not used. The interest of students in using these technologies is seen as a precursor to their readiness to operate in and the validity of an online environment. The connection to Online Readiness was examined for the access and reasonable operating speed of the computer technologies and the link to Online Usefulness was explored for the propensity of the identified technologies to deliver online courses.

4.7.4 Positive Learning

This construct examined the effect of computers on educational assessment and the impact this perceived learning gain has on students' learning. There is an expectation that a majority of teachers acknowledge that computers have a positive effect but that effect would not be exploited due to teachers' uncertainty in how to utilize the applications to engage students' learning. The possible relationship to Online Readiness was explored through the readiness and ability of schools to incorporate an online facility in areas of assessment as well as extending the options available to both the student and the teacher. The link to Online Usefulness examined the possibility of a positive learning environment being enhanced by adding an online component to it.

4.7.5 Online Readiness and Online Usefulness

Online Readiness examined network and other infrastructure details that teachers may perceive as being necessary for an online environment. It also examined the issue of teacher training for an online environment. Whereas Online Usefulness examined the current and future scenarios of online learning in the school environment. It determined teacher attitudes towards possible benefits of online learning as well as their preparedness to participate in the delivery of online courses.

4.8 School Leadership Opinion about Computer Technology in Schools

The principals from nine schools were interviewed and asked eight focus questions (see Appendix 3). The questions covered the areas of demand for the use of computers, skill and application for learning, future direction and current online usage. The principals' answers to these questions formed part of the connectedness between the teacher and student responses as well as key background information for the case study schools.

4.8.1 Demand for the Use of Computers

The first three questions focused on the demand for computers in education both generally and at the local school level. Question 1 elicited the principals' opinion on the general demand for computers in education and whether it was present in the school. The principals were asked to expand on this information with the next question about defining where the demand was coming from in the school thereby enabling any trend to be identified in school both individually and overall. The final question in this set sought to gauge the satisfaction level with the technology as it was. This question also established what demands for future technologies there was amongst the users in the school. The response to Question 3 also formed part of the answer to research Question 3 concerning schools' current use of online learning resources. It was considered that the school technology plans would reflect current and future learning strategies for the school.

4.8.2 Skill and Application for Learning

The next group of four questions examined the areas of computer competence and skills amongst students and teachers and the implications that may have on the learning environment. The principals' opinions about the computer competence and skill of teachers and students in using applications were asked in Question 4. The opinions sought were fundamental to the next three questions on learning as they were seen as having some effect on the strategies developed for the use of computers in the school environment and decisions regarding the future of computers and learning. Question 5 focused on the effect of computers on student learning and any means that the school had established for measuring this effect. The second part to this question sought information about any evaluative or reflective practice within the school that would modify learning with computers as a result. This question also contributes to the answer of research Question 5. Question 6 asked for the principal's vision about the direction of the school as they have a great deal of discretion in setting the educational agenda for the school. The principal's vision impacts very much on hiring new staff, resource acquisition and school capital works. The pattern of staff recruitment under the leadership of the incumbent principals can be compared to these responses as well as current computer acquisitions and building renovations. Question 7 sought information about planning strategies that may be in place to fulfill short or long term roll-outs of technology, particularly to encourage learning practice. The information from Questions 6 and 7 was used to answer research Question 8 concerning use of computer technologies in the learning process.

4.8.3 Current Online Usage

The last question sought to determine whether the school currently used an online platform for any of its courses and whether there was future school plans to adopt or maintain an online platform. It is proposed that any actual or future implementation of online courses influences the responses of students or teachers involved with the courses. The question also gauged the principal's perception of any advantage to their school's adoption of online courses to deliver programs of study in the local school context or the wider system context. The last part of the question determined implications for the school in terms of infrastructure, cost and benefit to the school community. The response from this question is used to answer research Question 7 concerning the delivery on an online program within the schools.

4.9 Approval to Conduct the Study

Approval to conduct this research was given by the University of Newcastle Ethics Committee in 2003. The Committee also approved the forms and questionnaires to be distributed to the participants. The data resulting from the study will be held for a period of 5 years as per the committee's requirements. Approval also was obtained from the Catholic Education Office, Sydney (CEO) to conduct the study in ten schools in the Archdiocese of Sydney. The CEO approved access to the ten schools for the main study and one school for the pilot study in 2003. The final decision about the schools' participation in the study was left to the principals of those schools and all school principals who were initially approached agreed to their school's participation.

4.10 Pre-testing and Modification of Instruments

One school, in the Sydney Archdiocese, was invited to participate in the pre-testing of the two survey instruments. The researcher contacted the school principal by phone for an appointment to discuss the research, the purpose of a pilot, issues of privacy, feedback to the school and appropriate method for conducting the research in the school. The principal granted approval for the pilot to be undertaken and understood that the data would not be included in the final analysis.

Arrangements for the conduct of the study were discussed at the meeting between the principal and the researcher. The students involved in the pilot would be taken from the year 8 cohort. The principal preferred that the students' roll teachers distribute the information and consent forms with a week's turnaround. Invitations were sent to 189 year 8 students and their parents to participate and 142 students returned signed acceptance forms to participate. The questionnaire was completed by the assembled cohort in the school hall. The Year Coordinator, briefed by the researcher, conducted the survey and collected the responses. The researcher was present at the school for the administration of the pilot questionnaire (see Appendix 4). The exercise was timed and monitored for any problems in understanding the questions. No irregularities, in fact no questions, were raised by the students on the day and the average time taken by the students to complete the questionnaire was 10 minutes. The data from the completed questionnaires were coded and entered into a computer, using the statistical software package SPSS v 11.5. Descriptive statistics on computer access and computer use both at home and at school were obtained. Pearson's correlation coefficients were also calculated to determine if there were significant relationships between the variables. Based on the student responses, a minor change was made to the form. The order of Questions 6 and 7 was reversed as the existing order apparently contributed to confusion over Question 8.

The participation of teachers in the pilot was problematic. The conduct of the pilot was in the term 4 reporting period. This period is quite intense for teachers as it necessitates compilation of final grades as well as report comments for all the students in their classes. The principal informed the researcher that a number of teachers met in committees and requested that that be the starting point for teacher participants. The principal also suggested that possibly the "Learning Committee' would be an ideal place to start. The principal commented that one of the briefs of that committee was to examine the use of ICT, that there was a sufficient range of experience and the gender ratio was similar to that of the entire staff population. The invitation to participate in the pilot was extended to the eight teachers in the committee. All eight teachers accepted the invitation to participate, the experience level of the teachers ranging from 1 year to 30 years. The gender balance of the participating group was five females and three males. It was felt that this group would be sufficiently representative of the wider staff of the school. The researcher negotiated a time in the schedule of meetings to conduct the questionnaire. All eight teachers were present for the pilot and completed the questionnaire. The exercise was timed and monitored, the average time taken being 15 minutes. The data collected were then coded and entered into a computer and analysed using SPSS v11.5. Based on the feedback, it was decided that the questions should remain as they were as there were no discrepancies and using Pearson's correlation there were relationships found sufficient to suggest that the questions would provide the required data.

The researcher made a follow up appointment with the principal. At that meeting, feedback was given as to the usage pattern of computer applications by teachers and students as well as the access to a computer outside school by the students. This information was presented in tabular form to assist the school's presentation of that information to parents.

4.11 Research Sample

The target population for this research comprised the principals, the entire teaching staff and students of year 8 and year 10 in the Sydney Catholic systemic schools. There are 35 secondary schools in the Sydney Archdiocese. As the researcher was working in one of the three regions that comprise the Sydney Archdiocese, it was the Ethics Committee's condition of the study that the schools of that region not be approached for the main study to avoid influence and bias, thus leaving 29 secondary schools to be sampled. It was considered that a sample of ten secondary schools would be a sufficient size to investigate the research questions as there were sufficient numbers for stable multivariate regression analysis of the data but not too many schools to enable individual case study analyses to be conducted. A detailed account of the selection of the ten schools follows in the next section.

The year levels chosen for the sample were year 8 (13 to 14 year olds) and year 10 (15 to 16 year olds). These years were chosen because they mark the ends of Stage 4 and Stage 5 of the curriculum (Board of Studies, 2001). These years were also chosen because those students would need to select elective courses of study for the following two years of schooling. As outlined in the development of the student questionnaire, the influence of computers in elective subjects is examined and would be fresh in the minds of these students as they answered the survey questions.

4.11.1 Factors determining the Choice of Schools

The criteria for the selection of the 10 schools were based on a rating of social and economic well being, as well as the type of secondary school. In the Sydney Archdiocese, the schools are grouped according to gender, co-educational or single sex, as well as junior secondary (years 7 to 10), secondary (years 7 to 12) or senior secondary (years 11 to 12). Most secondary schools in the Archdiocese offer a complete secondary education to year 12 and this factor did ensure that most of the schools that participated in the study were year 7 to 12 schools. There were enough schools in both the single sex and co-education categories to guarantee adequate representation from both groups in the study. The distribution of schools can be seen in Table 4.5.

Table 4.5: Total number of systemic schools for each category in the Sydney Archdiocese, with survey schools highlighted

	Years 7 – 10	Years 7 - 12	Years 11- 12
Single Sex Female	**2** (1 selected, school G)	**8** (2 selected, schools E&F)	
Single Sex Male	**6***(1 selected, school A)	**8** (2 selected, schools I&J)	
Co-Educational		**8** (4 selected, schools B,C,D&H)	**3***

* I school has a 7-10 single sex and 11-12 co-educational structure on the same campus

It was important that the schools be drawn from various socio economic areas to allow for any socio-economic impact on student access to computer technology away from school. The schools were placed on a continuum of social and economic levels to highlight the different status of the areas. This meant establishing a basis and adequate measure for employment, wages and educational attainment. In order to define this social and economic status of the families that sent their children to schools in the Archdiocese, the Australian Bureau of Statistics Index of Relative Socio-Economic Disadvantage for Sydney Metropolitan Councils was used. This information is derived from the Australian Census of Population and Housing 2001.

Attributes used to develop the Index of Relative Socio-Economic Disadvantage are derived from factors such as low income, unskilled jobs, high unemployment, low educational attainment and variables that reflect disadvantage (Australian Bureau of Statistics, 2001). The scoring of the index for the Sydney Metropolitan Area ranged from index scores of 849.2 to 1,151.4 (ABS, 2001). Low scores indicate a prevalence of low income families, unskilled occupations and little training. High scores on the other hand reflected few families with low incomes and few people with unskilled occupations and little training in the council area. This information provided by the Index provides a suitable background for the amount of resourcing as well as educational background for the local metropolitan areas that fed into the schools. The sample schools chosen would need to represent a cross section of the range identified by the Index.

There are 44 local councils that form the Sydney Metropolitan area. The seven councils that the schools were drawn from, as well as the schools, are shown in Figure 4.4. In the council areas shown, more than one catholic high school draws from each of the council areas mentioned therefore protecting each school's anonymity. Where survey schools drew from two council areas then school enrolment data were checked and the council with over 90% of students was chosen for that calendar year.

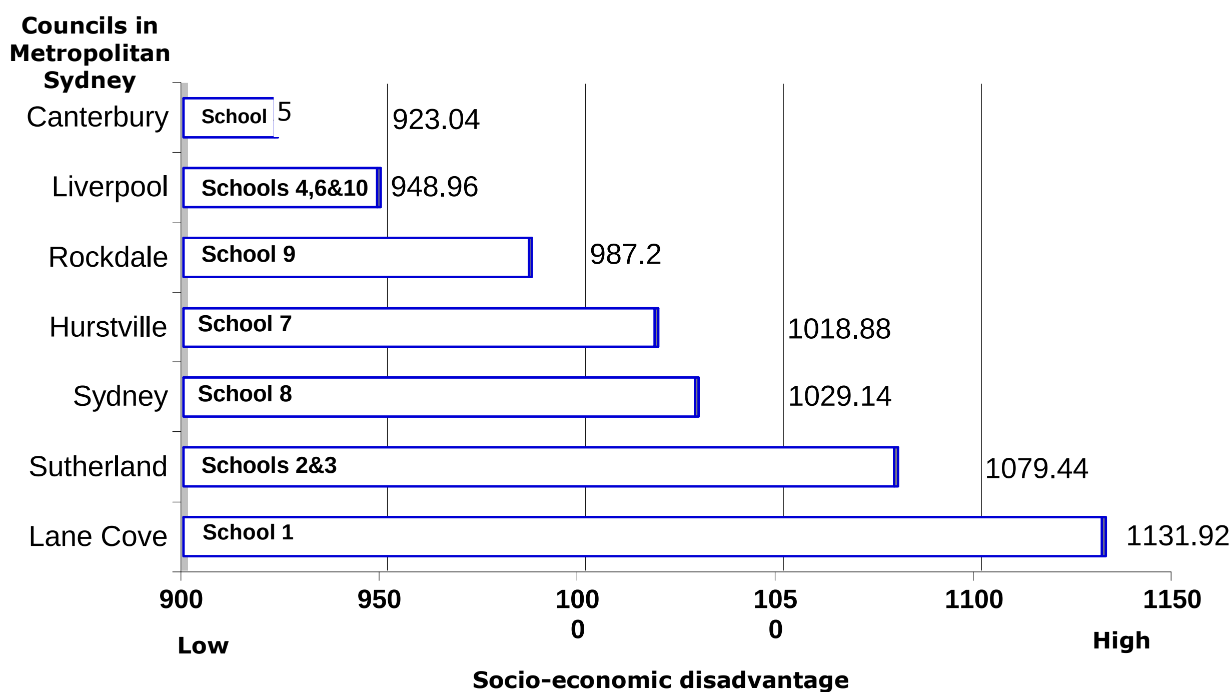


Figure 4.4: Case study schools ordered by socio-economic disadvantage index

To place some perspective on the indexes shown, the lowest index (as previously mentioned) is 849.2. Whilst the difference between the lowest index score overall and the lowest council index score of a school included in the study is 73.84, Canterbury does represent the third lowest index.

Liverpool has the fifth lowest index, showing that 40% of the survey schools drew from some of the most disadvantaged areas for the Sydney metropolitan area. Four of the schools had their intake from two or more different council areas. In these cases, the council area with over 90% student representation was chosen to be recorded as the appropriate index for the school as the other minor council statistics would have little impact.

4.11.2 Administration Procedures for the Survey

The timeline for the administration of the surveys was from April to June 2004. The ethics-approved proforma was sent to schools to inform and gain the consent of the participating school principals (see Appendix 5). The package sent to principals also included information about the study as well as the various forms that were intended for the various participants. Appointments were made with each of the principals to gain their consent personally. At these meetings, the research was discussed and issues/concerns such as privacy, disruption to school time, feedback to schools, the most appropriate time to conduct the survey and distribution and collection of material was discussed. A tentative time was also made for a follow-up interview with the school principal.

In all cases it was the wish of the principal that the distribution and collection of permission and information forms be undertaken in the students' administration time. A similar format was adopted for the conduct of the survey. For the staff, eight principals wanted material left in the staff room for a period of two weeks. The principals advertised the survey at a staff briefing and arranged for a secretary to collect the forms. It was stressed with the principals that the completed surveys must be accompanied by a signed consent form. The principals undertook to brief the staff on the surveys and consent forms. The other two principals wished to minimise possible inconvenience for teachers and used a staff meeting as an opportunity. At these meetings the surveys were part of a number of activities for the staff and there was no compulsion to complete the survey. As with the other schools, it was stressed that staff had to complete a consent form with the survey. As a result of the meeting with the principals, the correct number of information and consent forms was sent to the schools to be distributed to all the teaching staff, the year 8 and year 10 students and the parents/caregivers of the students (see Appendix 6).

For the students, nine of the ten schools chose to run the survey in the morning administration time; the tenth school chose to run the survey in an administration period that ran once a week. The principals and the researcher decided that one week prior to the conduct of the survey, information and consent letters would be sent to parents. Replies would be collated by the roll call teacher. In eight schools it was agreed that the researcher would liaise with the year coordinator and in the two remaining schools it was with the assistant principal and principal. The researcher contacted the designated people to ensure that enough forms had been sent on the day before the survey was to be administrated. On the nominated days for the conduct of the survey, the researcher was present at two of the schools according to the principal's wishes. For the remaining eight schools the contact people had been informed that the researcher was available by phone. Four schools sent the student consent forms and survey responses by mail to the researcher. The remaining consent forms and survey responses were collected by the researcher at the other six schools. A problem did occur at one school due to a misunderstanding between the researcher and the principal. The surveys and consent forms were given to only one class in each year not the whole year. The class was chosen at random by the particular year coordinators. It was decided in discussion with the principal to include the result but not involve the rest of the classes in those years subsequently as it would cause too much disruption.

For teachers, the conduct of the survey was as agreed by the researcher and the principals. In six schools, the principal briefed the staff at a morning staff briefing and the surveys and consent forms were left in the staff room for the teachers to collect and return to the nominated person. In two other schools the staff were informed via the staff newsletter but the collection of the appropriate forms was the same as the other six schools. In the two remaining schools the survey was completed by the teachers at a staff meeting. The teachers had been informed of the various options at the staff meeting, the survey was just one of the options, at a previous morning briefing. Those staff that completed the survey on those days, handed the completed forms to the nominated person. In all cases, the researcher collected the consent forms and the completed surveys from the schools.

4.11.3 Response Rates

Information regarding the number of letters sent out and the returns for the sample are set out in Table 4.5. The figure for students has been adjusted for the administrative error that was referred to above and reflect only the letters that were actually sent.

Table 4.5: Response rates for all participants

Group	Letters Sent	Acceptances	Percentage
Year 8	1462	1042	71.2%
Year 10	1346	981	73%
Teachers	630	233	37%

All those who gave consent participated in the survey and each student and teacher response was able to be used. The participation rate in excess of 70% for the students could be attributed to one or more of the following factors;

- Time given to complete the survey
- An alternative activity to the normal routine of the class

- The classes were supervised
- The topic was one that was of interest
- The questionnaire was short and easy to complete

Probably the fact that the students were supervised is the greatest cause for the completion of the questionnaires. Vining (2003) noted that students who are supervised are more likely to take surveys seriously. Even though the teacher response was low, the responses were used as the teachers participating represented a broad range of teaching experience as well as the eight curriculum areas (Board of Studies,2001) of school study. The two variables of teaching experience and curriculum diversity are integral to the study as they ascertain whether experience and type of curriculum impact on computer use. Previous surveys of teachers, with low response rates, have found that results are valid if basic criteria have been met (Brandon, 1983; Rots et al., 2007).

4.12 Interview with Principals

After the data had been entered into the statistical package and descriptive findings were produced, the principal of each school was contacted for a follow-up interview and to be informed of the descriptive findings of the analysis. Whilst there were difficulties in finding convenient times, the researcher was eventually successful in securing meetings at 9 of the 10 schools. At the tenth school there were three aborted attempts for the interview. After phone calls were not returned, the researcher decided that an interview was not possible with the principal of that school. The researcher did send the descriptive findings of the student and the teacher questionnaires for the principal to relay that information to the appropriate people within that school community.

At the interview with the principals of the remaining schools, the descriptive findings of the questionnaires were presented. These findings were discussed particularly with reference to how to present the data to the teachers, students and parents and how the data could be used. One principal used the information about computer access to provide the school's discarded but working computers to families without computers.

Prior to this interview, the principals had been sent a copy of the interview questions (Appendix 3) and they were also asked whether they preferred to omit any of the questions the researcher intended to ask. After discussion of the data concluded, the principals were asked if they were prepared to have their interview responses recorded. All the principals agreed for the interview to continue and were happy with the proposed questions. One principal did bring the assistant principal to the interview as that person had a better knowledge of the information technology within the school. The interviews were then taped to ensure that all conversation was captured.

Once the interviews had concluded, the tapes were transcribed into Microsoft Word. The transcripts were then grouped and coded according to the research questions and the constructs established for the students and teachers.

4.13 Summary

Employing qualitative and quantitative methods within a case study methodology enables the broad research findings to be informed by localised detail of each individual case. This chapter has explored the basic premise and assumptions involved in the selection of a research method. The purpose and goals of the research were discussed along with the prevailing parameters which were used to design an appropriate methodology which in turn directed the most appropriate methods of data collection and analysis. Relevant details about the participants were discussed towards the end of the chapter along with the type of data and the role of the researcher.

The setting of the study, the school sector, influenced the design of the research with its various sub strands. The feasibility of using technology for online learning is supported by various issues identified and addressed in the analyses. The interpretation of the analyses will answer the three main research questions and the subsequent sub questions. The next four chapters will address the analyses that emerged from the data and interpret them in two phases; firstly for all schools as an overall model, then in individual case studies.

Chapter Five Analysis of the Data

The previous chapter described the methods used to undertake research in the ten case study schools, and the nature of the scales used to describe the constructs included in the model to be tested for both teachers and students. In this chapter, descriptive details of the student and teacher samples are identified and explained in the context of current research. The procedures used to quantitively analyse the student and teacher responses to the questionnaires and qualitatively analyse the principal interviews are described and their contribution justified. Results of the analyses are detailed and explained as they pertain to the demographics, research questions and the overall model of investigation. The reporting of the analyses are organised into a presentation of the students' results followed by the teachers' results. The investigation model concludes with discussions of the principal interviews and the effect of the eFactor coding on the ten schools.

5.1 Data Analysis Methods

The samples are first described using percentages to quantify elements of gender, age descriptors and school experience. The use of computers away from school by the samples is also described by percentages in the categories of access to those computers, intended use of those computers and the type of computer application used. Scale scores for student and teacher perceptions of computer technology use are then developed and models explaining relationships between the constructs are described. The analyses culminate in the development and reporting of the developed eFactor standard for all schools and the relationship to the scales are analysed and described.

Factor analysis was used to develop a set of scales for inclusion in the multivariate model. The scales

- Computer Applications
- Computer Use
- Relevance
- Positive Learning
- Online Readiness
- Online Usefulness

relate to the perceptions of the students and teachers in the sample about various aspects of computer technology used in a secondary school environment and are described briefly in 5.4.1 and 5.6. The perceptions were collected from the instruments described in Chapter Four (pp.68-71, 73-76). The reliability of each scale has been determined through the use of Cronbach's coefficient alpha.

The model (shown on p.64) was tested and refined using multiple linear regression analysis. Analyses were undertaken in stages with a progressive series of dependent variables, namely relevance, positive learning, online readiness and online usefulness. The independent variables for each analysis consisted of all variables to the left of the dependent variable in the model. First the patterns of significant relationships between dependent and independent variables were established. Secondly, the relative importance of the independent variables was obtained by comparing the magnitude of the standardised regression coefficients between them.

To prepare for data entry, the data from the questionnaire were coded with the allocation of a higher numeric code for positive responses. Where necessary the variables were recoded so that responses from negative questions would follow this pattern. The coded data were then entered into the Statistical Package for the Social Sciences (SPSS v14.0) dataset. The data were checked for entry accuracy by cross checking questionnaires against the codes.

The audio recordings of the principals' interviews were transcribed into a word processor, Microsoft Word 2003. The data transcriptions were checked for entry accuracy by sampling three interviews and cross checking the hard copy of the interview with the audio copy. Qualitative analysis was provided with the grouping and coding of data using the software analysis package NVIVO 7.

5.2 General Description of the data

General findings extracted from the student and teacher questionnaires are reported first. The demographics of the samples as well as usage pattern of computers away from school that do not contribute to the development of the scales are presented and discussed first. However, a point of comparison has been provided with the students' contextual use of the computer at school and their use of the computer away from school.

The background detail from the student and teacher questions not used to form the scales is located in Appendix 7. The student data are reported first in aggregate and then separately by the two years, years 8 and 10, and/or gender depending upon the possible relationships that are investigated between either year or gender. Similarly teacher data are reported first in total and then for specific sub-samples of the data that are further organised by years of experience and in one instance by gender. Finally, summary information of the questions that form the scales is given with an explanation for each scale provided. The questionnaires with the totals of the responses for each question, as a percentage, can be found in Appendix 1 for the students and Appendix 2 for the teachers.

5.3 Students and their interaction with computers

5.3.1 Student access to a computer outside school

A total of 2023 students took part in the study across the ten schools. Almost all students (99%) reported having access to a computer outside of school. Whilst most of this access could be presumed to be to a home computer, it also takes into account access to public libraries, internet cafes, friends and the wider family unit. The questionnaire did not seek to determine the location of the computer away from school but the computer applications that students were using. The amount of access that the students in the sample reported having seems quite high when compared with the Australian Bureau of Statistics (ABS, 2003) data which showed that 66% of Australian households had a computer and this was an increase of 5% on the previous year. Further investigation into family sub-categories involving school students, shows that the Australian data for access to a computer away from school for students, (91%) displayed in Table 5.1, approaches the access reported in the present study.

Table 5.1: Comparative data for access to computers away from school

Subject	Access (%)	Year	Source
Australian children under 15	85	2000	ABS (2003)
Australian 15 year old students	91	2000	Corbett & Willms (2002)
Canadian school students	89	2000	Corbett & Willms (2002)
United States high income families	98	2002	Grunwald Associates (2003)

The percentages shown in Table 5.1 provide evidence that in metropolitan areas of developed countries there is a greater possibility of access to computers for school aged children. The socio-economic status of the case study school families would also add to the increased opportunity for access to computers. Households with incomes of $50000 plus were twice as likely to have a computer at home (ABS, 2000).

Computer ownership or access by students is further informed with the amount of permitted use students have of the away-from-school computer. Students were asked to indicate the amount of time they were allowed to use the computer and this is detailed in Figure 5.1. The data reveal that approximately 90% of the students had access to the computer either most or all the time enhancing the meaningfulness of their reported use of the computer.

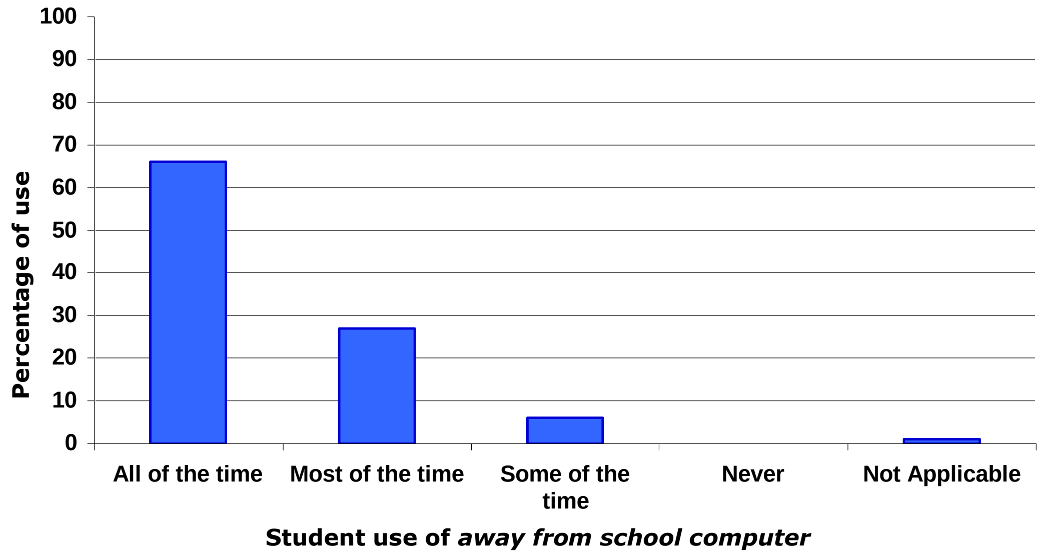


Figure 5.1: Reported access by students to *away from school computer*

The use of the *away from school computer* was qualified by the amount of time the computer was used for school purposes, Figure 5.2.

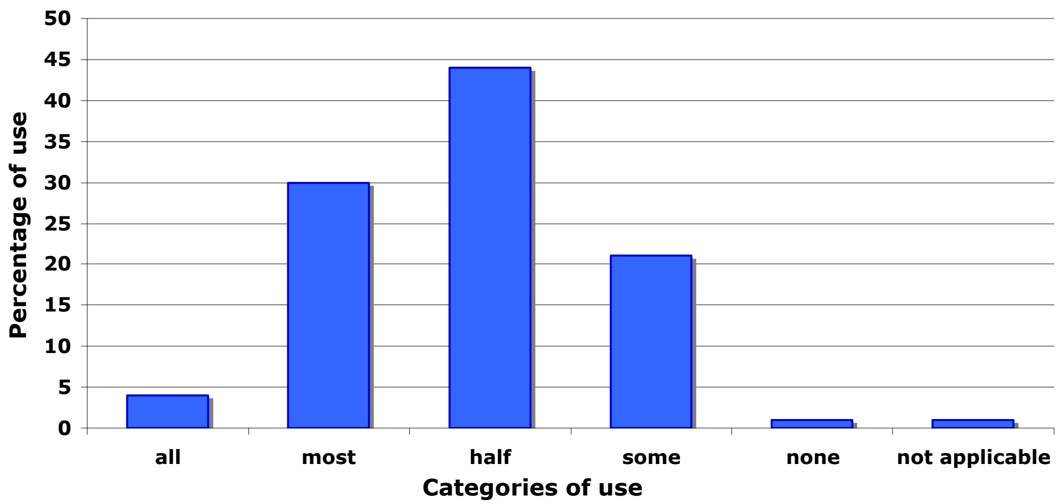


Figure 5.2: Use of *away from school computer* for school work

Between the year levels (Appendix 8) there was little difference in use with 0.6% higher use for year 10 students over year 8 students. These results indicate the majority of students from both year levels use the *away from school computer* for school purposes from half to all of the available time. There is an appreciable difference, by gender, with 86% of female students and 69% of male students indicating they used the computer for school purposes from half to all the time. This gender difference is part of a growing trend of female students using their computers as a cogent part of concentrating on their academic achievement and concurs with similar findings on the use of computer applications (Campbell & Perry, 1988; Kramarae, 2000; Kumar, 2003). A high proportion of students (89%) also indicated a preference for using an *away from school computer* compared to a school computer.

5.3.2 Student Use of Computer Applications away from school

Students were asked to give a yes/no answer to the use of certain applications on the non-school computer. Initially there were six main categories with the addition of 'other' allowing students to list other applications. The Internet was the most popular category with use by over 90% followed by word/spreadsheet and then games with between 70% and 75% usage. These findings are similar to the trends displayed in a United States survey in 2005. The survey conducted by the Institute of Educational Sciences (2005) showed that the Internet was the most popular category followed by games, then email and word processing.

From the total student sample, 185 students (9%) reported using a range of applications such as HTML editors, typing tutors and music editing software in the category of 'Other'. These applications were not identified singly as the highest number of users for any one of the applications was less than 1% and not significant in identifying trends of student use. However 'Chat' featured prominently and, as a result, it has been included as an additional category; Figure 5.3 displays the totals for these categories;

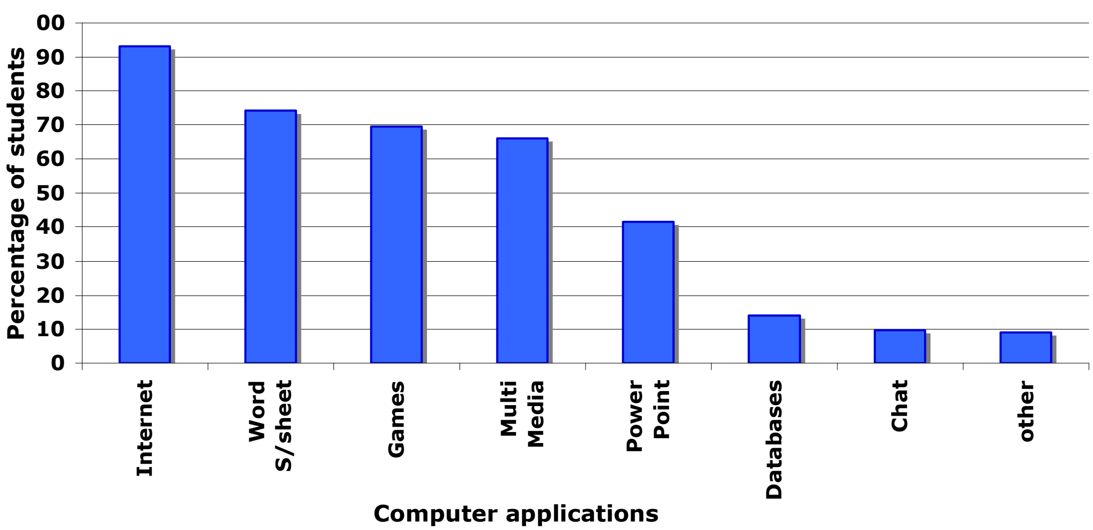


Figure 5.3: Application use of the *away from school computer*

In order to identify any similarities or differences in the use of a non-school computer, the data were ordered by the variables of year then by gender. The results are displayed in Table 5.2 and reported by the percentage of students responding ‘yes’ to the use of the application. The categories of other and not applicable were both omitted due to their negligible impact on patterns of application use which was less than 1% recorded use for all applications.

Table 5.2: Use of Non School Computer Organised by Year Group and Gender				
Applications	**Year 8** (%)	**Year 10** (%)	**Female** (%)	**Male** (%)
Internet	92	94	95	91
Word/Spreadsheet	67	82	76	72
Games	72	67	60	79
Multimedia	57	75	63	69
Power Point	40	42	40	42
Databases	12	17	10	19
Chat	7	7	8	6

From the data presented by year it can be seen that Internet use was still the most popular for both year groups, however, there was a difference in the order for word/ spreadsheet, games and multimedia from year 8 to year 10. The academic requirements for year 10 could impact on these results as formal assessments are required of year 10 by the NSW Board of Studies (2001). Various assessment items could require less use of games and more use of the other applications.

The data for gender suggests that there was little difference in the use of applications between genders with the exception for games. The use of the Internet was the most popular for both genders which was similar to the identified percentage use by both year groups. This was followed by the males’ use of games and then word processing and spreadsheets. Similar gender patterns of use were recorded for the less popular applications.

5.3.3 Student Use of a Computer at School

All students reported that they were allowed to use a computer at school, after eliminating for the survey period any restriction due to either difficulties accessing school computers or discipline matters restricting students’ computer use at that time. School computer use was then contextualized with the students being asked to state where they used a school computer. Five categories were provided for the students; computing class, library research, other classes, occasional work and other.

Table 5.3 displays the findings for the total student cohort. The table is organised by type of classes using school computer faclilities to determine whether any curriculum requirements impacted on computer use.

Table 5.3: Contextual Use of School Computers		
Types of Classes	**Year 8** (%)	**Year10** (%)
Library Research	71	77
Occasional Work	61	69
Other Classes	56	64
Computer Class	3	37
Other	1	1

In four of the five categories, a similar pattern was identified with year 10 students identified as higher users of the school computer resources. Higher percentage use was also identified for both years in the first three categories. A higher frequency of year 10 students recorded studying in computer classes. The computing class refers to the study of computing science which is a NSW Board of Studies (2001) approved stage 5 (years 9 & 10) curriculum subject. The presence of some year 8 students may indicate an acceleration of these students in this subject as part of a gifted and talented program within a school or it is part of the Design and Technology program (Board of Studies, 2001). There is also the possibility that some year 8 students interpreted the question to mean the compulsory computer skill classes that schools have implemented in response to the Board of Studies computer technology guidelines (Board of Studies, 2001).

School computer applications were assessed by the next question with nine applications or application categories being listed for the students to respond to. The most popular application was the Internet with a total of 94% followed by word processing/ spreadsheets with 76% and powerpoint with 50%. The other applications were all below 27% (see Appendix 8). There were some similarities with the use of school computers and the use of non-school computers. Variations on the use of computer applications were evident when the data were arranged by year (Appendix 8). Internet searching was still the most common and there was little variation between year 8 and 10 at 92% and 96% respectively. There was also little variation with the use of powerpoint at 46% for year 8 and 54% for year 10. However, in the categories of word processing/spreadsheet, databases, multimedia applications and web page design, year 10 usage was much higher than year 8. Reasons for the variation in application use could again be the Board of

Studies curriculum, cited earlier for application use on the non-school computer. The data for the use of other applications are displayed in Appendix 8 as only 0.2% of the student sample was represented in this category.

5.3.4 Computers and their applications affecting Student Choice

There were four questions, not used in the development of scales, where students were asked their opinion about computers and the Internet affecting subject choice. These questions all had an aspect of negativity in them ranging from not choosing subjects because of computers to finding studying over the Internet difficult because of the difficulty of accessing an Internet-linked computer. These questions were specifically placed in the questionnaire to remove any ambiguity for those students who did not like the computer environment. A small percentage, between 3% and 4%, of students indicated they would not choose subjects that used computers. This perception was more than balanced in the student sample by the high proportion of students (96%) who indicated they would choose subjects because of computers. Students electing to choose subjects utilising computers reinforces student preference for using computer technology as well as knowing the current assessment rewards students receive for computer processed assessment (see the following section).

5.3.5 Effect of Computer Use on Key Learning Areas for Students

The next question (Q10) asked students whether using computers in any of their subjects made a difference to their results in either a positive or negative way. Many students (57%) chose not to answer this question and it may possibly indicate had not considered that using computers affected their results or that computers may no difference to their results. The majority of students that did comment wrote positive comments and these ranged from 1% in Languages to 23% in Technological and Applied Studies whilst less than 1% of the student sample recorded a negative comment in five subjects. The higher percentage of positive comments in Technical and Applied Studies does correspond with the teachers in the medium eFactor group schools (Chapter Seven) response to the use of technology. The positive comment total for all curriculum areas can be seen in Figure 5.4.

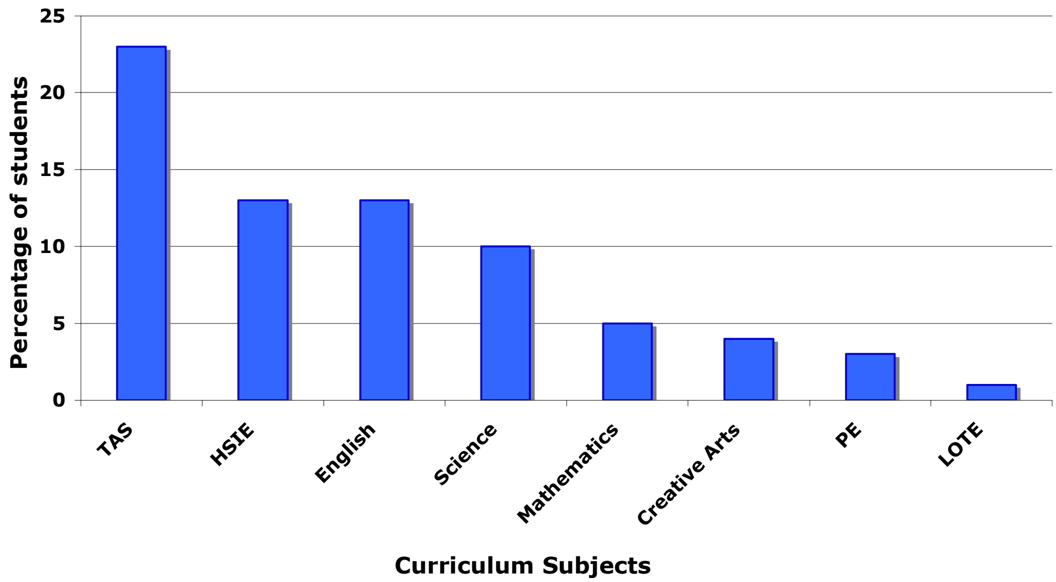


Figure 5.4: Student record of positive impact of computers on subjects

The students were given an additional opportunity for written comment and 210 students chose to comment. Whilst the comments were quite varied and ranged from using particular computer applications to general statements such as computers make subjects more interesting, there were two comments that were made frequently. The most common comment (57 students) was that computer-processed assignments earned them more marks for presentation or conversely marks were deducted if the assignments were not computer processed. The second comment (11 students) was that spell and grammar check in Microsoft word would earn them more marks. These comments were mainly confined to year 10 students but were made equally by both genders.

These positive and negative student comments raise questions about the criteria forming the basis for setting and correcting assignments. The comments also question teachers' awareness of the various functions of word processing packages that include automatic spelling and grammar correction as well as other application packages that may be used for assessment. It would appear that the students who have commented are aware that using the computer in this fashion has some advantages for their final summative assessment.

5.4 Relationships formed between model constructs for students

Much of this study focuses on the use of technology for the school environment but an important strand of the inquiry is students' current familiarity with computer technology. It was important to determine aspects governing students' use of the computer both at school and away from school as well as the types of applications students would be likely to use in both environments. The school parameters governing students' use of the computer with associated applications affected students' perceptions of computer use. The determination surrounding the development of scales assessing student computer use was achieved through a process of factor analysis which captured most of the variability present in the pattern of correlations. The six scales listed earlier were developed from a set of individual items forming each construct.

5.4.1 Student Scales

The questions used to form the student scales can be found in Appendix 15. Outlined below is a brief explanation of each scale and their response categories;

1. **Computer Applications** - The purpose of this construct was to gather a usage pattern of computer applications on school computers by the students. The resulting measure also enables a comparison with the teacher's skill rating of computer applications as well as their use of the same applications. A two-point scale, yes or no, for each application was developed to measure effectively the number of applications used by the students on the school computers. Higher scores on this scale indicated use of a greater number of applications.
2. **Computer Use** – The aim of this construct was to determine the actual curriculum use of the computer. It purposely separated computer studies classes from other subjects and examined the computer use in those other subjects whether it be teacher or student instigated. Acknowledging both teacher and student initiation of computer use allows for instances such as student computer use in the library. Aspects about the prevalence of computer use by teachers emerge but are treated in the section 5.7. In five schools the principals alluded to a high use of library computers by students with one principal stating that the computers were in constant use. Two measures were combined to form this scale. The first measure aggregated the different types of classes that students attended to use computers. There were five different class types and a five-point scale was developed to record this. The second measure was also a five-point scale, ranging from 'strongly agree' (4) to 'strongly disagree' (0), developed to measure student opinion about teacher use of the computer in school. Higher scores indicate greater effect and therefore greater computer use.
3. **Relevance** – This construct examined how students perceived computers affecting their current and future subject choice. This perception also includes influences such as parent opinion and the way that the school structures its assessment. A five-point scale was developed to measure this

student perception ranging from 'strongly agree' (4) to 'strongly disagree' (0). Higher scores indicate greater effect and therefore relevance.

4. **Positive Learning** – This construct examines the effect that computers may have on motivating students to learn, stimulating students' interest or whether computers have any effect on the students' enjoyment of their subjects. A five-point scale was developed to measure these students' perceptions ranging from 'strongly agree' (4) to 'strongly disagree' (0). Higher scores on this scale indicated students' perception that computers did effect students' motivation to learn.
5. **Online Readiness** – This construct examined access issues that would be experienced by the students' both at home and at school. The amount of online access available to the students, if it were available, would determine whether it was a factor affecting students considering online courses. Other factors examined were the students' ability to organise their school work schedule as well as working with decreased amounts of supervision. A three-point scale was developed to include the responses yes (3), don't know (2) and no (1). Higher scores on this scale indicated a greater number of difficulties for to students to work online.
6. **Online Usefulness** – This construct examined the current and future scenario of online learning. It examined students' perceptions of current practice amongst teachers in schools in their use of the internet platform. It also gauged whether students have considered issues such as time and choice with the use of online subjects. A five-point scale was developed to measure these student perceptions ranging from 'strongly agree' (4) to 'strongly disagree' (0). Higher scores indicate greater effect and therefore usefulness.

Table 5.4 lists the descriptive data of each scale, the standard deviation as well as the reliability of each scale.

Table 5.4: Descriptive data of the six student scales

Scale	Min	Max	Mean	Standard Deviation	No. of Items	Cronbach's Alpha
Computer Applications	0	9	3.07	1.65	10	0.62
Computer Use	0	11	6.2	1.97	7	0.51
Relevance	0	16	8.73	3.58	4	0.75
Positive Learning	0	16	10.34	3.14	4	0.77
Online Readiness	0	8	5.89	2.15	4	0.71
Online Usefulness	0	20	10.07	3.54	5	0.71

The ranges indicated for the scale scores differ considerably and this is largely due to the item response scales used. The low mean score for computer applications also indicates that the majority of students use very few applications on the school computers. The standard deviation shows that the least variation of student response for this scale. The high mean scores for the scales Relevance, Positive Learning and Online Usefulness indicates that the majority of students perceive that computer technology can have a positive affect on learning. Individual teachers as well as the technology policies in the individual school may be responsible for affecting the student response. The experience of the utilisation of computer technology for learning would vary from school to school and be dependent on teacher application of the technology. Year 8 students, too, may not fully appreciate the concept of studying courses online.

The Cronbach Alpha values of four of the scales are greater than 0.7 indicating at least a reasonable level of reliability was reached. Two of the scales have a reliability coefficient of less than 0.7; namely Computer Use and Computer Applications. The question of removing the scales to raise the reliability of the model overall would, as Kopalle and Lehmann (1997) suggest, detract from the overall thrust of the research and the research questions. Fayes and Hand (2002, p. 233) also argue for the retention of such scales because they possibly provide an important independent relationship to the dependent variable. The two scales were retained due to their importance in the model of relating school computer use, both in strategic computer use and computer applications to an online platform. However, it is recognised that their capacity to relate to the other variables in the model is limited by their low reliability.

5.4.2 Relationships between variables in the student model

Two separate linear regression analyses were undertaken to determine any relationship from the first four scales mentioned above with the scales of Online Readiness and Online Usefulness as dependent variables. The results are displayed in Figure 5.1 with the standardised regression coefficients in parentheses on the path from the independent variables to the dependent variable. The first coefficient shown indicates the value of the standardised regression coefficient when all the independent variables are in the equation and the second coefficient indicates only the significant paths. The continuous lines in Figure 5.5 indicate the significant paths.

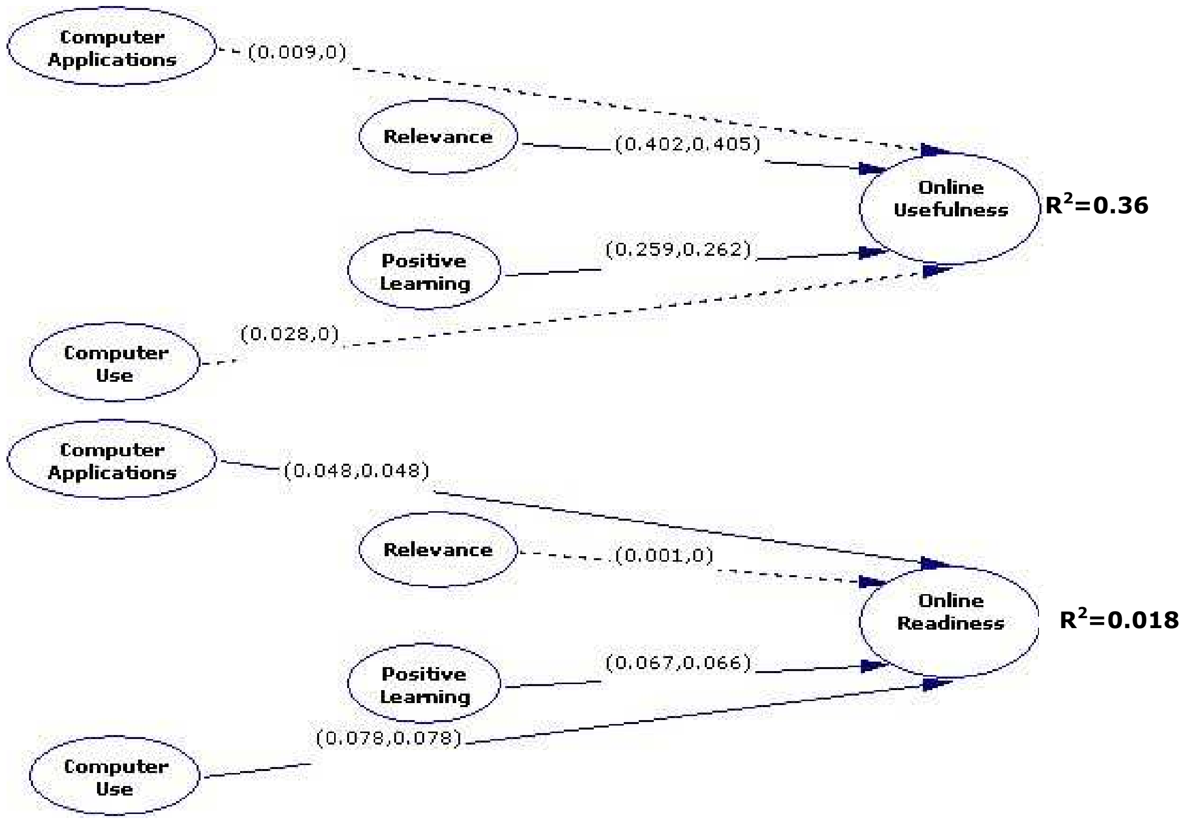


Figure 5.5: Path diagrams for students showing relationships with Online Usefulness and Online Readiness

A greater percentage of the variance in Online Usefulness was explained in the model which explains 36% of the observed variance informed by the contribution of the independent variables of Relevance and Positive Learning. The regression coefficients were significant at the .05 significance level and Relevance was identified as the primary contributor ($\beta = 0.405$ compared with $\beta = 0.262$ for Positive Learning).

The identification of relevance as the primary contributor reflects the everyday utilisation of technology by the students. The technology is seen by the students as an essential and preferred method of staying connected. Tapscott (1998) depicts today's children as living and interacting with digital resources as a matter of course. This view of a child's life in the developed world raises technology use to almost an essential element in a child's learning practice. The strength of this path is in direct contrast to the relationship with online readiness and the paths outlined for the teachers.

In comparison, the model with Online Readiness as the dependent variable, explains only 1.8% of the variance through the effects of the independent variables of Computer Applications, Computer Use and Positive Learning. With such a small percentage of the variance in Online Readiness being explained by Computer Application, Computer Use and Positive Learning, this portion of the model would have to be judged as fairly ineffective.

The comparison of the two regression paths highlights that the student's operational focus with computer technology and the Internet centres on the usefulness of engaging with the Internet. This finding also confirms other research demonstrating that students are actively engaging with the Internet. For example, the study conducted by the Pew Internet and American Life Project (Lenhardt & Madden, 2005) found that over 50% of teenagers involved in this research were not just engaging but creating content for the Internet.

5.5 Participating teacher demographics and use of a computer at home

From the ten schools participating in the study, a total of 243 teachers volunteered to take part by completing questionnaires. The teachers were largely self-selected and their particular characteristics are discussed in the following paragraphs.

The majority of teachers who accepted the invitation to participate in the survey were female, forming 68% of the sample. This compares to the overall population of secondary female teachers in Sydney Catholic Schools of 58% (CEC, 2003). The teachers had a range of experience with good representation at each level (Appendix 2) with the exception of the 31 – 45 year bracket. The experience of the teachers is discussed in greater depth in the individual school case studies where the possible impact of teacher experience on the use of the computers is considered. Teachers represented each of the key learning areas ranging from Human Society in its Environment with the greatest representation (23%) to Languages other than English (3%) with the lowest representation. Figure 5.6 displays the teacher representation across all subject areas.

It is expected that curriculum areas have varying components of technology in their programs even though the NSW Board of Studies (2001) has mandated the use of technology in all subject areas. This study examines the use of technology by teachers of different subjects. The different proportions of subject-teacher representation in the sample are to a large extent representative of the size of subject departments in the ten schools. The collected teacher perceptions of technology use reflect each individual school's overall education strategies that included a technology focus, the influence of the subject area that teachers taught in as well as each teacher's interpretation of how technology should be used. The specific school focus combined with a subject-based clustering of teachers within that school produced different results for some of the schools and this effect is discussed in the school case study chapters.

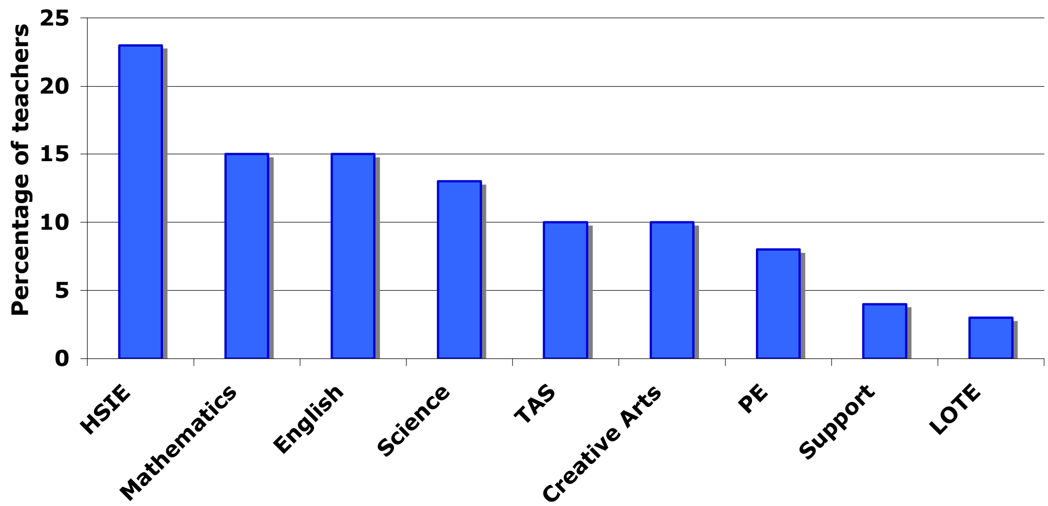


Figure 5.6: Teachers' representation from the different curriculum areas

A very high proportion of teachers (96%) indicated that they owned a computer. The nature of the use of that computer varied and the amount of time teachers stated that they used that computer in a usual week is displayed in Table 5.5. Overall 84% of teachers indicated that their computers were connected to the Internet but a few teachers (0.4%) were unsure if they had an Internet connection. Whilst nearly three quarters of the teachers indicated that they used the computer at least most days, the use of the Internet was lower with approximately 50% of teachers using the Internet at least most days. The frequency of Internet use by teachers on their home computer for general and school purposes is lower than students' use of the Internet (Figure 5.3).

Table 5.5: Teacher use of home computer in an average week

Category	**Overall Computer use** (%)	**Proportion of Computer use for Internet** (%)	**Proportion of Internet use for School** (%)
Every Day	41	29	17
Most Days	32	27	28
Some days	21	26	33

The contrast in teacher overall computer use and their Internet use compared with general computer use may reflect a generational effect. Teachers' use of the computer and Internet at home is not as prevalent as the students they teach. The computer usage reflects a practice where the computer has been used by teachers for mundane tasks and not incorporated into their lifestyle as it is for students (Cuban, 2001; Redmond & Brown, 2004; Underwood, 2004).

5.5.1 Teacher Access and Management of Computer Technology at School

All teachers indicated that they had access to a school computer and could use the computer when they wanted to. Teachers may have assumed that this question applied to the computer to be used for administration and lesson preparation because they were asked about the ratio of computers to teachers as shown in Figure 5.7. A later question, in the context of computers enhancing student work, asked the teachers about the need for more computers at school and teacher response was contradictory to their previous information about the ratio of computers to teaching staff.

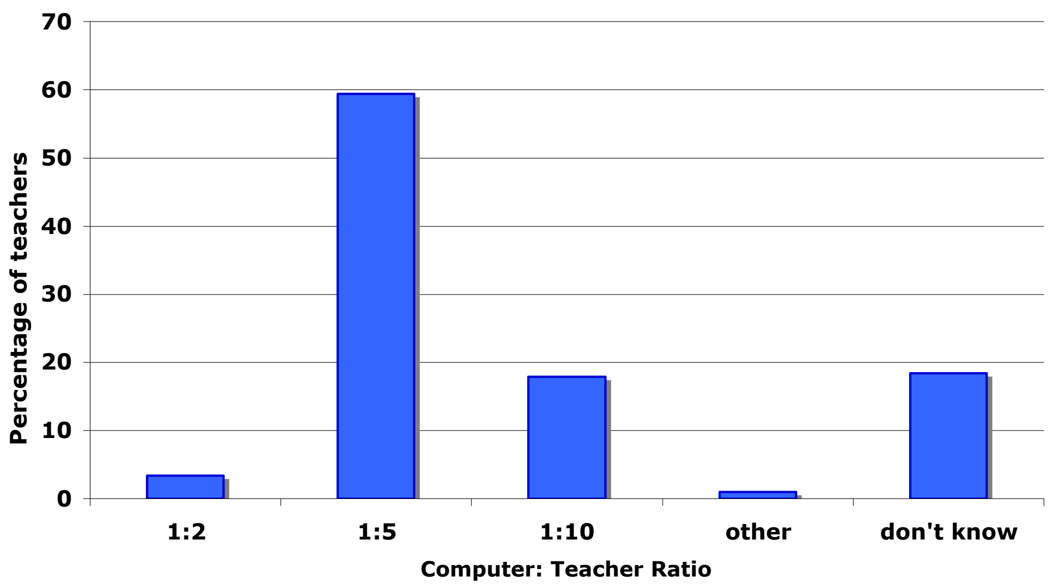


Figure 5.7: Teacher perceived ratio of school computers to teachers

Nearly 60% of the teacher sample indicated the availability of one computer for every five general teaching staff. Teachers who did not know the computer teacher ratio may fall into the category of not using a computer at school or their access to a computer has not been impeded thereby negating a need to investigate the number of computers. Teachers were then asked how often they would use the school computer for administration or class preparation. Nearly 75% of staff indicated that they would use the computer most days of the week with only 2% stating that they never used the computer.

Teachers' knowledge of school computer systems and training as well as their own data management was found to be variable. Most teachers indicated that their schools did possess a common network drive (85%) but, of that number, only 37%

stated that the network was available off campus and 22% indicated that they did not know whether remote access was possible. The last statistic would certainly show that at least that proportion of teachers had not attempted to access or find out whether the remote access was possible. Information available from the Catholic Education Office indicated that remote access was only available in a few schools. There may have been some confusion by teachers about accessing the school webpage that contained information and accessing the school's computer network. Knowledge of a school's computer systems management as well as the individual use of the technology may be influenced by a teacher's interest in using the technology, the individual school's policy, the resources that the teacher has access to or a combination of all these factors.

As well as examining teacher use of computers, teacher management of electronic data was also investigated particularly with reference to saving and transferring information. Electronic transfer of data by teachers reported was divided into four categories; dial into the network 6%, email 31%, burn cd/dvd 14% and save to floppy, zip device or flash stick 62%. Teachers had the opportunity of indicating more than one means of transfer but the most popular method was the last option. Overall teachers did acknowledge the impact of computers in the classroom. When asked if students showed more interest in class when computers were involved, 75% of teachers either strongly agreed or agreed that students did show more interest when computers were involved. Teachers also indicated by nearly the same margin that they needed their own laptops to be effective in the classroom. However, the most telling result was that 97% of teachers indicated that they needed more financially-assisted training with computer technology. This fact could possibly represent a range of needs from teachers proficient in the use of some technologies wanting more skill training, to those teachers feeling pressure from within the school begin to adopt technology as part of their practice.

5.6 Teacher Scales

Much of this study focuses on the use of technology for the school environment. As one of the key components of this study, it was important to determine which aspects have the greatest influence in affecting teacher use of computers particularly as it affects students. The development of scales assessing teacher computer use was achieved through a process of factor analysis which captured most of the variability present in the pattern of correlations. The six scales formed are described below and were developed from the individual items forming the construct.

The questions used to form the scales can be found in Appendix 9. For each scale a five-category response scale was developed with the highest positive response receiving a '4' to the lowest category of '0'.

1 **Computer Applications**– The purpose of this construct was to provide a range of information about the skill level of teachers in their utilisation of various computer applications. The particular computer applications were chosen for their commonality on personal computers at school and at home.

2 **Computer Use**– This construct examined the extent teachers accommodated computer use as part of their routine practice as well as the importance of integrating computer technology across the curriculum. This scale also collected information about teachers' current computer practice in managing data and access to technology assistance with training and network management.

3 **Relevance** – This construct examined teacher perceptions about the relevant different computer applications affecting student learning. This involved examples such as the use of word processing or powerpoint for assignment presentation. The interest of students in using these technologies for school related work is seen as a necessary requirement to their readiness to operate in an online environment.

4 **Positive Learning** – This construct examined teacher perceptions about the effect of computers on learning and educational assessment. It particularly examines factors such as the role of computers in increasing the motivation of students to learn as well as the possibility of increasing student academic performance.

5 **Online Readiness** – This construct examined school networks and other infrastructure details that teachers may perceive as being necessary for an online environment. It also examined the issue of teacher training for an online environment.

6 **Online Usefulness** – This construct examined teacher perceptions about the viability of online learning. It examined whether teachers thought it would add to the flexibility of the school curriculum, student flexibility for academic study and their preparedness to oversee such courses.

The mean, standard deviation, number of items and the reliability coefficient of each scale are listed in Table 5.6. A wide range of teacher response is indicated in the scale Relevance, which had by far the most items. Teacher opinion about the use of various applications was similarly diverse and reflects factors such as teacher proficiency and teacher practice in using such applications and computer technology in general. The standard deviation for the scale Computer Applications also indicates the presence of outlying scores, as it did for the scale Relevance. This may reflect the range of abilities in some of the case study schools where there were small groups of teachers that displayed a much greater understanding of a wide range of computer applications. A more consistent response is indicated for the remaining scales, allowing for the different scale lengths. High means in Computer Use, Positive Learning and Online Readiness reflects the mixture of school strategies and teacher perceptions that drive teacher use of computers at school.

Table 5.6: Descriptive data of the six teacher scales

Scale	Min	Max	Mean	Standard Deviation	No. of Items	Cronbach's Alpha
Computer Application	0	32	13.7	7.3	8	0.89
Computer Use	7	21	15.2	2.24	2	0.80
Relevance	0	49	22.2	11.83	12	0.89
Positive Learning	4	16	10.9	2.7	4	0.70
Online Readiness	12	24	19.2	2.6	5	0.71
Online Usefulness	0	16	9.7	2.4	4	0.78

5.6.1 Relationships between variables in the teacher model

Using the same analysis structure used for the student data, two linear regression analyses were undertaken to determine any relationship from the first four scales mentioned above with the scales of Online Readiness and Online Usefulness as dependent variables. The results are displayed in Figure 5.8 with the standardised regression coefficients in parentheses on the paths from the independent variables to the dependent variable. The first coefficient shown indicates the value of the standardised regression coefficient when all the independent variables are in the equation and the second coefficient indicates only the significant paths, which are indicated by continuous lines in the models shown in Figure 5.8.

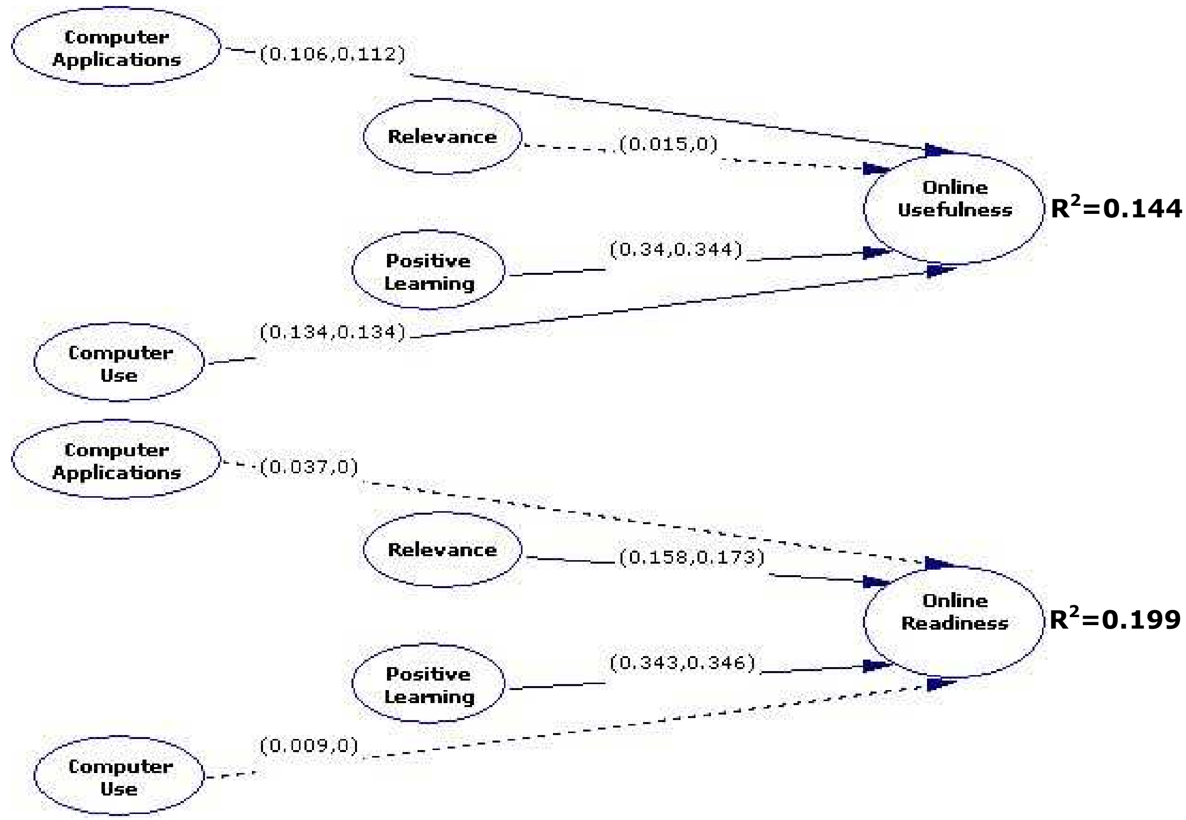


Figure 5.8: Path diagrams for teachers showing relationships with Online Usefulness and Online Readiness

The first model with Online Usefulness as dependent variable explains 14% of the variance informed by the contribution of the independent variables of Computer Use, Computer Applications and Positive Learning. The coefficients for the three variables were significant at the .05 level.

The identification of Positive Learning as the primary contributor (β = 0.344) shows the importance that teachers place on integrating computers into the student learning environment. Although the amount of variance explained is 20% less than the student model with Online Usefulness, 14.4% was explained by the contribution of Positive Learning, Computer Use and Computer Application. Contributing factors explaining the teacher model are drawn from the different teacher perceptions about using the online environment, the different teacher practices that emerged from the various curriculum areas as well as each school's strategic technology focus. Practices peculiar to each individual school, elaborated by the principal's vision, are further explained in the case study Chapters Six to Eight.

A slightly greater percentage of the variance in Online Readiness (20%) was explained in the model, informed by the contribution of the independent variables of Positive Learning and Relevance, which were significant at the .05 level. As with the other model, Positive Learning was identified as the primary contributor ($\beta = 0.346$). The identification of Positive Learning as the primary contributor in both models, confirms a small but core teacher perception about the importance of integrating technology into the curriculum. This perception should be seen in the light of a wide a variety of teacher views about the most appropriate method to employ for integration as indicated by the large standard deviation for Relevance. The diverse teacher views about technology use as well as the various school technology practices that teachers engage in demonstrates a lack of cohesiveness about integrating technology and a lack of clarity about the concept of using technology for learning in schools. The different paths established for the students and the teachers act as an interesting precursor to the final analysis of the eFactor taken up in section 5.8.

5.7 Interviews with the Principals

As stated previously, nine principals were interviewed. The qualitative analysis of the transcripts provided necessary supplementary material to the individual case study schools and the three eFactor school groups that emerged. The qualitative study provides a significant role in this research identifying factors that impact on the use of technology in schools and eventually students. The qualitative analysis is used in conjunction with quantitative analysis to identify the impact of technology on the overall student population.

To facilitate the combination of the qualitative and quantitative data, the first step in the qualitative analysis was to allocate interview content to areas consistent with the constructs developed for the quantitative analysis. The constructs had been previously designed to assess important school characteristics related to attitudes towards the use of computer technology in the school environment and the adoption of more flexible learning utilising online technology. The qualitative analysis package NVivo was used to categorise the principal interviews tagging responses similar to the construct descriptors used in the construction of the student and teacher scales. The number of references to the constructs as well as the percentage coverage of each transcript, for the nine principals interviewed, is seen in Tables 5.8.

Table 5.8: Organisation of the Principal Interviews into response categories for schools 1 – 10, omitting school 8

	Number of References and Document Coverage for each scale per School								
Scales ↓ School No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**
Computer Application	**3(8%)**	**3 (5%)**	**1(3%)**	**6(9%)**	**4 (8%)**	**4(9%)**	**5(12%)**	**1(4%)**	**4(11%)**
Computer Use	**8(10%)**	**3(4%)**	**5(11%)**	**4(9%)**	**5(16%)**	**5(10%)**	**8(16%)**	**4(5%)**	**6(8%)**
Relevance	**2(3%)**	**1(2%)**	**7(19%)**	**3(6%)**	**3(11%)**	**6(8%)**	**5(8%)**	**5(6%)**	**3(5%)**
Positive Learning	**4(7%)**	**4(9%)**	**3(8%)**	**3(6%)**	**2(2%)**	**3(6%)**	**4(7%)**	**3(5%)**	**6(14%)**
Online Readiness	**2(3%)**	**2(3%)**	**1(2%)**	**1(3%)**	**1(3%)**	**3(3%)**	**3(5%)**	**1(1%)**	**2(3%)**
Online Usefulness	**3(7%)**	**2(3%)**	**1(1%)**	**3(7%)**	**3(10%)**	**4(8%)**	**6(10%)**	**2(3%)**	**3(3%)**

After grouping the principals' impressions into the various categories, trends were examined and correlated with the quantitative data. Overall with the greatest number of references (48) and document coverage, Computer Use was perceived as important by the principals in their interviews. The access to enough computers for teachers to use in their teaching as well as for students to use at school was given the most attention by the principals. Computer Applications, Relevance and Positive Learning had approximately the same number of references when combined for each construct. Together with Computer Use, the responses indicate that principals were focused on the use of computers both in terms of access and within the curriculum. The remaining two constructs of Online Readiness and Online Usefulness received the least amount of coverage overall and indicates that principals may not be giving as much attention to their school's online learning presence. The principal of school 7 was the exception and the fact that the particular school was undergoing extensive refurbishment may have influenced that principal's answers.

Individually, the principal's responses enabled the enhancement of case study descriptions for each school which are reported in Chapters Six to Eight. Collectively the responses assisted in identifying common characteristics for schools in the low, medium and high eFactor group.

5.8 eFactor

The research design, discussed in Chapter Four, called for a documentary analysis of the learning material present on each school's website to develop an overall measure of the different types of learning material called the eFactor. This final step in the research design required the analysis of website content and the development of an eLearning evaluation rubric specifically for secondary schools. Seven eFactor constructs were formed and these are outlined in detail in Table 5.9. The table outlines the constructs that were coded to form the eFactor. Each eLearning construct was coded and sequentially weighted according to the material's importance to the particular learning sequence, whether the material is a single entity or whether a composite of various activities and stimuli, and the amount of interaction required.

Table 5.9: eFactor Constructs				
	Description	**Learning**	**Context**	**Interaction**
Administration	**Location:** This material is posted in either the general school or class section of the school webpage. **Material:** The postings are forms or notices used for school organisational matters and examples noted were excursion permission forms and year enrollment forms. **Use:** These materials are not learning activities but could assist learning activities. This category is important as it encourages students and the school authority to use the webpage as a means of communication and forms a basis for the school using an electronic platform to deliver education.	Associated	Related	One Way
Auxiliary	**Location:** This material is posted in the class section of the school webpage. **Material:** The postings are learning activities generally related to the subject being studied and are not topic specific, examples noted were links to mathematics games websites and links to comic material for english classes. **Use:** These materials may be used for extension, enrichment or general enjoyment but the omission of specific student direction renders its specific use uncertain.	Singular	Related	One Way
Reference	**Location:** This material is posted in the general school or class section of the school web page. **Material:** The postings are hyperlinks, though some documents had been downloaded, to governmental or educational authorities and examples noted were links to the NSW Board of Studies examination guidelines and the Universities Admissions Index. **Use:** The target audience for this material were students at the stage of completing their compulsory schooling or students in their post compulsory years of study. Whilst lacking directions to use the material, the amount of material and its currency suggests that students were referred to these sites to access guidelines, regulations and exemplars appropriate to their study.	Singular	Supplemental	One Way

Preparatory	**Location:** This material is posted in the class section of the school web page. **Material:** The postings are directions to books, websites or documents contained on the web page and examples noted were links to a novelist's biography and a mathematics revision exercise. **Use:** Students are directed to these materials to either practice or acquire extra information in preparation for a forthcoming learning activity.	Singular	Essential	One Way
Directed	**Location:** This material is posted in the class section of the school webpage. **Material:** The postings are directions to a task that needs to be completed for homework. The task may be found in a posted doucment, a hyperlinked site or a partcular book/worksheet and noted examples were a geography task in a textbook and a history quiz. **Use:** Students are directed to these learning activities with the purpose of completing the activity and submitting the activity either the following day or in the next few days.	Singular	Essential	Two Way
Dependent	**Location:** This material is posted in the class section of the school webpage. **Material:** The postings are structured as a guided learning sequence and may be either downloaded or completed online or a combination of the two and examples noted were a senior english film task and a geology project. **Use:** The access and completion of such work will usually be outside of the scheduled class time or occassionally when the teacher is absent. The material does require some level of investigation and at some stages there may be cause to engage in a level of dialogue in order to complete the task before it is submitted usually electronically.	Multi-task	Essential	Multi

Variable Interactive	**Location:** This material is posted in the class section of the school webpage. **Material**: The postings are structured as a collaborative guided learning sequence and examples noted were solar car challenge and mathematics olympiad. **Use:** The learning interaction is multiple and much of the learning and interaction takes place outside of scheduled class time. There was a constant flow of dialogue and information observed on many of the learning levels. This type of learning was currently being used to enable other extension activities or lesson units to take place in class or in one case to allow a student who was absent for the year, the opportunity to participate with the class in learning activities.	Synergised	Essential	Multi

These criteria were distilled into three main areas; learning, context and interaction and are defined as follows:

- **Learning** - **Associated**: A school process that complements a learning task
  - **Singular**: An assigned learning task or action, usually unitary in nature, to be completed by the student.
  - Multi-Task: Staged work usually comprised of a variety of materials and stimuli. At some of the stages there are options for the students to interact with another student, teacher or organisation to complete a section or access some information. This material would be able to replace instructional time in the classroom.
  - **Synergised**: Structured material of varying stimuli that encompasses collaborative dialogue as part of the learning process. The possibility of dialogue, in all its forms, may be between peers, the teacher, a third party or a combination of those possibilities. This material would be able to replace instructional time in the classroom
- **Context** **- Related:** Additional curriculum material for use by students at their discretion or need.
  - Supplemental: Aligned curricula material for the students to use or investigate at their discretion.
  - Essential: Accompanying instruction renders this material a necessary part of the learning sequence and requires the student to interact with the material.

- **Interaction**- Identifies the information and communication flows established by the school for depositing, retrieving and sending information. Where there is a lack of documentation, a one way flow has been assumed.

The weighting for the development of the eLearning categories was derived by initially grouping the seven characteristics into their criteria groups. A unit factor was assigned to the item that was least important to the learning sequence for each group and the weighting was incremented by '1' for each subsequent item of that group. An exception was applied to linked learning as the learning was necessary to classroom practice and therefore was beyond the first step. The weighting justification applied to each characteristic is displayed in Table 5.10 with Table 5.11 showing the weighting applied to each posting. The number of postings for each category can be seen in Appendix 9 for the ten schools. In 2005 a new web platform, encompassing administration and learning, was implemented for all schools in the Sydney Archdiocese. This meant training for all schools with a focus on administration first, thereby resulting in a small number of learning web pages being developed by the schools. Consequentially only the 2006 data were used to calculate the eFactor although the increase in the number of postings from 2005 to 2006 is also discussed in chapters 6, 7 and 8.

As discussed in the methodology section (p. 65), the weighted postings were divided by the number of teachers in each school to remove school size as a factor and finally multiplied by the proportion of teachers posting the learning to show how widespread the practice was in each school.

$$\textbf{eFactor} = \frac{\text{weighted postings } \mathbf{x} \text{ proportion of teachers posting}}{\text{Number of teachers in the school}}$$

The schools were ranked according to their eFactor score and three groups were developed (low, medium & high), displayed in table 5.12. The number of weighted postings (Appendix 10) does influence the eFactor order with schools 3, 1, 9 and 5 at the top of the table order due to the magnitude of the postings. However, mediating the size of the respective schools is the depth of learning evident from the categorisation of the individual postings with the breadth of the percentage of teachers posting the material and it was these factors that assisted in defining the three groups. This process has assisted in recognising the extent to which eLearning is present in the school's virtual learning space.

Table 5.10: Coding of eLearning Categories			
Characteristic	**Weighting Multiple**	**Justification**	**Criteria Grouping**
One Way Interaction	X 1	One action to access material	**Interaction**
Two Way Interaction	X 2	Two actions; one for access & one to send output or communicate	
Multi Interaction	X 3	At least three actions; one for access, one to communicate or research & one to send output	
Related context	X 1	Document associated with a class practice	**Context**
Additional context	X 2	Learning activity related to the learning stage of the student	
Essential Context	X 3	Necessary learning activity to be completed in a class's learning sequence with appropriate instruction	
Linked Learning	X 2	Connection to learning content	**Learning**
Encased Learning	X 3	Self contained learning sequence designed to cover part or all of a topic and replace class time	
Synergised	X4	Self contained with collaborative learning, designed to cover part or the entire topic and replace class time.	

Table 5.11: Categorisation of eLearning Constructs				
Construct	**Learning**	**Context**	**Interaction**	**Weighting**
Administration	Associated	Related	One Way	1
Auxiliary	Singular	Related	One Way	2
Reference	Singular	Supplemental	One way	4
Preparatory	Singular	Essential	One way	6
Directed	Singular	Essential	Two Way	8
Dependent	Sequential	Essential	Multi	27
Variable	Synergised	Essential	Multi	36

The presence of eLearning is particularly noticeable with school 10 and school 9. Whilst the number of postings for school 10 was less than school 4, the fact that school 10 was smaller in size than school 4 and a larger proportion of school 10 teachers was involved in posting material caused school 10 to rank above school 4.

The process also accounts for the saturation of technology use amongst each school's teachers.

Table 5.12: eFactor groups

	Sum-2006	School Size	Proportion of Teachers	eFactor-2006	
School 3	3701	49	55%	42	High
School 1	3048	46	46%	30	High
School 9	2969	51	31%	18	Medium
School 5	1940	55	20%	7	Medium
School 2	1072	58	24%	4	Medium
School 10	529	39	28%	4	Medium
School 4	647	75	12%	1	Low
School 6	432	61	13%	0.9	Low
School 8	210	54	11%	0.4	Low
School 7	175	47	9%	0.3	Low

Schools 1 and 9 are similar in size and the number of postings, yet with 46% of teachers from school 1 posting material on the school webpage compared with 31% for school 9, a large difference resulted between these schools' eFactor scores. The schools in the high eFactor group are distinguishable due to the much higher percentage of staff posting material on the school web pages. The type of postings (Appendix 10) indicated that these two schools were utilising a posting with a higher learning context to the other schools. School 9's position is well above the rest of the schools in the medium eFactor group and may have been in a process of transition to the high eFactor group at the time of the study.

The postings for each of the schools are discussed in greater detail in Chapters Six, Seven and Eight with the eFactor groups framing the structure of that discourse.

5.9 Relationships between variables and the eFactor

The relationships between variables for the student and teacher models differed with greater percentages of the variance explained in Online Usefulness and Online Readiness respectively. To test whether there was any relationship between the six constructs shown in the student and teacher analyses and the eFactor as dependent variable, linear regression analyses were undertaken for both students and teachers. There were no significant relationships between any of the scales and the eFactor for either the student or teacher sample, however, with only 10 values of the eFactor only very large differences would be identified as statistically significantly different. The inability to identify a significant relationship for the total sample may suggest that relations between teachers, students and their interaction with learning posted on school web pages differ for schools at different levels of eLearning.

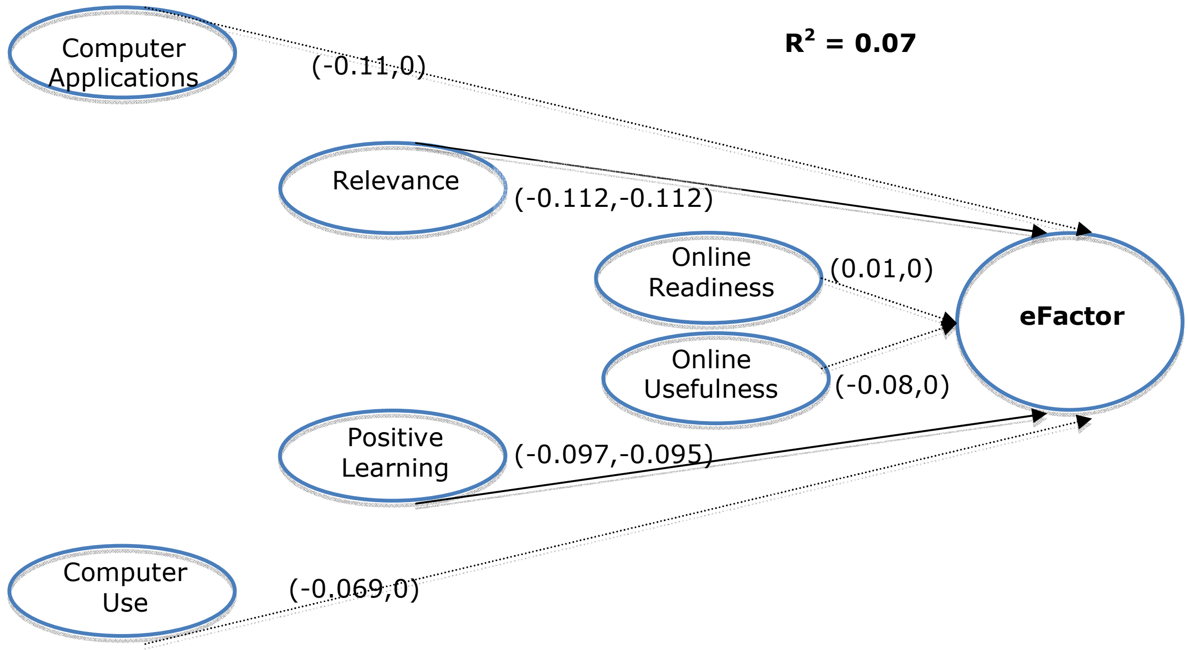


Figure 5.9: Path diagrams for students in the medium eFactor group showing relationships with the eFactor

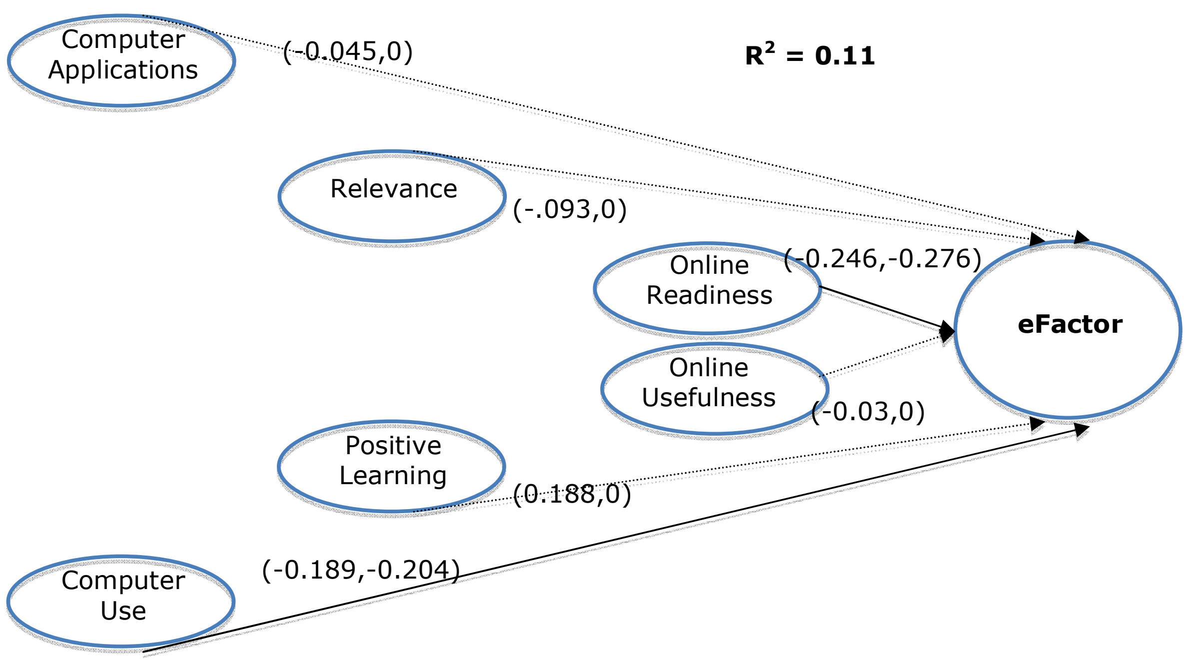


Figure 5.10: Path diagrams for teachers in the medium eFactor group showing relationships with the eFactor

The student and teacher samples were then separated according to the three eFactor groups and the regression analyses repeated to determine whether there was any significant relationship between the six scales and the eFactor for each group of schools. Any relationships identified would establish a nexus with the common characteristics associated for the particular group for the students, teachers or both.

The analyses identified a relationship in the medium eFactor group for both students (Figure 5.9) and teachers (Figure 5.10) but not for the other two groups. The standardised regression coefficients are indicated on both models with the first coefficient indicating when all the independent variables are in the equation and the second coefficient indicates only the significant paths. For the student medium eFactor group the independent variables of Relevance, Computer Use, Positive Learning and Online Usefulness explained 7.2% of the variance. The coefficients for two of the variables, Relevance and Positive Learning were significant at the .05 level (Appendix 11). The same independent variables were also significant in the overall student model and reflect students' perception about the everyday utilisation of technology.

For the teacher medium efactor group, the independent variables of Computer Use, Positive Learning and Online Readiness explained 11% of the variance. The coefficients for Computer Use and Online Readiness were significant at the .05 level. Teachers perceived computer use in the classroom as essential to the implementation of technology strategies, in the overall teacher model as well as this group.

The failure to establish relationships for the other eFactor groups may be indicative of the stages of teachers' technology proficiency in those schools. This was evident with the wide range of teacher perceptions about the use of computer applications in the school environment both in and between groups, as well as the diverse computer skills identified by the teachers themselves. Another realisation is the learning content posted on the school web pages are created and placed by teachers not students. Students have the capacity only to access the material or deposit material as a response to learning instruction. These two student factors are only considered by the eFactor categorisation in terms of communication flow.

The development of the eFactor categories approaches the issue of learning in a virtual environment. The categories distinguish between the type of material that the teachers are posting and the amount of interaction that the material and task requires. The learning posted on the school web page platform is predominantly what Khan (1997) calls instructor enabled. The design, authorship and selection of the learning is still teacher/instructor driven. One must also account for the number of teachers, perhaps due to their technology skills, who are posting the material. Only one school had more than 50% of its staff posting material. Hence the fact that the analyses were unable to establish a relationship between the eFactor and the six scales for the students and teachers in the high and low eFactor groups may be related to the varying stages of technology development within each of those schools in both groups. It also demonstrates the varying relationships of the different independent variables for each of the schools and in the technology use amongst the students and teachers.

5.10 Summative Discussion

The analyses have uncovered features confirming existing research about the use of technology and the Internet by secondary school students and teachers. They have also led to the development of a new framework for learning in the online environment for school students.

The amount of access that students have to computers away from school is higher than may have been assumed. The computer resource as well as the amount of time that students are able to use the resource calls into question views about the 'haves' and the 'have nots'. Automatic assumptions made about socio-economic areas and access to computer technologies should be re-thought (Perraton & Creed, 2001) as more family homes become equipped with computer technology (Woessmann & Fuchs, 2004; Schmitt & Wadsworth, 2006). Gendered use of computers confirms recent findings that the gap between females and males use of the computer is narrowing, particularly if the use of the computer is school-work focused. There was a tendency in most cases for males to play games more than females except for the single sex girls' school where female use of games applications was high. All the other applications identified in the survey displayed little difference in gender use and indicated the use of more applications on the *away from school computer* that could be utilised as part of a school's technology strategy.

School technology integration strategies have established practices in schools that inhibited the contribution of technology to learning. The adoption of the NSW Board of Studies technology framework as a sole strategy by some of the case study schools was limiting, as it tended to focus on competency use rather than a wider issue of engaging students. Some principals found technology challenging and two principals were critical of the lack of strategic direction from the systemic authority. Where principals had implemented strategies that started to incorporate learning strategies, there was a greater adoption of a wider range of computer technology by teachers. The strategic use of computers by teachers was reflected in student computer application use at school.

Students' use of the computer at school indicated students were accessing computers in the library for research and in classes for topic instruction and single lessons for specific curriculum tasks that were enhanced by the use of the computer. The utilisation of computer technology in school is called into question as few students chose to indicate a positive impact of computer use for a particular subject. The fact that students commented on a property of a particular application to gain them extra marks rather than making the subject more engaging would tend to suggest the use of computers at school is limiting compared to the students' own experience. This factor is also reinforced by the strong teacher desire to have more training with computer technology suggesting that they acknowledge further improvement in the use of computers at school is needed.

The regression analyses confirmed the different technology standpoints of the students and teachers with students engaging in the area of online usefulness and teachers more in the area of online readiness. The students have demonstrated that they use computers frequently outside of the school environment and they have claimed they are proficient on many applications. Teachers have acknowledged the positive learning effect to be had from using computers, however, they are concentrating on their readiness to launch into the online environment. This readiness includes the provision of further training in computer applications, more computers and personnel being available to assist with the technology.

The concentration on basic computing competencies with web-based learning tasks is reflected in the learning postings that are being placed on the school web pages. There were only a small number of postings that required any level of research and collaboration to fulfill the task. Also the small overall proportion of teachers posting material indicates reluctance or an inadequacy. Rowntree (1997) asserted that fear of the innovation as well as reticence in developing the online material all contribute to the failure of teachers to engage with this aspect of learning. The number of online materials requiring a lower amount of engagement far outweighed the postings that required a significant engagement by the students. In some cases one imagines that it was a significant achievement for teachers just to post the material. The proportion of teachers posting the material did not exceed 50% in most schools with the high eFactor schools being the exceptions.

The different understanding and use of the technology are confirmed in the strength of the regression models developed for the students with Online Usefulness and to a lesser extent, teachers with Online Readiness. Further evidence about the different levels of technology understanding exists in that only one of the eFactor groups (medium) was able to establish any significant relationships for the efactor dependent variable and the six constructs for students and teachers.

The computer practices and perceptions of students and teachers from each of the ten schools are discussed in the next three chapters. The discussion focuses on the distinguishing features of the schools and the computer technology practices and views of the students and teachers of each individual school. The interaction between the six constructs for each school is described with information from the principal interviews providing substantiation about school projection and development plans for technology. The discussion of the ten schools has been organised around their eFactor groups of low (Chapter Six), medium (Chapter Seven) and high (Chapter Eight) with the common characteristics for each group highlighted at the conclusion of each chapter.

Chapter Six: Low eFactor Group Case Studies

6.1 Introduction

The research presented in this chapter describes various characteristics of the four schools identified in the low eFactor group described in Chapter Five. In subsequent chapters the identifying characteristics for the medium and high eFactor groups are discussed. For each of the three groups, the research describes the various elements of student and teacher skill and perception about computer use in a learning context for the case study schools. Each school is introduced by a description of its location, size, school facilities, student and teacher population and the curriculum offered in the school. All schools are owned by the Sydney Catholic Archdiocese but administered by different groups and these groups are identified in the participating schools. Given the nature of this study, specific information about the school's computing facilities and arrangements were included in the more general descriptions. The order of schools presented in this chapter, and in Chapters Seven and Eight, represents the order in which each school's data was entered into the software analysis package.

The relationships between the contextual factors at the individual school level were evaluated through multivariate regression analysis. The purpose of the analysis, as for the overall model, was to determine the strength of the linear relationships between the independent variables of Computer Application, Computer Use, Relevance, Positive Learning, Online Usefulness and Online Readiness and the eFactor as the ultimate dependent variable in the model. The significance test results for the students and teachers are outlined in Appendices 12 and 13 respectively. In the case of two schools, simple correlational analyses were performed where there were insufficient teacher responses (taken as fewer as 20 teachers) to perform regression analyses. The correlation analysis was used to test the strength of the relationship between the variables outlined above.

Excerpts from the interview with the school principals are included to provide substantiation for teacher practice and add depth to the description of individual school practices as well as the quantitative analysis for each school. These excerpts were grouped into the constructs developed for the analysis of the quantitative data. The qualitative analysis package NVivo was used to categorise the interviews by tagging responses similar to the construct descriptors used for the construction of the student and teacher scales. After grouping the principals' impressions into the six constructs, trends were examined and correlated with the quantitative data.

The final stage in the case study profile is how each school's eFactor was developed. Aspects of the type of postings on the school webpage, relating to the eFactor scale, are discussed as well as the proportion of teachers posting the webpage material. Each school's final eFactor position is discussed with particular reference to those elements that make the main contribution to the final calculation of the eFactor.

The chapter concludes with a discussion of the common characteristics of computer practice for both students and teachers in the low eFactor group schools as well as identifying the differences between the schools. The principals' comments are synthesised to highlight common areas of school direction, amongst the four schools. The common features from the three different perspectives are gathered to form the basis of identification of schools in the low eFactor.

6.2 School 4

6.2.1 School Structure

School 4 is a large outer metropolitan co-educational school with a total enrolment of over 900 students. The school, administered by the Sydney Catholic Education Office, was opened in the late 1990's to cater for the rapidly expanding residential population in the area. The school delivers a secondary curriculum for year 7 through to year 12. As the area has a high population growth and the school is a regional high school for several Catholic primary schools, the school's enrolment is very strong despite the presence of two Government high schools in the vicinity.

The school is situated on a large block surrounded by residential areas. The buildings are relatively new and look modern on the exterior but most of the classrooms are traditionally organised with rows of desks facing the front. The omission of some of the latest developments in school design incorporating technology could simply be the result of financial constraints. However, the construction of traditional buildings may point to a lack of vision and knowledge about new trends for the design of the modern school, (Ackoff, Rovin; 2003). The school has specialist facilities for science, design and technology, hospitality and creative arts. The recreation areas for this school are extensive, with both passive, large outdoor covered grounds, and active areas catered for. There are ovals for the students to practise and play sport on.

The school has three computer laboratories with 25 personal computers in each and are placed around the walls of the room. At the time of the study, the computers were less than two years old. Each of the rooms has a networked printer and scanner and the data are stored on a central curriculum server. There are also eight multi-purpose rooms, with five rooms equipped with one personal computer and the other three with five personal computers. There are also three laptops that can be used in these rooms depending upon the needs of the particular class at the time. These rooms do not have a specific configuration but can be organised according to the learning needs of the class at any given time. The library can also be used as a computer laboratory with a total of 28 personal computers, two printers and a data projector. The computers in the multi purpose rooms and the library are all networked and the data are stored on a central server.

6.2.2 General Description-Students

The area surrounding the school is multi-racial and this is reflected in the school population. The 2004 enrolment identified 70% students from a Language Background Other Than English (LBOTE) and a 1% indigenous population. In years 8 and 10 there was a total of 353 students and 253 students (72%) accepted the invitation to participate in the survey.

Access to and use of a computer away from school is described in Table 6.1.

Table 6.1: Student use of Away from School Computer

Use Categories	Year 8 (%)	Year 10 (%)
Able to access the computer at least most of the time	93	88
Able to access the Internet	88	93
Allocated computer use for school work at least half the time	79	88

From the data it can be seen that a slightly greater proportion of year 10 students surveyed used the computer for school purposes and the Internet. These two issues may be connected for year 10 assessments. The most commonly used applications for both years were Internet browsing, word/spreadsheet, games and multimedia. This usage pattern is similar to the total student usage pattern displayed in Chapter Five, Figure 5.3, and is seen in Figure 6.1 below. Despite the high percentage of students involved in Internet browsing, only a few reported using 'Internet Chat'. In the category 'other' activities there were some creative arts applications identified but these applications were all different.

The school use of the computer in different class contexts is slightly below that for the total sample in most areas, as seen in Figures 6.2 and 6.3. The use of the library for Internet research is lower in both years compared to the total sample, particularly in year 10. This may be a result of not having enough computers for the student population.

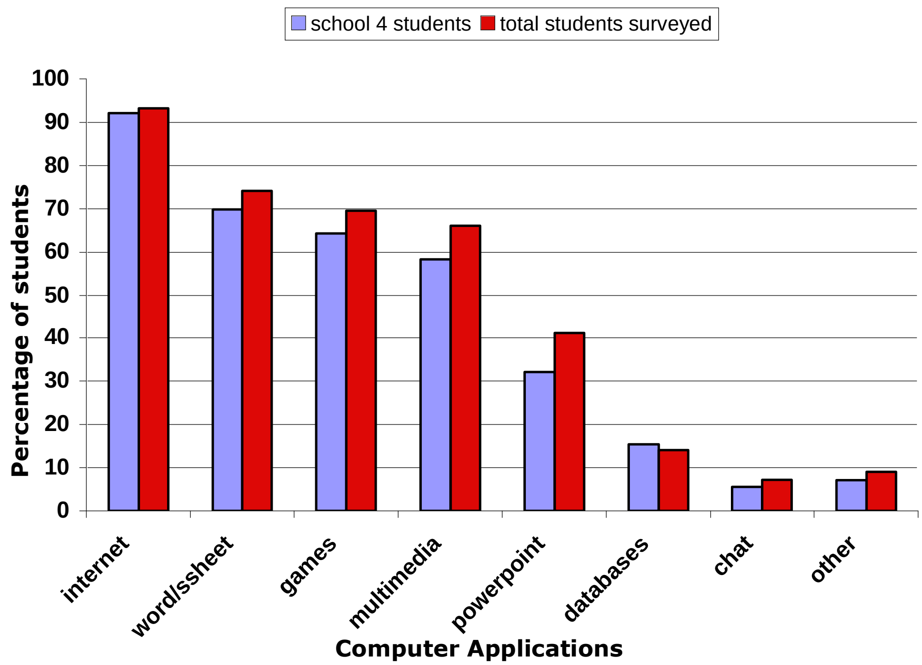


Figure 6.1: Comparison of school 4 students to the total number of students surveyed in the use of computers away from school

The principal commented that in some timetabled classes, the senior computing class would be given preference in the library. In year 8 the 'other' category was marginally higher than that of the student sample. This may be a result of key learning areas using the computing area to facilitate a particular unit of study. This planned use of the computing area for a small timetabled block differs from the occasional one or two lesson allocation and possibly indicates a more strategic integration of technology with learning.

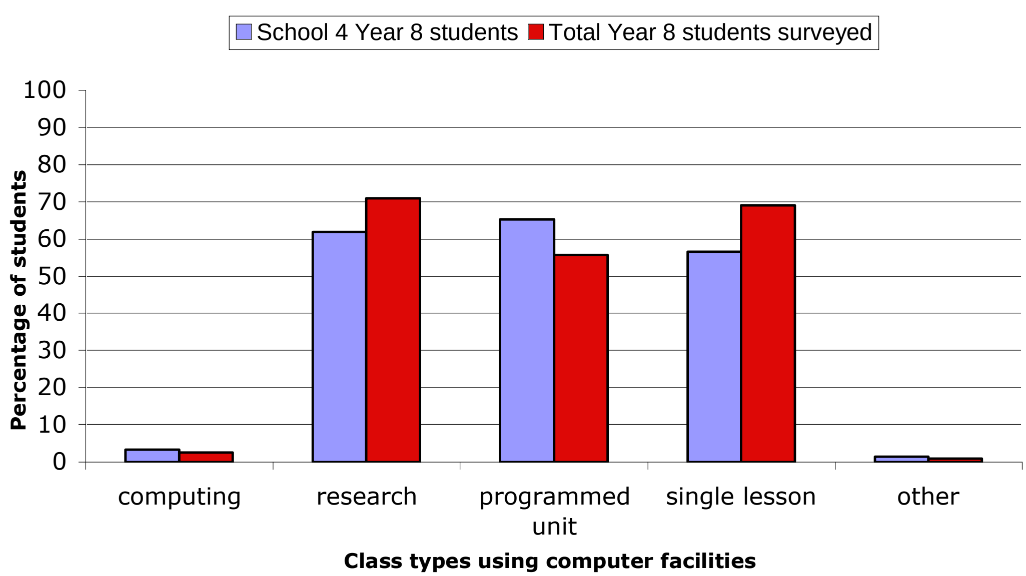


Figure 6.2: Computer use by class activity in year 8

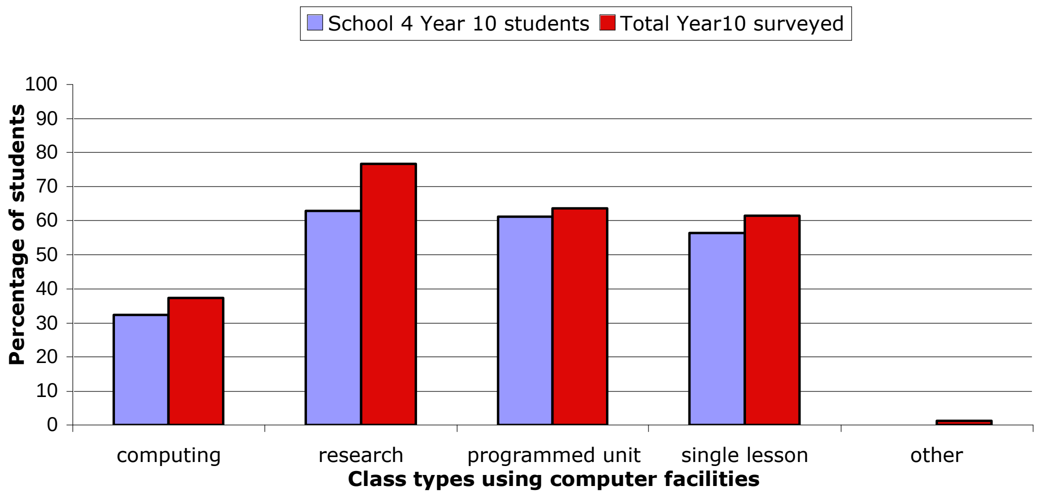


Figure 6.3: Computer use by class activity for year 10

The students' use of a range of applications is also identified and their overall usage pattern can be seen in Figures 6.4 and 6.5. There are some notable differences in the use of applications. Consistent with the whole student sample, Internet searching is the most popular, however, the use of word processing/spreadsheet is below that of the total sample for year 10 students. In comparison to the total student sample there is a greater use of web projects by both years, powerpoint by year 8 and web design by year 10. The use of powerpoint as a focus technology is common to other schools in the study and can be associated with the high teacher proficiency in the use of powerpoint (see Figure 6.6). However, the use of Web Design as a focus technology is different from the other participating schools and may point to a group of teachers in the school particularly skillful in the use of those applications. In other applications, the use of email was below the overall sample and the use of the remaining applications was approximately the same as for the total student sample.

This school also recorded the most student comments about computers positively affecting a subject. Nearly 25% of students perceived that the use of computers in Technological and Applied Studies had a positive effect. The same effect was also recorded by a smaller percentage of students for Human Society and its Environment and English. The smaller percentage may be due to a smaller number of teachers affecting the use of technology in those subjects.

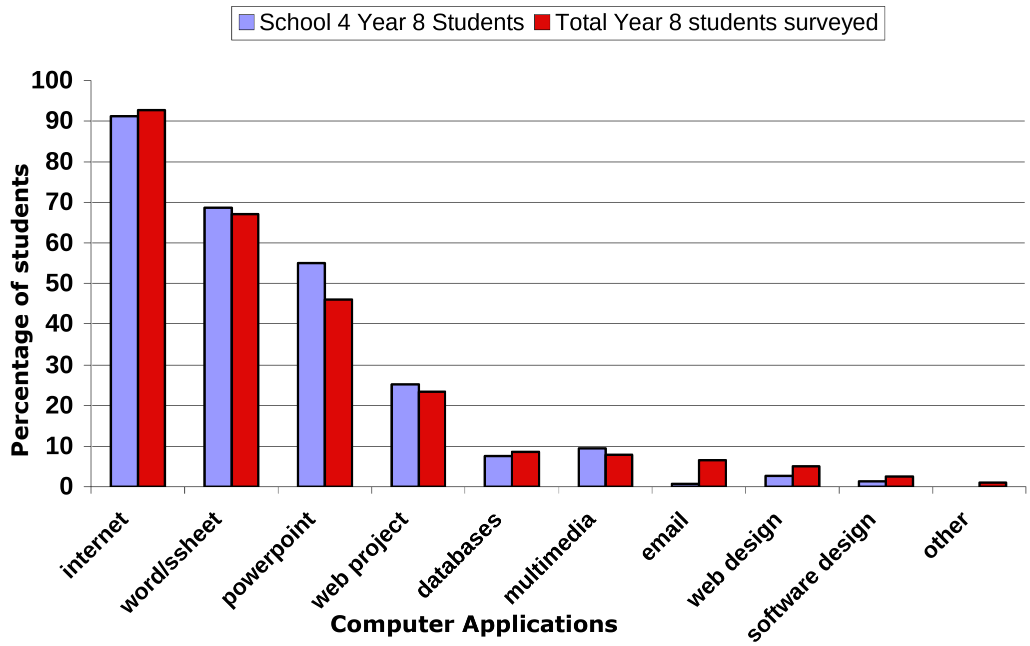


Figure 6.4: Year 8 school computer applications use

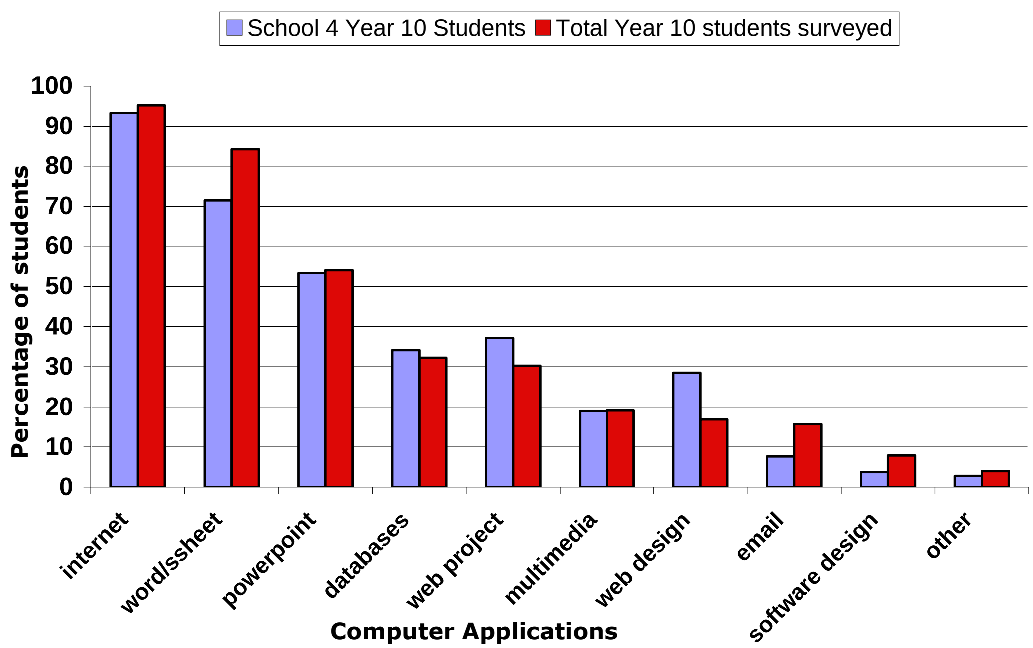


Figure 6.5: Year 10 school computer applications use

6.2.3 Relationships between variables in the student model

In keeping with the regression models presented in Chapter Five, the regression model presented in this section is consistent with the overall trend for the student model identifying relationships with the dependent variable Online Usefulness. The continuous lines in Figure 6.7 indicate which independent variables have the most

effect on the dependent variable. The first number shown in the parentheses indicates the value of the standardised regression coefficients where all variables are included in the model and the second coefficient indicates only the significant paths. Similar to the overall student model, the model explaining online usefulness was stronger with 32.8% of the variance explained by the contribution of the independent variables of relevance and positive learning as seen in Figure 6.6. Only relevance was significant at the .05 significance level confirming student opinion about the appropriateness of using computers in an online context. The standardised beta coefficient identifies Relevance as the primary contributor.
For the model with online readiness as the dependent variable, 1.2% of the variance is explained by the independent variable computer applications which was significant with p = .047. This model, explaining only a small proportion of the variance, confirms the strength of the student relationship with the dependent variable online usefulness.

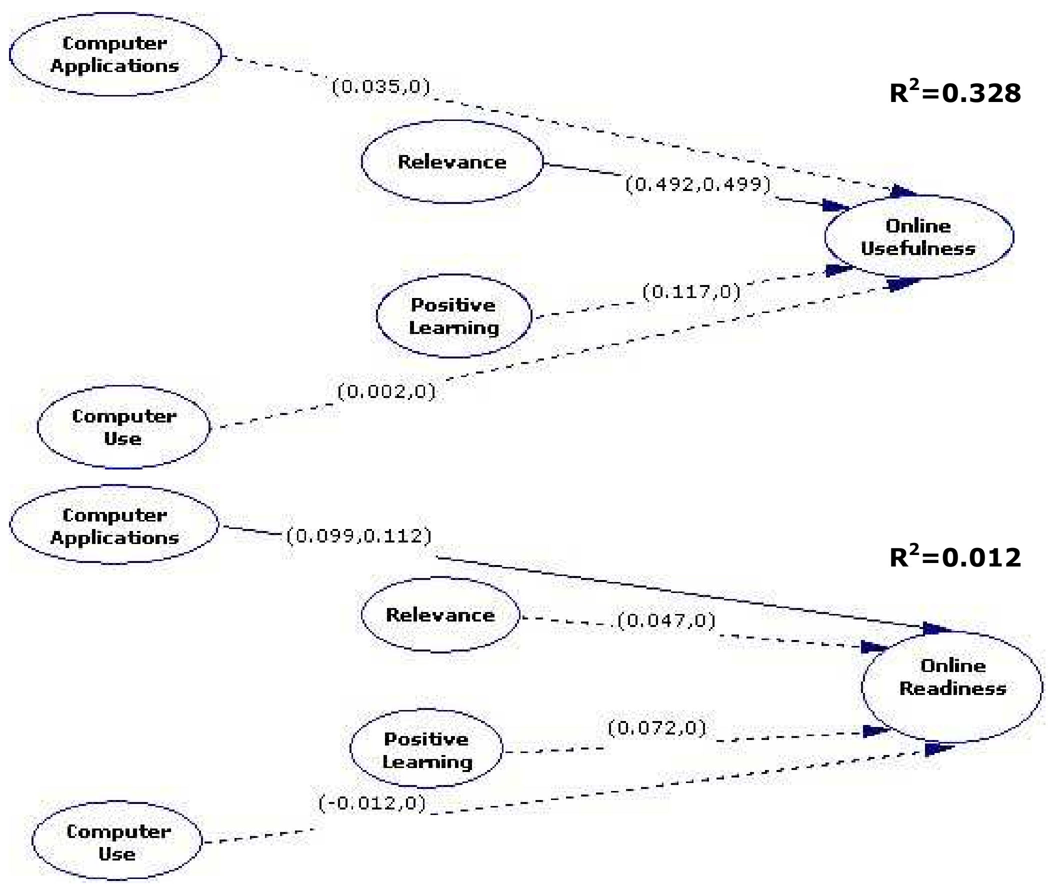


Figure 6.6: Paths diagrams for students of School 4 showing relationships with Online Usefulness and Online Readiness

6.2.4 General Description-Teachers

Of a total of 85 teaching staff, 12 female and 3 male staff (18%) accepted the invitation to participate in the survey. The small number of teachers participating could be due to timing of the survey period. The survey was conducted during an examination period, where marking and report writing would have impacted on the time available for teachers. These teachers were drawn from the key learning areas of English (2 teachers), Mathematics (2 teachers), Science (4 teachers), Human Society in its Environment (3 teachers) and one teacher each for Technological and Applied Studies, Languages Other Than English and Support. Personal Development, Health and Physical Education was not represented in this school's teacher sample. The times these staff had been employed at the school for these staff were 1-5 years (12 teachers) and 6-10 years (3 teachers). As this school is comparatively new, these employment groupings are to be expected. The total teaching experience of these teachers, shown in Table 6.2, indicates a considerable depth of experience in this small sample of teachers.

Table 6.2: Total years of Teacher Experience for Participating Teachers in School 4

Years of Teacher Experience	Number of Teachers
1 – 5	3
6 – 10	6
11 – 20	3
21 - 30	3

There is a tendency to assume that experienced teachers do not need as much induction or mentoring because of their experience (Feeney Jonson, 2002). These more experienced teachers are likely to miss curriculum mentoring that may also contain some aspects of technology integration and it may well be a flaw in schools' induction programs for teachers new to the school. Notwithstanding this all the teachers had a computer at home and two thirds had their computer connected to the Internet.

The majority of teachers rated themselves very good, good or 'ok' in the following computer applications; word processing, spreadsheet and presentation software. These applications tend to be at the easier end of the application spectrum and used first with varying degrees of skill by teachers (Fuller, 2000). For the remaining applications over 50% of teachers surveyed sought assistance in databases and desktop publishing applications. Total comparisons for the computer application proficiency are found in Figure 6.7.

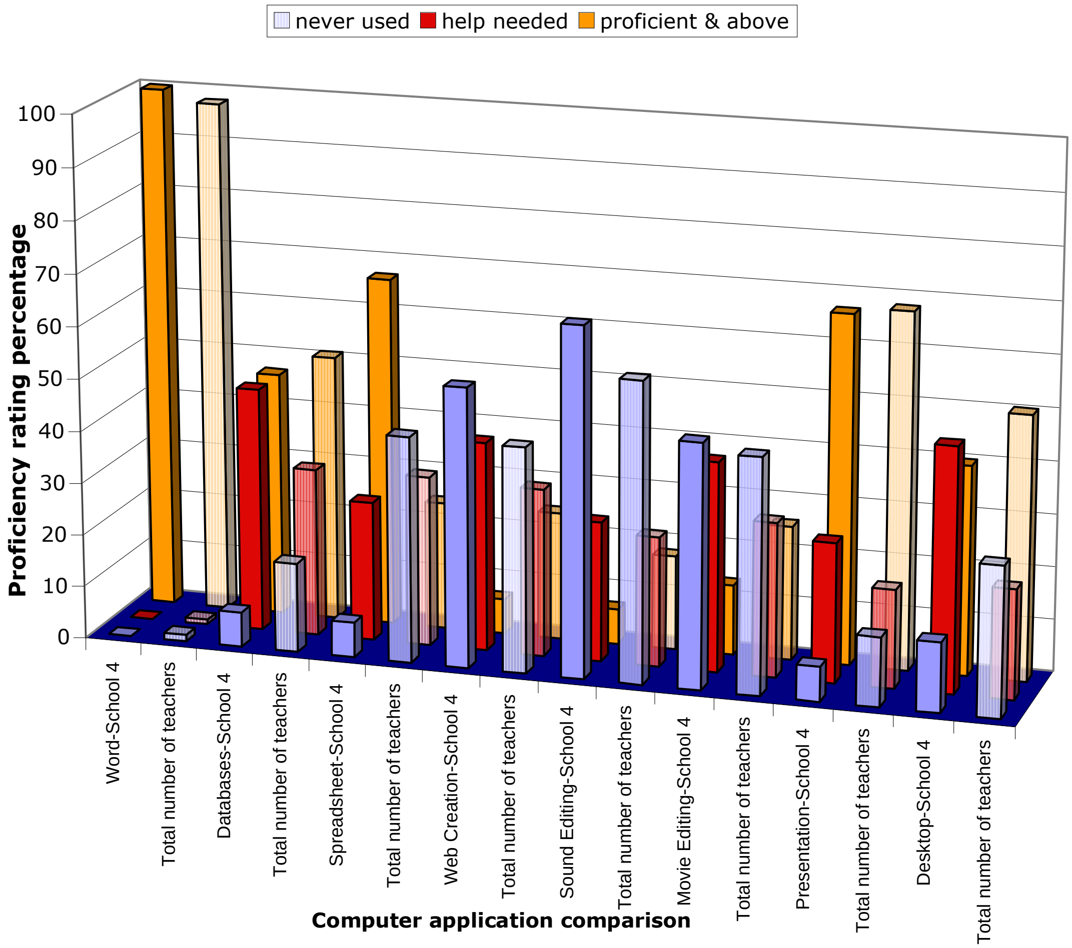


Figure 6.7: School 4 teacher proficiency rating compared to the total teacher sample

The higher proficiency in web creation than the total teacher sample is attributable to the small group of teachers who considered their skill to be good. There appears to be a link between that group of teachers and the acknowledgement by year 10 students of the extra concentration in the use of web creation. In terms of applications stimulating learning, the teachers identified the following; word processing, web searching, multimedia and presentation software. In the use of CDs, desktop publishing and spreadsheets opinion was mixed across all the categories. In the applications creating web pages and movie/photo editing, the teachers were divided into two groups. Whilst over 50% indicated the applications had no effect on learning, a small group in both cases indicated that the applications had a very good effect on learning. For the remaining applications, the majority of teacher opinion was that the applications had no effect on learning.

6.2.5 Relationships with variables in the teacher model

As indicated in the introduction, correlational analyses are presented here because there were fewer than 20 teacher responses. Significant correlations between variables are indicated by an asterisk. The test results, shown in Table 6.3, indicate a significant correlation between the variables Positive Learning and Online Usefulness. As the correlation is negative it indicates that the surveyed teachers in this school do not perceive that the online environment has a positive influence on student learning. The results may reflect the anxiety of teachers about their skills with particular computer applications and their readiness to apply those skills to a web based platform.

Table 6.3: Correlations showing relationships between the independent variables for teachers in school 4

School 4	N	Use	Application	Relevance	Positive
Application	15	-.368			
Relevance	15	.265	.445		
Positive	15	.330	-.124	.305	
Readiness	15	.286	-.340	-.138	.011
Usefulness	15	-.340	-.097	-.109	-.529*

6.2.6 eFactor for School 4

The learning material posted for this school increased by 40% when comparing the period of 2005 with 2006 but, as the initial number of postings was low, this is not a substantial increase. The eFactor calculated (1) places this school in the lowest category. Several elements are identified contributing to this eFactor score such as a small percentage of teachers posting material and the type of material posted being rated at a low learning level. The low teacher response rate also indicates the level of teacher interest in computer technology. Probably the most important point is the staff development concentration on improving their skills in computer applications, as identified by the Principal. With some of the staff surveyed having a clear preference for web-based technologies, the school's eFactor may rise in subsequent years as these teachers extend their use of web technologies.

6.2.7 Summary School 4

The student responses were largely typical of the total student sample in relation to access to computers and breadth of computer application use. Overall student use of computer applications at home was slightly below the total student use, perhaps due to the elevated application use at school. Some of the trends displayed for this school differ from other schools, particularly in the year 10 class use of web technologies. The use of powerpoint as a technology focus is consistent with the focus of the majority of schools and something that the principal has related to the Board of Studies computer competencies and test.

The teachers' proficiency in computer applications was similar in the main to the total sample although a distinct group was identified as having certain skills in web applications. It seemed that this skill was translated to the classroom with year 10 identifying the use of web applications in web projects and web design as higher than the total student sample. It is perhaps this skill that explains why teacher opinion was polarized when it came to the use of the web interface and its impact on learning. It was apparent that the web skill of these teachers and its practice in the classroom, demonstrated that these teachers attributed some impact of web applications on learning. The pairing of web technology with an effect on learning was also evident with some students identifying that technology had a positive impact on their lessons. A school focus on the implementation of certain computer applications was evident in the teacher's skill self-evaluation but it seemed that the focus was quite narrow with only one application, powerpoint, being targeted.

6.3 School 6

6.3.1 General Description

School 6 is a large outer metropolitan coeducational school with an enrolment of over 900 students. The school, opened in the 1980s, was the result of planning and lobbying by parents from local parish communities that wanted a school and church to service their expanding communities. When the school opened it had the status of a regional Catholic high school for the local primary schools. Even though more schools have been constructed, however, the enrolment demand to enroll students continues to be strong. The school's year 12 Higher School Certificate results, as well as its reputation in the community, currently guarantee full enrollment despite the availability of choice between schools in the area. The school is situated on a large block, that used to be surrounded by a bushland setting but has been replaced by large residential developments. The site is shared with a church, primary school, community hall and priest's residence. The school buildings are relatively new and the design of many rooms easily accommodates group work as opposed to the traditional classroom which facilitates desks facing the front. Apart from the general purpose areas, the school has made extensive provision for the areas of Creative Arts, Science and Technological and Applied Sciences.

The school has decided to provide broad access to computer facilities for the students and teachers, with eight computer laboratories. Each laboratory has approximately 28 personal computers situated around the walls of the room, and a printer and scanner to share between two laboratories. The age of the computers varies from one to three years and the policy of the school is to replace the computers once they are three years old. All the machines are networked and the data are stored on a central curriculum server. There are five multi-purpose rooms each with a networked personal computer and a data projector. The room configuration is flexible as it is dependent upon the needs of the particular class but each can accommodate up to 30 students. One of the rooms has an interactive whiteboard and there are plans to introduce more boards to the school in the near future. The library can also be used as a laboratory, though the setting is not convenient for a formal class. There are 40 personal computers, of similar age to those in the laboratories and spread across a wide area, with three printers and five scanners all networked to the school's computer system. The school also has a wireless network, with approximately 90% coverage, to encourage teachers to use the 20 laptops in the classrooms as well as enabling students to use their own laptops. The principal envisages that students and teachers will be bringing their own laptops in the near future and believes that the school should accommodate this type of learning now. The school should have 100% wireless coverage next year as well as more laptops, encouraging the use of computer technology away from the computer laboratories and across the entire school campus.

6.3.2 General Description-Students

Approximately 50% of the 2004 enrollment was identified as having a Language Background other than English. In years 8 and 10 there was a total of 437 students and 305 students (70%) accepted the invitation to participate in the survey- 126 year 8 students and 179 year 10 students. One student from each year indicated that they did not have access to a computer outside of school and the remaining student access is described in Table 6.4.

Table 6.4: Student use of away from school computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	95	98
Able to access the Internet	94	98
Used for school work at least half the allocated time	92	95

These students had a high degree of access with a high percentage of students using the computer for school purposes. The most commonly used applications for both years were Internet use, word processing and multimedia. Compared to the total usage pattern, seen in Figure 6.8, application use is approximately the same as other schools with the exception of powerpoint. The use of this application is below the total student sample. This pattern of usage may be a result of the application not being required by teachers for assessment purposes and makes this school one of the few schools not focusing on this application.

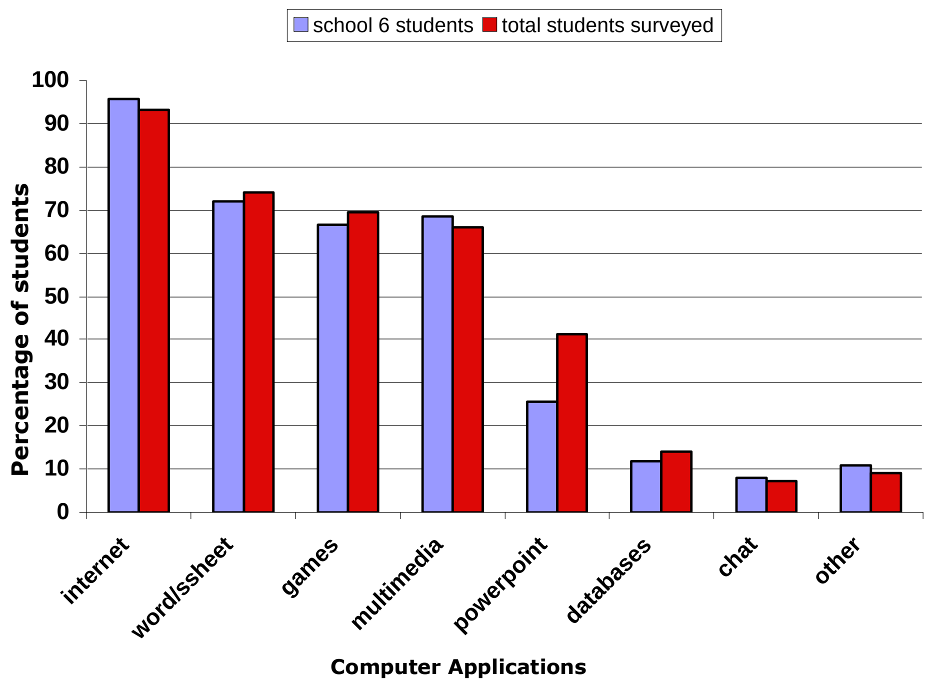


Figure 6.8: Comparison of school 6 students to the total number of students surveyed in the use of computers away from school

In the category 'Other', the only application consistently recorded by three students was visual basic, the other few applications in this category all being different.

Use of computers at school is reported by year level. Researching in the library is recorded at higher levels than for other schools particularly in year 10. This appears to have had a corresponding effect in the other categories with the recorded use at school below that of the total sample as can be seen in Figures 6.9 and 6.10.

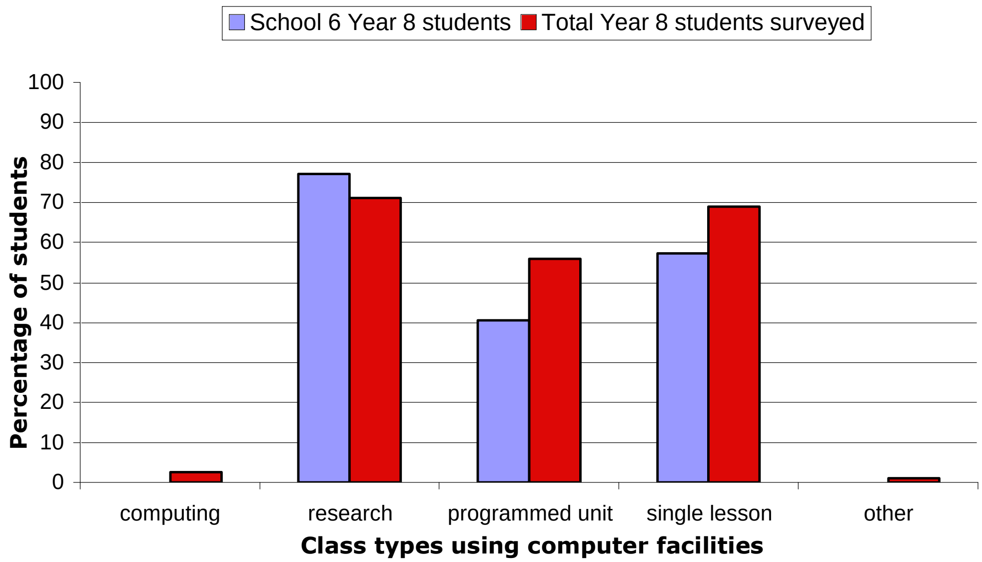


Figure 6.9: Computer use by class activity for year 8

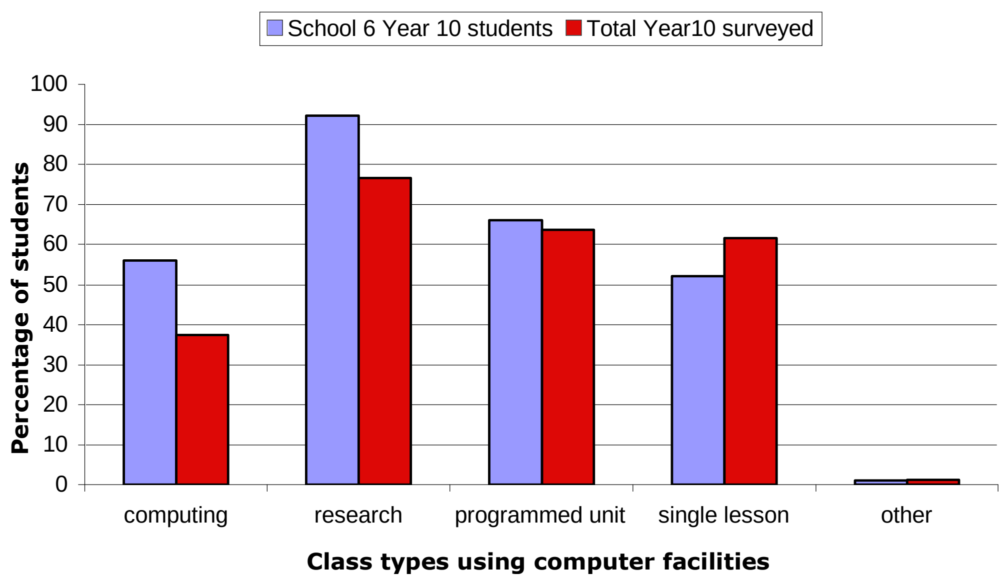


Figure 6.10: Computer use by class activity for year 10

Some of the work carried out in the library, for research, may be instead of occasional single lessons using compute facilities in one of the laboratories. The number of year 10 students in computing classes is slightly higher and this may be due to the emphasis placed on the subject given the school's resources.

The use of applications housed on the school computers was also recorded in each year level, seen in Figures 6.11 and 6.12. The applications most commonly used were Internet searching and word processing/spreadsheet for both years. Compared to the total sample of year 10 students, there was greater use of databases, software design applications and email projects. The higher use of these applications may be due to a school technology focus through specific curriculum areas in year 10. Another notable usage pattern was the lower use of powerpoint in both years compared to the total number of students. This may indicate a departure from a common practice of using powerpoint as a technology focus (Tufte, 2003). The school has either decided to use other applications for students to present their work as part of its technology strategy or it may simply mean that the school has decided not to focus on this application.

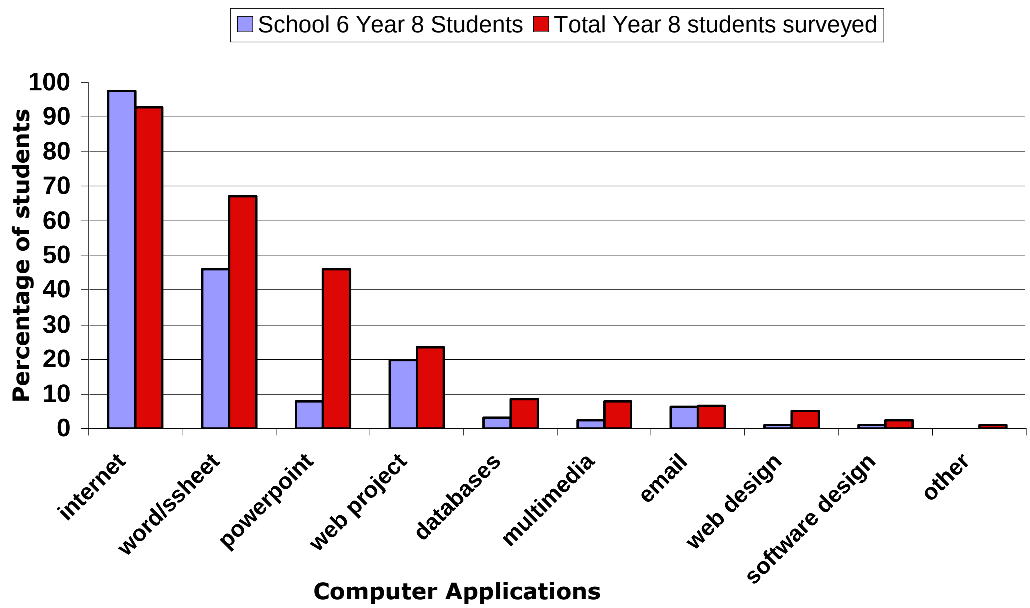


Figure 6.11: Year 8 school computer applications use

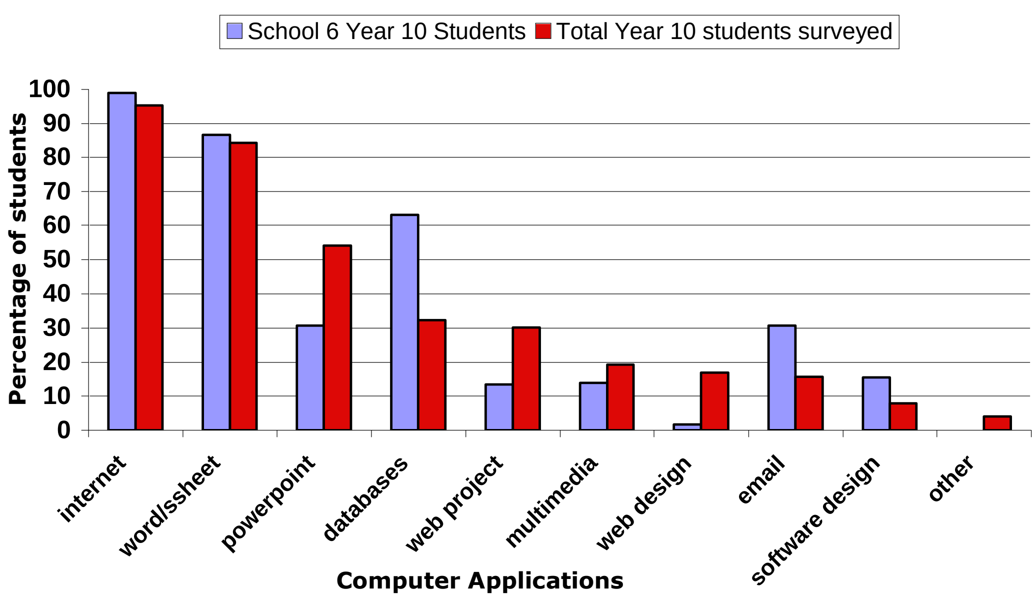


Figure 6.12: Year 10 school computer applications use

The use of computers in the school was not recorded by the majority of students as having a positive effect on their learning. However, approximately 10% of the students surveyed did indicate a positive effect on their learning in the areas of English, Science, Human Society in its Environment and Technological and Applied Studies. Whilst the numbers are low, this belief may reflect some of the different uses of technology recorded in the students' use of computers.

6.3.3 Relationships with variables in the student model

With a movement towards a diverse learning structure in computer applications at the school, it is surprising that the evidence is not reflected in the student models. The multiple regression analyses indicated that the model (see Figure 6.13) with Online Usefulness as the dependent variable explained 25% of the variance. The standardised beta coefficient confirms Relevance as the primary contributor, with Relevance and Positive Learning being significant with p=.000 and .002 respectively. This is one of the smallest amounts of student variance explained for Online Usefulness in the ten case study schools. It may reflect the students' practice and opinion about internet usage at the school, compared to their accustomed internet practice.

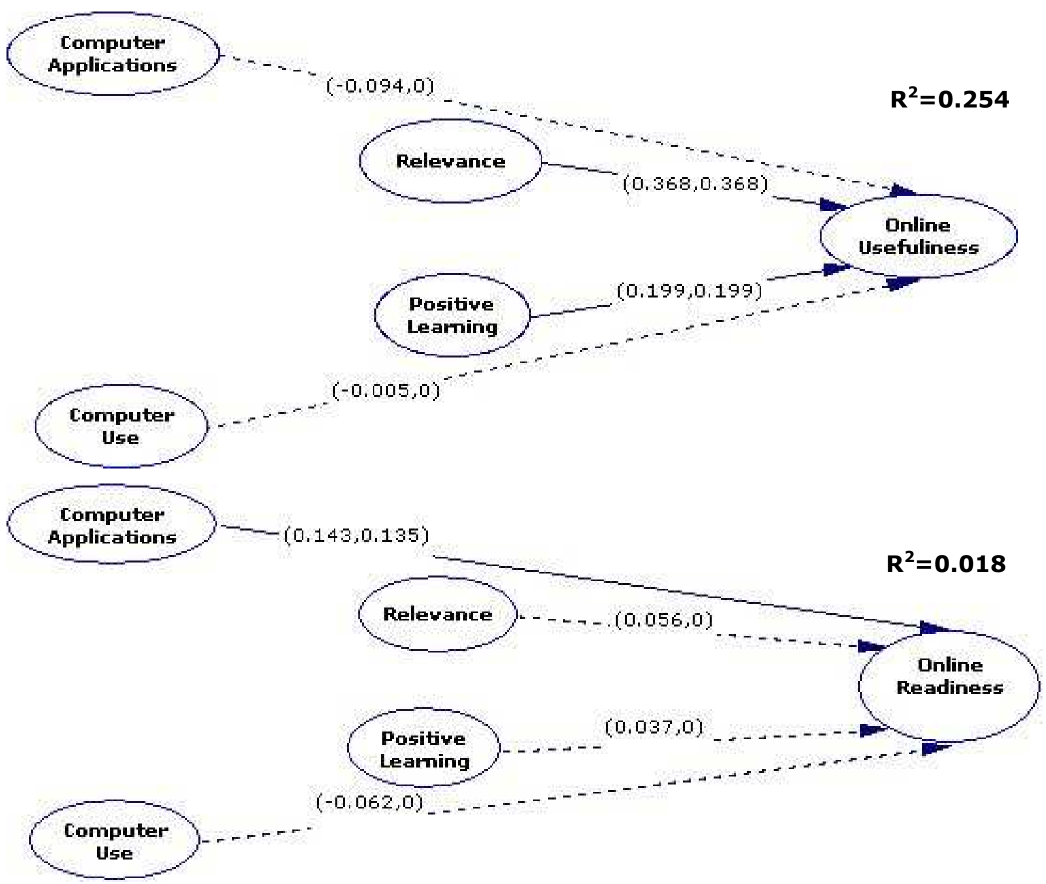


Figure 6.13: Path diagrams for students at School 6 showing relationships with Online Usefulness and Online Readiness

Only 1.8% of the variance for the model with Online Readiness as the dependent variable is explained by the independent variable Computer Applications. The lack of a substantial relationship in itself endorses a trend for students to be operating in an online environment rather than waiting for it.

6.3.4 General Description-Teachers

From a total of 85 teaching staff, 10 teachers (11.7%) accepted the invitation to participate in the survey. This was the smallest sample of teachers participating and may reflect the timing of the conduct of this questionnaire in relation to the school's calendar. The junior secondary school were in an examination period and the senior school had major excursions at this time. Both events would have taxed staff resources leaving little time for other activities. The proportion of males to females on staff is approximately equal, however, seven males and three females participated. These teachers were drawn from the key learning areas of Science (3 teachers), Human Society in its Environment (2 teachers), Technological and Applied Studies (4 teachers) and Creative Arts (1 teacher). This was the only school where the English and Mathematics Faculties were not represented. The time employed at the school for the participating teachers was; 1-5 years (6 teachers), 6-10 years (2 teachers), 11-20 years (1 teacher) and 21-30 years (1 teacher). These employment levels are compared to the overall experience levels shown in Table 6.5.

Table 6.5: Total years of Teacher Experience for Participating Teachers in School 6

Years of Teacher Experience	Number of Teachers
1 – 5	3
6 – 10	3
11 – 20	1
21 - 30	3

Whilst this teacher sample was small, the data indicate some experienced teachers are relatively new to the school and may not have received appropriate curriculum induction. The possibility that these teachers have their induction waived because of their experience highlights a possible flaw in school induction/mentoring programs. Part of the induction/mentoring program would no doubt include technology and these teachers are the ones who experience the greatest anxiety in the use of technology (Goddard, 2002), whether or not they have their own computers. All the teachers had a computer at home and all but one was connected to the Internet.

The small sample from this school considered themselves totally proficient in the application of word processing and most proficient in the use of spreadsheets, databases and powerpoint. As in other schools, there were two distinct skill groups in the use of the other applications. Half the group indicated they had not used the applications whereas the rest of the teacher group ranged in their competence level, this dichotomy can be seen in Figure 6.13. Whilst the small size of the sample may hinder a complete picture of this staff's computer skills, there are some comparisons that can be drawn with the student use of computers. The reversing trend of powerpoint use, the increase in database use and software design use in year 10, evidenced in Figures 6.11 and 6.12, all indicate a movement towards a more diverse use of technology. The pattern of student use alludes to a different technology focus in this school and designates some of the teacher application skills as representative of the whole staff with their impact on the year 8 and 10 classes.

The same pattern is evident when teachers were asked to indicate which applications had a positive effect on learning. There was total agreement that web searching did have a positive effect but in all other categories the teacher opinion was divided. A large proportion of teachers recorded that spreadsheets, databases and presentation software did have a positive effect in their use. A similar proportion of teachers indicated that using web pages, multimedia, email projects and desktop publishing did not have any positive effect on learning.

6.3.5 Relationships between variables in the teacher model

The results indicated significant correlations between a number of variables for the small number of teachers surveyed. In Table 6.5 the highly significant correlations are indicated with a double asterisk and significant relationships with a single asterisk. The relationships establish a pattern amongst the schools of some teachers who are using technology to modify the delivery of curriculum (Cox et al., 2006). This pattern is also consistent with other survey schools. The strongest relationships are identified between Relevance and Computer Applications ($p=.001$) and Relevance and Online Usefulness ($p=.008$). Medium relationships are identified between Online Usefulness and Computer Applications ($p=.012$), Positive Learning ($p=.037$) and Online Readiness ($p=.029$). A medium relationship is also identified between Online Readiness and Positive Learning ($p=.023$).

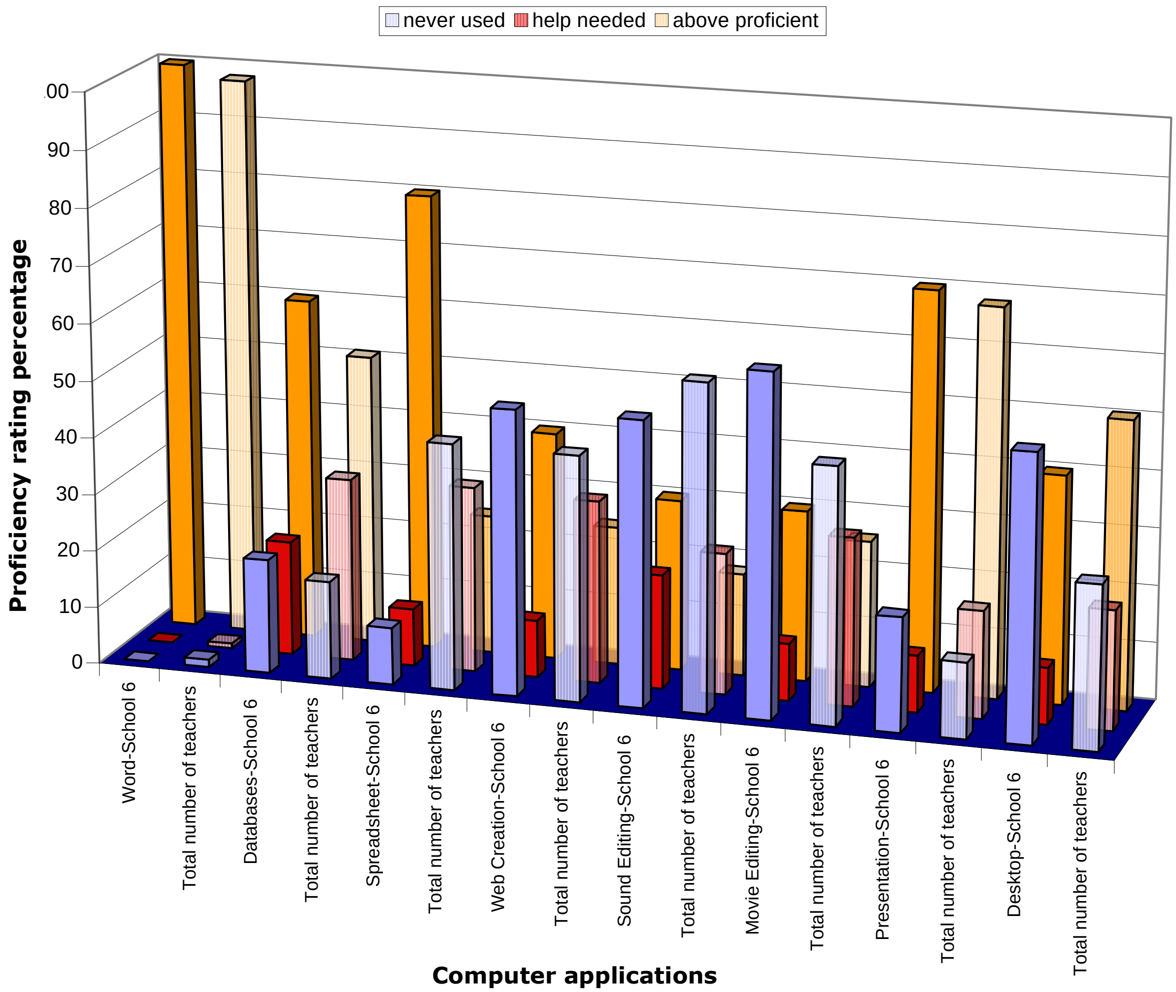


Figure 6.13: School 6 teacher proficiency rating compared to the total teacher sample

Table 6.5: Correlations showing relationships between the independent variables for teachers in School 6					
School 6	**N**	**Use**	**Application**	**Relevance**	**Positive**
Application	10	.394			
Relevance	10	.499	.876(**)		
Positive	10	.374	.462	.453	
Readiness	10	.343	.171	.298	.704(*)
Usefulness	10	.440	.752(*)	.776(**)	.663(*)

The unique relationship established between the dependent and independent variables for this school does demonstrate that some teachers see a connection between aspects of learning and Online Usefulness. The correlations together with the teacher self proficiency ratings demonstrate that a small group of the teachers surveyed for this school place some importance on using technology in the curriculum. This view is supported by school application use, indicated by the students, demonstrating that only a small number of classes showed evidence of technology integration in the years surveyed.

6.3.6 eFactor for School 6

The number of postings on the learning-related section of the school's web page indicates that a small percentage of the teachers were using this learning avenue. There were 17 postings in 2005 and this increased to 30 in 2006. The number of postings, together with the weightings, places this school in the lowest eFactor group with an eFactor score of 0.9. However, the highest number of postings in the variable interactive category was recorded in this school. As the variable interactive category attracts the highest weighting, it confirms just how few teachers were posting material on the school web pages. The low questionnaire response rate by teachers may also be indicative of a generally low level of interest in computer technology by staff. The relatively high number of postings in this category also indicates the strong motivation by a small group of teachers identified in 6.3.5 to integrate technology for the purpose of engaging learning.

6.3.7 Summary School 6

This school has the most computer laboratories for any school in the survey. The attention to resourcing the school in this area by the current principal illustrates a vision about the use technology in learning. However, in the interview the principal focused on the need for teachers to develop skill with technology applications and this was to be rolled out in a staged process. The principal was also convinced that the technology-infused learning would be evident in the statewide ICT literacy test which focuses mainly on skills rather than applications to learning.

There is some evidence that the principal's vision is being articulated in some of the perceptions and practices amongst the school teachers as well as the some of the application use by the students. Further in the interview, the principal did state that there was a need for the teachers to understand the purpose of technology integration but it seems apparent that this integration is very much linked to a skills development. It is quite possible that a process of understanding about integrating learning and technology is underway and once teachers have acquired certain skill levels in computer applications, it will be reflected in classroom practice.

6.4 School 7

6.4.1 General Description

School 7 is a medium to large metropolitan single sex school for girls with a total enrolment of over 800 students. The school, opened in the early 1990s, is a result of the amalgamation of two smaller schools and the increasing demand for senior secondary education. Despite the amalgamation, there is strong support for the school from the ex-students of the amalgamated schools and, with its regional status as a single sex school, enrolments are strong. The school delivers a secondary curriculum for years 7 through to year 12 and is operated by the Catholic Education Office.

The school is situated over two blocks, fronted by major roads, in a busy suburban area. The school shares one of the blocks with a church and there is off-street parking for the teaching staff owing to the lack of street parking. The recreation areas are a mixture of grass and concrete and there are sports ovals for the students. There are currently plans to substantially refurbish the school site by modernising the creative arts and hospitality areas and create learning spaces that facilitate interactive group learning. The plans also include wireless access to all areas of the school campus. The plans for new buildings and infrastructure represent a tangible intent on the part of the principal to move the learning at the school into the modern era. The principal's view is that a major impediment to the adoption of technology into the learning framework is the antiquated learning spaces and the aging computer infrastructure.

The school currently has four computer laboratories with 24 computers in each. These computers are placed around the walls of the rooms and there is a traditional learning space, with desks facing the front, in two of the rooms. The other two rooms, designed for group work, have tables in the middle of the room. Each laboratory has a printer and the machines are all networked with the data stored in a central curriculum server. There are also three multi-purpose rooms with nine computers and one printer in each. The rooms are configured to be flexible to the learning needs of the particular subject in any given lesson. The library can also be used as a computer laboratory where machines are connected to the school network and are set up in one area of the library which also has a printer and scanner. Only one of the laboratories has a data projector mounted but there are several mobile data projectors available from the library. The age of the computers varied from one to five years. The principal has been waiting for the new buildings to be completed before the older machines are replaced.

6.4.2 General Description-Students

A distinguishing feature of this school is the diverse cultural heritage of the student population. Approximately 66% of the students have been identified as having a Language Background other than English and 1% were identified as indigenous students. In years 8 and 10 there was a total of 279 students and 195 students (70%), made up of 106 year 8 students and 89 year 10 students, accepted the invitation to participate in the survey. Due to an administration oversight, a class excursion was scheduled for the nominated day of the survey and 28 year 10 students were unavailable for the survey.

There was only one student who indicated not having access to a computer away from school with the remaining student access described in Table 6.6.

Table 6.6: Student use of away from school computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	94	97
Able to access the Internet	91	93
Used for school work at least half the allocated time	84	99

The use of *the away from school computer* was unrestricted for most students. A greater percentage of year 10 student use was for school purposes and, as with year 10s from most schools, the higher use of the computer for school purposes may be a consequence of school assessment pressures. The most commonly-used applications on the computers by both years were Internet, word/spreadsheet and multimedia. The full comparison to the overall student sample can be seen in Figure 6.14. It shows that the use of games and databases by students at this school are below that of the total student sample. The students from this school have preferred to direct their computer use more towards an essential outcome (Margolis & Fisher, 2003), rather than on the recreational activity that computer games offer.

School computer use was different in the year levels and different from the overall trend. Notable for year 8 was the lower use of the computer for research. However, there is a higher instance of single lesson use by year 8 classes of the computer facilities seen in Figure 6.15. There is also a slightly higher use of computer facilities by various subjects for the teaching of some integrated topics. The greater use in computer, library research and integrated unit classes in year 10, seen in Figure 6.16, suggests there is a strategic use of computing facilities. It would appear that there is a specific use of computers in topic instruction for year 8 but a wider use of computers in year 10.

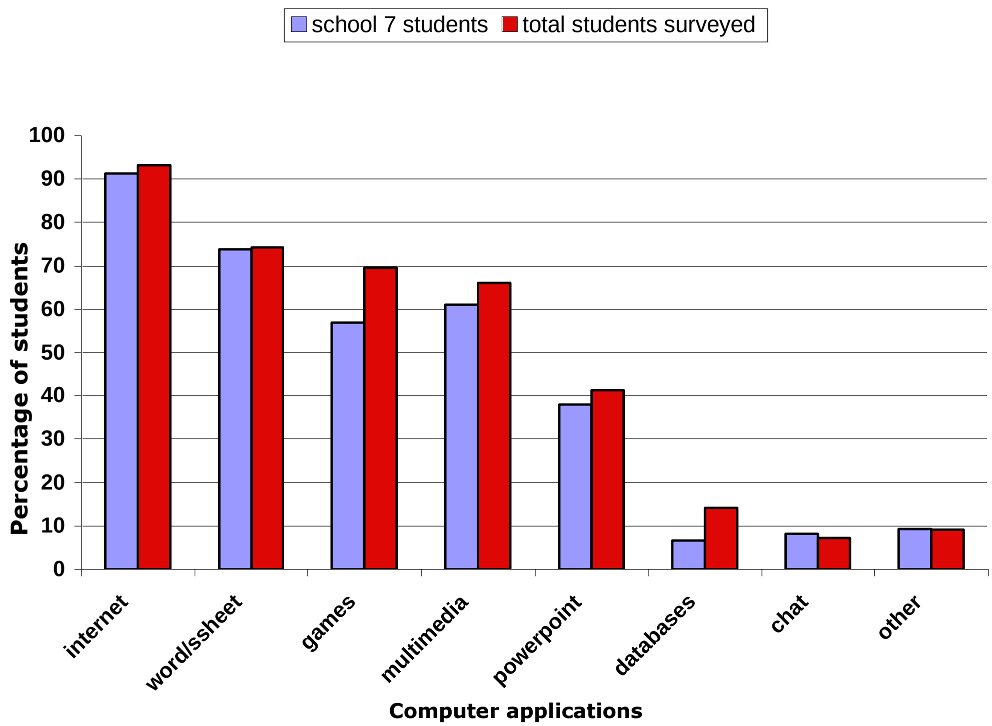


Figure 6.14: Comparison of school 7 students to the total number of students surveyed in the use of computers away from school

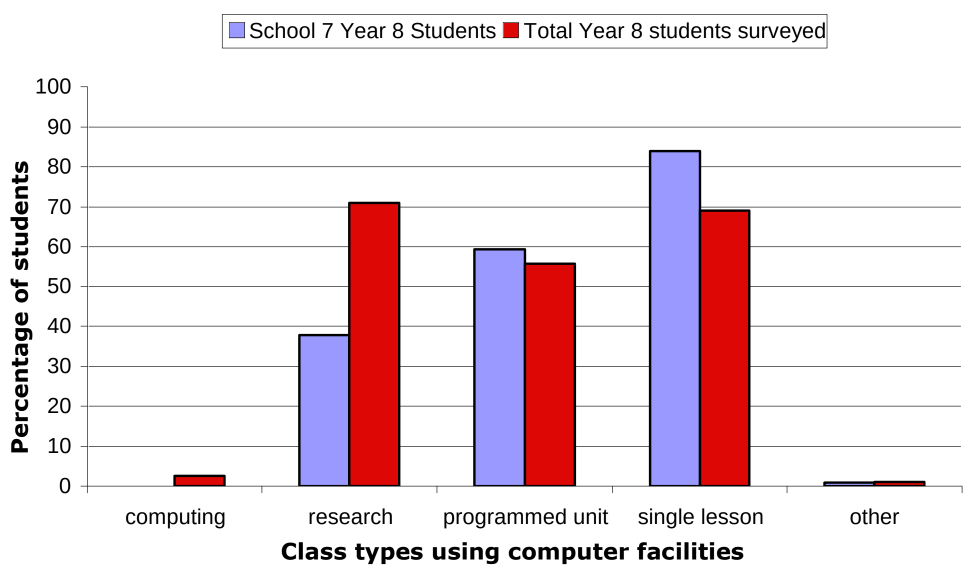


Figure 6.15: Computer use by class activity for Year 8

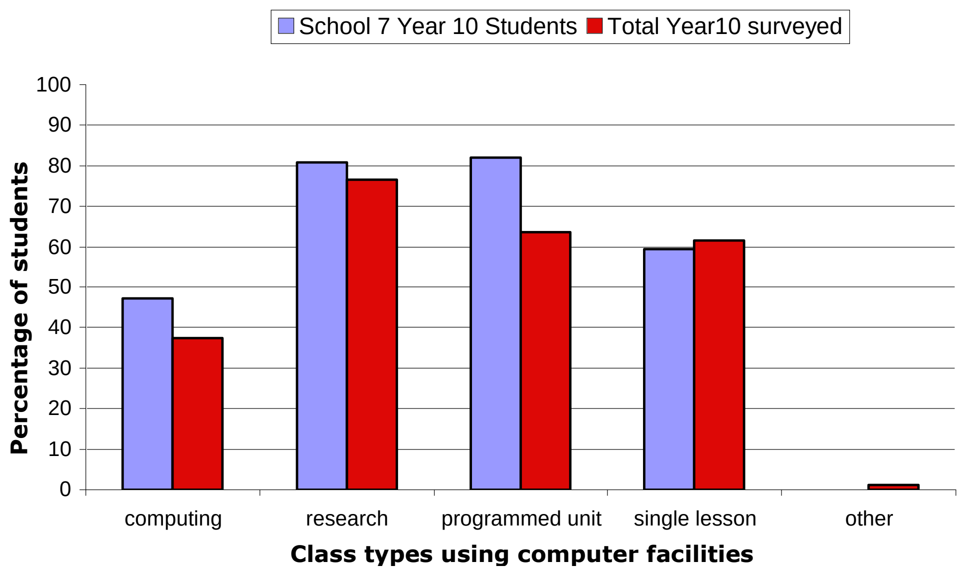


Figure 6.16: Computer use by class activity for Year 10

Consistent with other schools in the study, word processing and Internet use are the most popular applications in school use for both years, seen in Figures 6.17 and 6.18. The higher level of application use for some computer software by year 10 students also fits in with the higher level of programmed unit work in year 10 (see Figure 6.16).

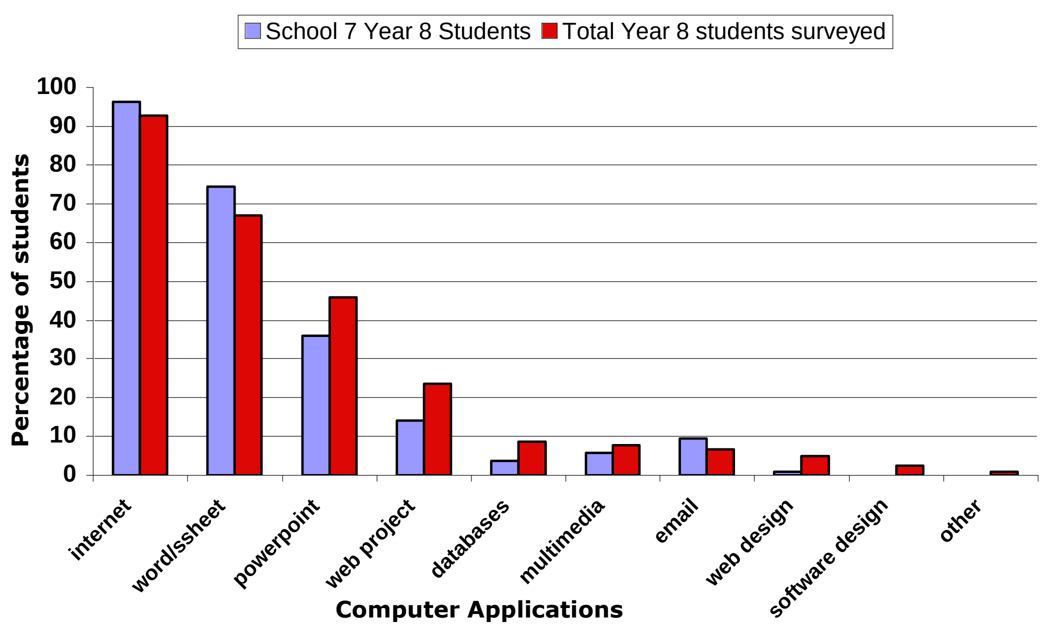


Figure 6.17: Year 8 school computer applications use

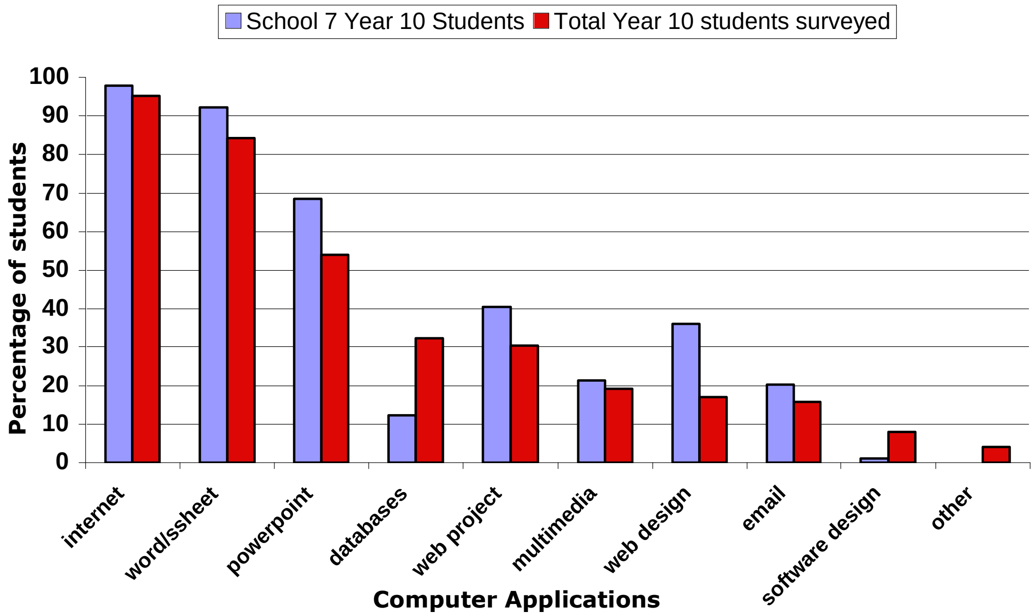


Figure 6.18: Year 10 school computer applications use

The use of applications by year 8 was less than that of the overall sample but year 10 use was greater in the areas of web projects, powerpoint and web design. The interview with the principal highlighted the demand by teachers to gain access to the computer laboratories to use specific programs. There appears to be some priority given to the older students and they may have preferential access to the sparse computer facilities though this is not stated anywhere in the school documentation.

In keeping with the overall trend, the majority of students from this school did not indicate that there was a positive benefit of using the computers in any of their subjects. Approximately 20 students in each year, however, did record a positive benefit from using computers in the subject areas of English, Human Society in its Environment and Technological and Applied Studies. The students' comments did not reflect the principal's observation that there were specialist computer programs in Mathematics and Science.

6.4.3 Relationships between variables for the student model

For this school the relationships established between the dependent variables of Online Usefulness and Online Readiness and the independent variables are consistent with the overall student model. The contribution of the independent variables Relevance and Positive Learning to the dependent variable Online Usefulness explained 38.7% of the variance, seen in Figure 6.19.

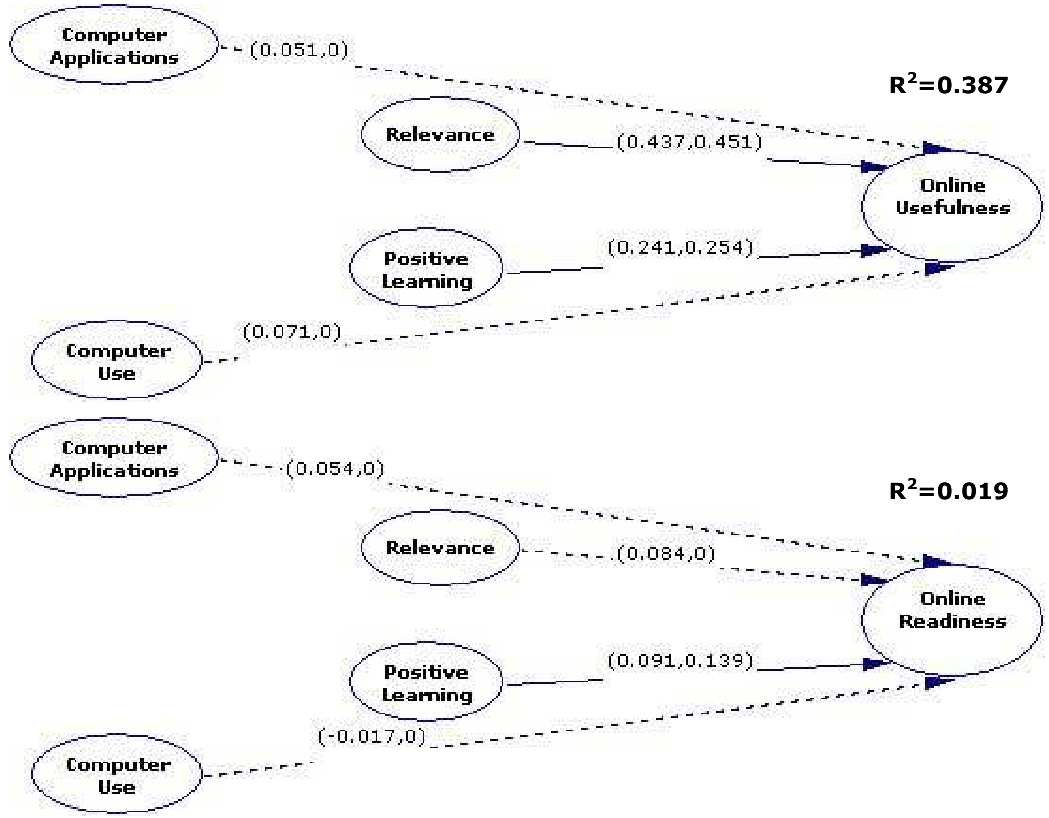


Figure 6.19: Path diagrams for students at School 7 showing relationships with Online Usefulness and Online Readiness

Both Relevance and Positive Learning are highly significant, with p=.000, in their contribution to Online Usefulness in the model for this school. The standardised beta coefficient identified Relevance as the primary contributor, confirming students' overall interaction and engagement with the computer away from and at school. Positive learning takes a secondary role and is perhaps influenced by the poor computer facilities the students currently experience. The facilities may also be responsible for the few comments from the students regarding the positive use of computers in subject areas (see Appendix 12).

For the model with Online Readiness as the dependent variable the contribution of the independent variable Positive Learning was significant. However, with only 1.9% of the variance explained, a strong relationship cannot be established between Online Readiness and the independent variables. This finding reflects the research stating that students are finding ways to interact online rather than waiting to be ready for it (Dutton, 1996; Hedberg 2002).

6.4.4 General Description - Teachers

There are 65 teaching staff in all at this school and 22 teachers (34%) accepted the invitation to participate in the survey. The proportion of female to male teachers at the school is 3:2 and in this survey 15 females and 7 males participated. So whilst there is a greater percentage of female teachers an even greater percentage participated which is in accord with the overall teacher participation pattern for this study. These teachers were drawn from the key learning areas of English (1 teacher), Mathematics (7 teachers), Science (2 teachers), Human Society in its Environment (6 teachers), Creative Arts (3 teachers), Physical Education (2 teachers) and Languages (1 teacher). This school had one of the highest representations from the Mathematics area and a notable absence of any teacher from the Technological and Applied Studies where computer studies are taught. The school tenure of the participating teachers was recorded at levels of 1-5 years (12 teachers), 6-10 years (6 teachers) and in the 11-20 years (4 teachers). These employment levels are compared to the overall experience levels shown in Table 6.7.

Table 6.7: Total Years of Teacher Experience for Participating Teachers in School 7

Years of Teacher Experience	Number of Teachers
1 – 5	5
6 – 10	5
11 – 20	7
21 – 30	3
31 - 45	2

These data suggest a recent movement of experienced teachers to this school. Perhaps the intended refurbishment of the school has attracted these people to work at the school. The presence of a relatively high proportion of more experienced teachers also helps to explain teachers' reticence in using the technology. Current research suggests that the age of the teacher does influence their motivation to use technology in the classroom, (U.S. Dept of Education; 1999, Hung & Hsu, 2007). All teachers indicated that they had a computer at home with three of them not connected to the Internet. The computer applications which the teachers considered themselves at least proficient were word processing, spreadsheets, desktop publishing and presentation software. The teacher proficiency claimed for spreadsheets and databases was above that of the total teaching sample and can be seen in Figure 6.20. There was also a higher level of proficiency in movie editing compared with the total sample and this may be a result of an initiative in a particular subject area.

The teacher indication of which computer applications stimulated learning follows two established patterns. There is an overwhelming confidence that the use of web searching, presentation software and word processing stimulates learning and this will be in part attributed to the teacher skill with these applications.

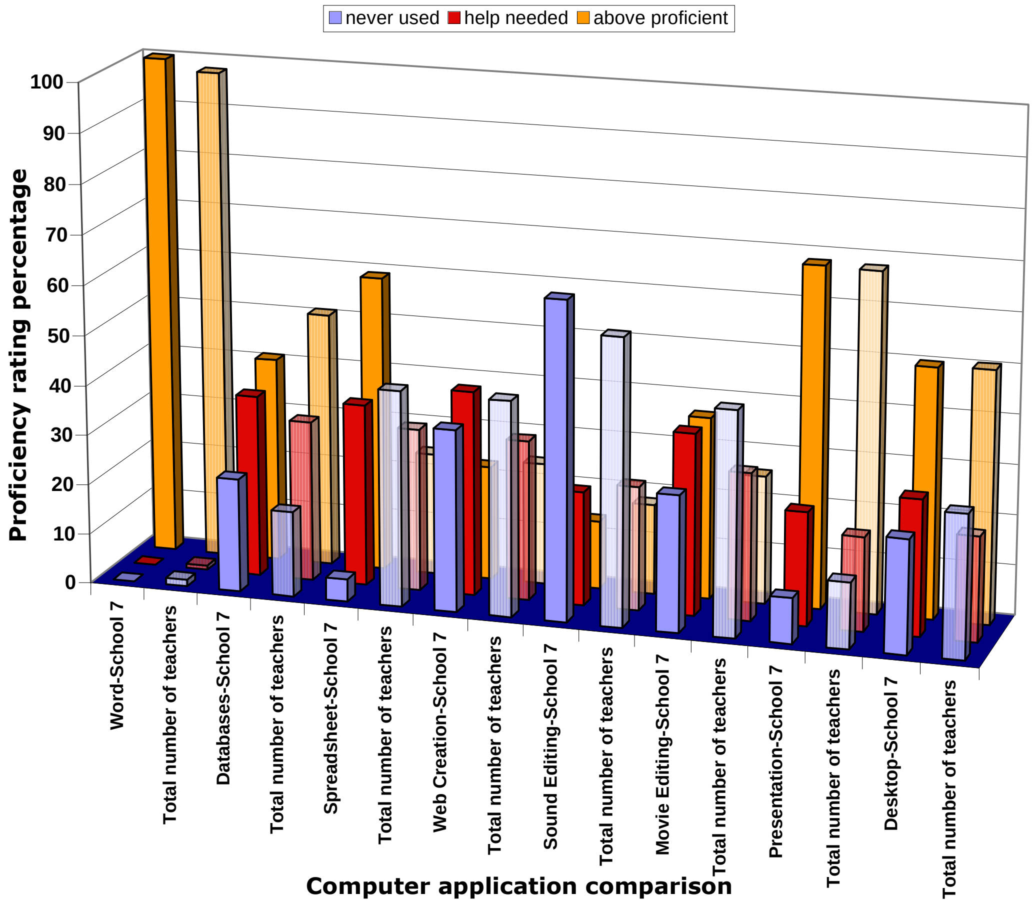


Figure 6.20: School 7 teacher proficiency rating compared to the total teacher sample

The second established trend is the approximately equal split in opinion of the participating teachers. For the applications of web pages, multimedia, movie and photo editing, desktop publishing, email projects and email feedback, the teachers were polarised in their opinion with the smaller group favouring the applications for student use. Some of the application use is reflected in Figure 6.18 with the reported year 10 use of computer application. These teachers are also identified by the principal as those who push the technology agenda by wanting more software and computer use.

6.4.5 Relationships between variables for the teacher model

It is estimated that the interplay between the two teacher groups identified in the use of computer applications to stimulate learning as well as some of the skill sets will influence the predictive importance of the independent variables. A relationship could not be established between the independent variables and the dependent variable Online Usefulness. The sole relationship was established between the independent variable of Relevance and the dependent variable of Online Readiness, seen in Figure 6.21.

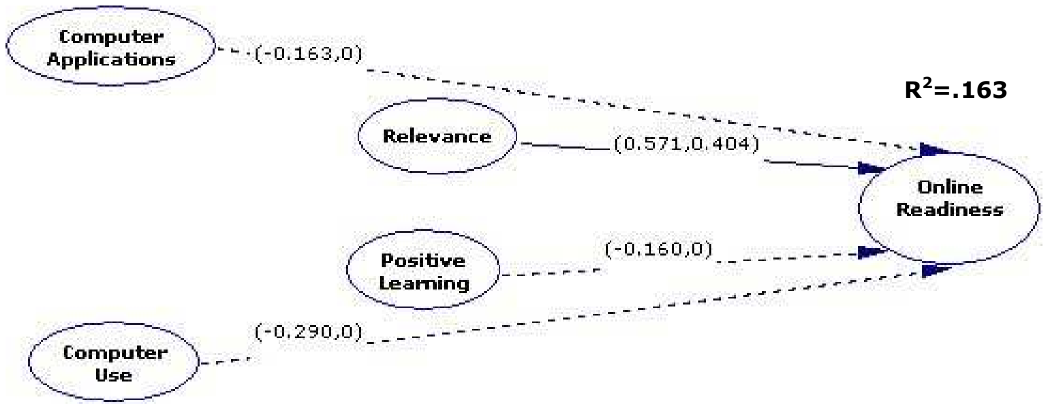


Figure 6.21: Path diagrams for teachers at school 7 showing relationships with Online Usefulness and Online Readiness

However, when the non-significant independent variables were removed from the model the significance of Relevance was just outside the .05 level, with p = .062. The fact that teacher opinion was split about the importance of using various computer applications in the classroom as well as the current state of the computer facilities may have influenced this outcome.

6.4.6 eFactor for School 7

This school had the lowest eFactor (0.3) of the 10 schools. The number of postings on the school's learning section was 4 in 2005 and rose to 16 in 2006. Despite some teachers using the opportunity to post some 'dependent' learning material and other teachers experimenting with integrating web postings into the learning framework of the classroom, this facet of learning delivery is still in its infancy. The small number of teachers involved with the postings suggests that this type of learning delivery is not a high priority for the staff at the time of the data collection. The principal alluded to insufficient bandwidth and poor infrastructure that would be remedied with the school refurbishment and that has perhaps delayed or impeded teachers in posting material to the school's learning site.

6.4.7 Summary School 7

The data suggest that there are contrasts in this school between a traditional learning structure and one that is embracing computer technology. There are contrasts in the amount of application use from year 8 to year 10, evident in Figures 6.17 and 6.18. In particular the use of web design applications and web projects by year 10 was greater than for the total student sample and the interests of one or more teachers may be responsible for this. The difference in application uses also highlights the varying opinion amongst the staff about the learning significance of the software and points to a potential change in the learning landscape of the school. The principal spoke of some teachers who were eager to embrace the technology whilst there were others who would distance themselves or avoid it altogether. Teachers who wanted to use the technology were encouraged but these projects operated in a haphazard manner. The principal also spoke of the skills and attributes of the students in using the technology to complete their assessments to a degree beyond expectation.

There is also the issue of the school placing strategic technology development on hold whilst waiting for the major refurbishment to finish. The observed impact on the technology integration was that it lacked a design for implementation. There was a definite undercurrent in the interview with the principal that the new network would solve many of the issues that the school was currently experiencing. Much of the school focus about integrating technology into the curriculum was postponed until the new facilities were in place because it was thought that an inadequate infrastructure would only serve to heighten teacher frustration.

6.5 School 8

6.5.1 General Description

School 8 is a medium sized metropolitan single sex school for boys with a total enrolment of over 700 students. The school, owned by the Sydney Archdiocese and operated by a religious teaching order of Brothers, has a secondary curriculum for years 7 through to year 12. Because of its unique position, the school has a long history and the ex-student allegiance is strong. It also acts a senior regional high school to several year 7 to 10 schools in the metropolitan area. Owing to these factors, the enrolments at the school are strong despite there being the options of several independent and well-regarded government high schools in the area.

The school is situated on a block with a large church, primary school and residential areas for the religious community. The school offers specialist areas in Computer Aided Design, Industrial Arts, Music and Visual Arts. Space is restricted in the school and whilst this facilitates easy movement between the classrooms it necessitates going off site to nearby playing fields for physical education, sport and active recreation.

The school has three computer laboratories with 28 computers, a printer and a scanner in each. All the hardware is networked and the data are stored in a central curriculum server. Two of the laboratories have a data projector and the third laboratory has an active plasma display. The age of the computers varies from one to three years, with the aim to replace the computers in their fourth year. There are also two multi-purpose rooms with a total of 34 computers all residing on the same computer network. Some of the computers are laptops and the intent is to equip the multi-purpose room with the required number of computers for the class so the laptops can be moved between the rooms. The computers in these rooms reside on the same network as the other computers and the data are stored on the same curriculum server. The configuration of all five rooms has the computers around the walls but the tables for the multi purpose rooms are designed to be moved to suit the needs of the particular classes. The library too can be used as a computer laboratory with a total of 38 computers, two data projectors and a printer all on the same network as previously described. Every other classroom in the school has four data outlets that a laptop can be plugged into for access to the curriculum server. There are currently four laptops that can be used by the teachers for this purpose.

6.5.2 General Description-Students

Due to its diverse drawing area, the ethnicity of the school population is more variable from year to year than the other schools in the case study. In the 2004 enrolment, 30% of the students were identified from a Language background other than English and less than 1% from an indigenous background. In years 8 and 10 there was a total of over 230 students and 203 students (88%) from year 8 and year 10 accepted the invitation to participate in the survey. Only two students, one from each year, indicated they did not have access to a computer away from school with the remaining students' access described in Table 6.8.

Table 6.8: Student use of away from school computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	95	96
Able to access the Internet	91	90
Used for school work at least half the allocated time	50	50

The majority of the year 8 and year 10 students were able to use *the away from school computer* either all or most of the time and all but 19 of these computers were connected to the Internet. The use of these computers for school purposes was the lowest of all schools in the study. The most popular applications used on these computers were Internet Use, games, word/spreadsheet and multimedia. The usage of games, databases, powerpoint and multimedia were higher than the overall student sample and can be seen in Figure 6.22.

The school use of the computer in the various class categories showed some differences to the overall usage pattern for the student sample and can be seen in

Figures 6.23 and 6.24. By comparison with the total student sample, there was a greater use by year 8 of the library computer facilities and a greater number of year 10 students in computer classes.

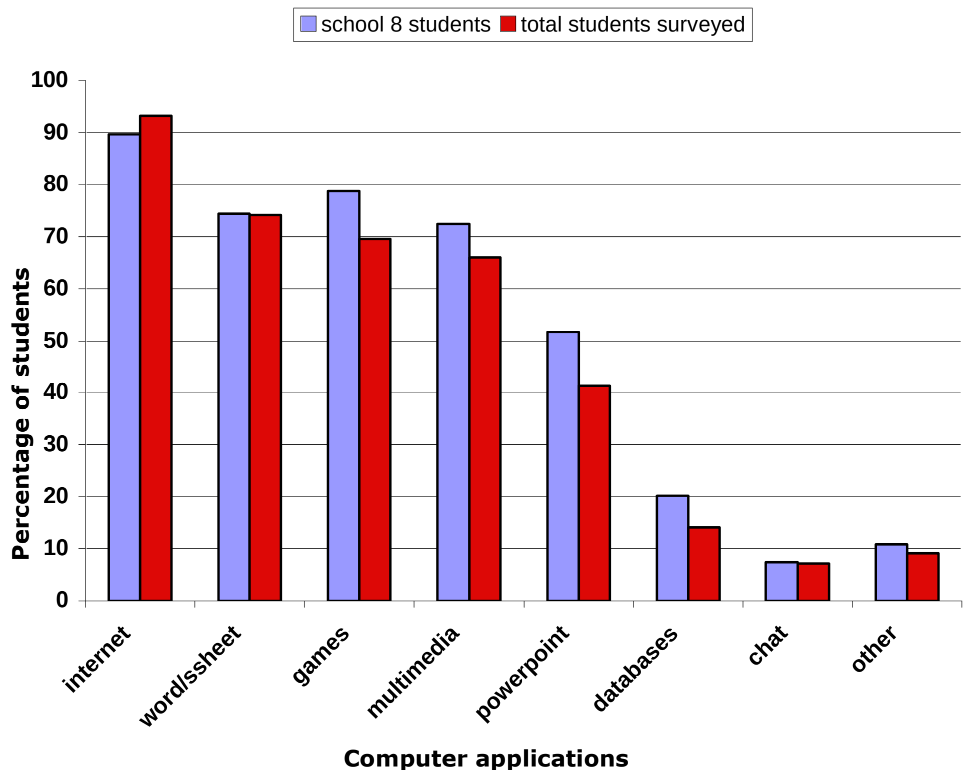


Figure 6.22: Comparison of school 8 students to the total number of students surveyed in the use of computers away from school

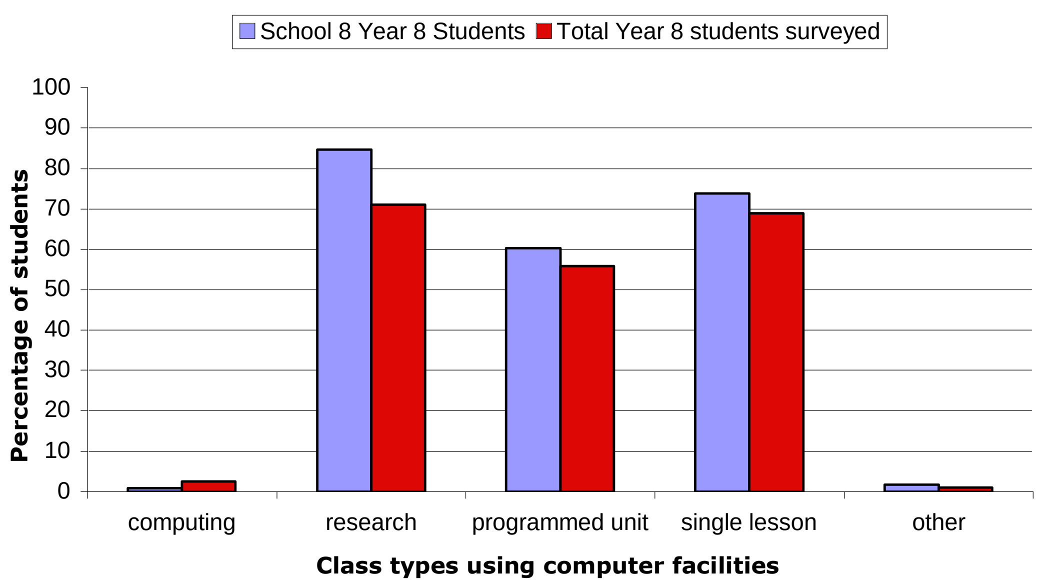


Figure 6.23: Computer use by class activity for year 8

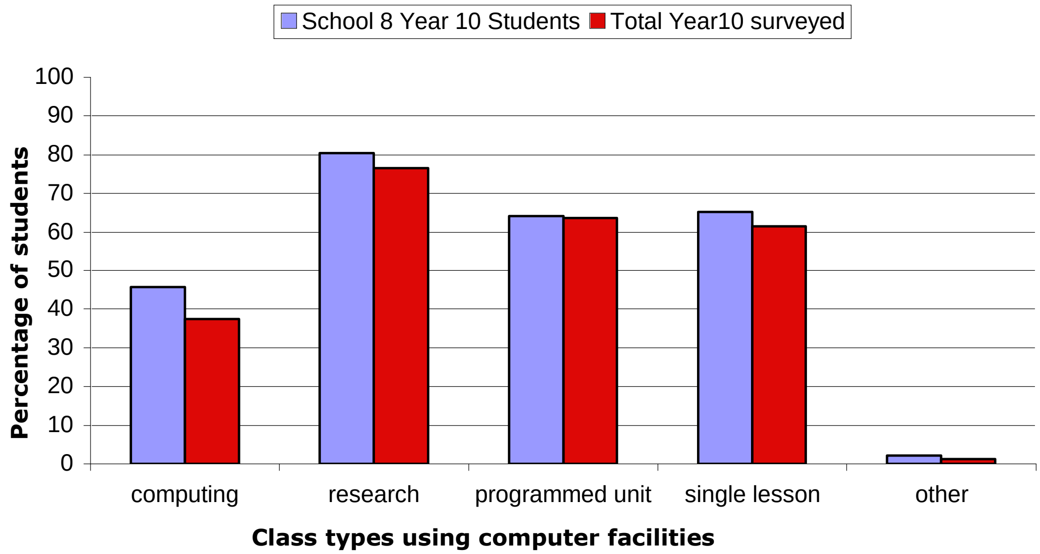


Figure 6.24: Computer use by class activity for year 10

Slight increases were also observed in the other and single lesson categories for both years. With the amount of computer facilities available, teachers may be taking advantage of the access available to them and using the technology to underpin the learning process.

The greater use of computer facilities is also supported by the higher use of some computer applications, particularly in year 10, compared with the overall student sample. Both years show a greater use of powerpoint and web projects and year 10 shows a higher use of software design, web design and multimedia. This pattern of application use may reflect particular historical strategies in boys' education and the use of computers to engage them as implied by Sanders, Koch & Urso (1997). The full comparison of School 8 to the total student sample can be seen in Figures 6.25 and 6.26.

In translating this application use to student perception of a positive impact on the subject, this school's finding was the same as the general trend with the majority of students recording no impact. Two subjects with the highest minority recording a positive impact were Human Society in its Environment and Technological and Applied Studies. Some of the application use may be attributable to these two subjects, particularly in year 10, as it is an assessment year and the use of computer applications would be seen as enhancing the assessment.

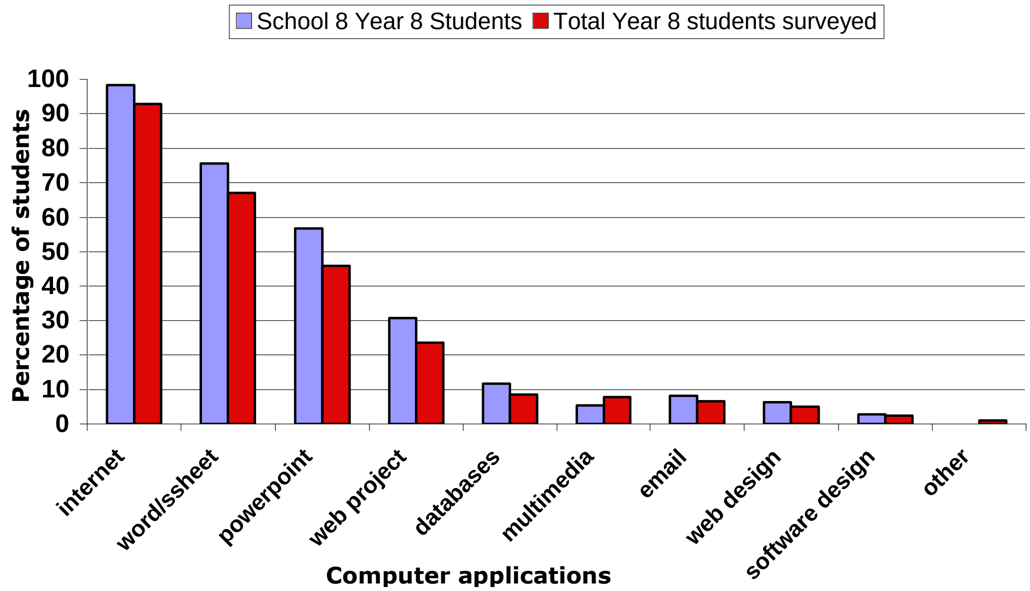


Figure 6.25: Year 8 school computer use

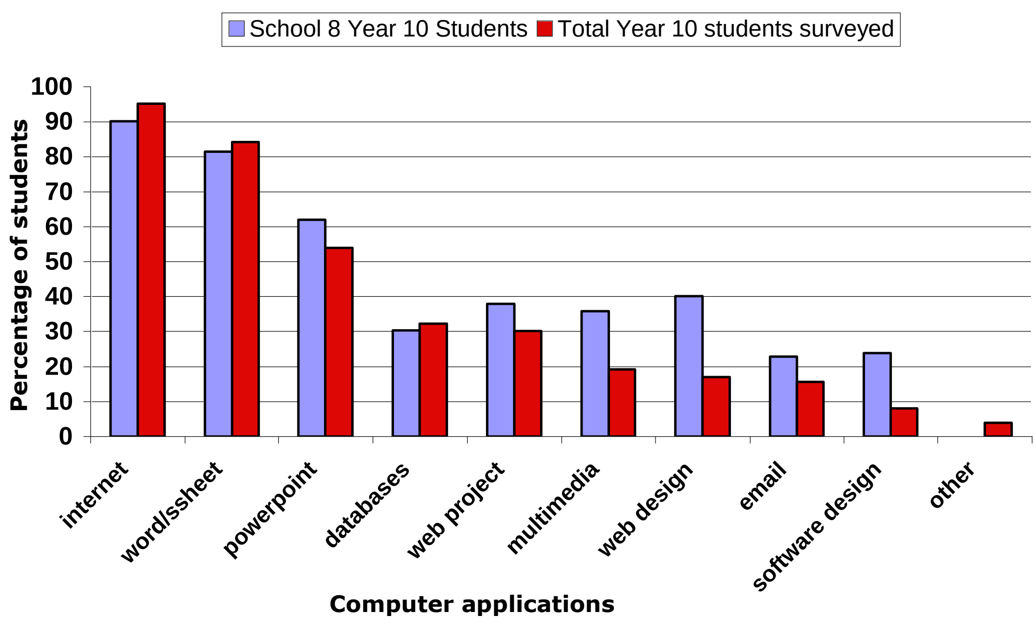


Figure 6.26: Year 10 school computer use

6.5.3 Relationship between variables for the student model

A strong relationship, with 44.9% of the variance explained, was established between the independent variables of Computer Use, Relevance and Positive Learning and the dependent variable of Online Usefulness (Figure 6.27). The standarised Beta coefficient shows that Positive Learning makes the primary contribution to Online Usefulness, although Relevance is almost as strong. Both

Positive Learning and Relevance are significant contributions with p=.000 and Computer use is significant with p=.018 (Appendix 12).

The model with Online Readiness as the dependent variable was the strongest of all four schools in the low eFactor group. However, with only 6.5% of the variance explained by the independent variable Positive Learning, a strong relationship could not be established.

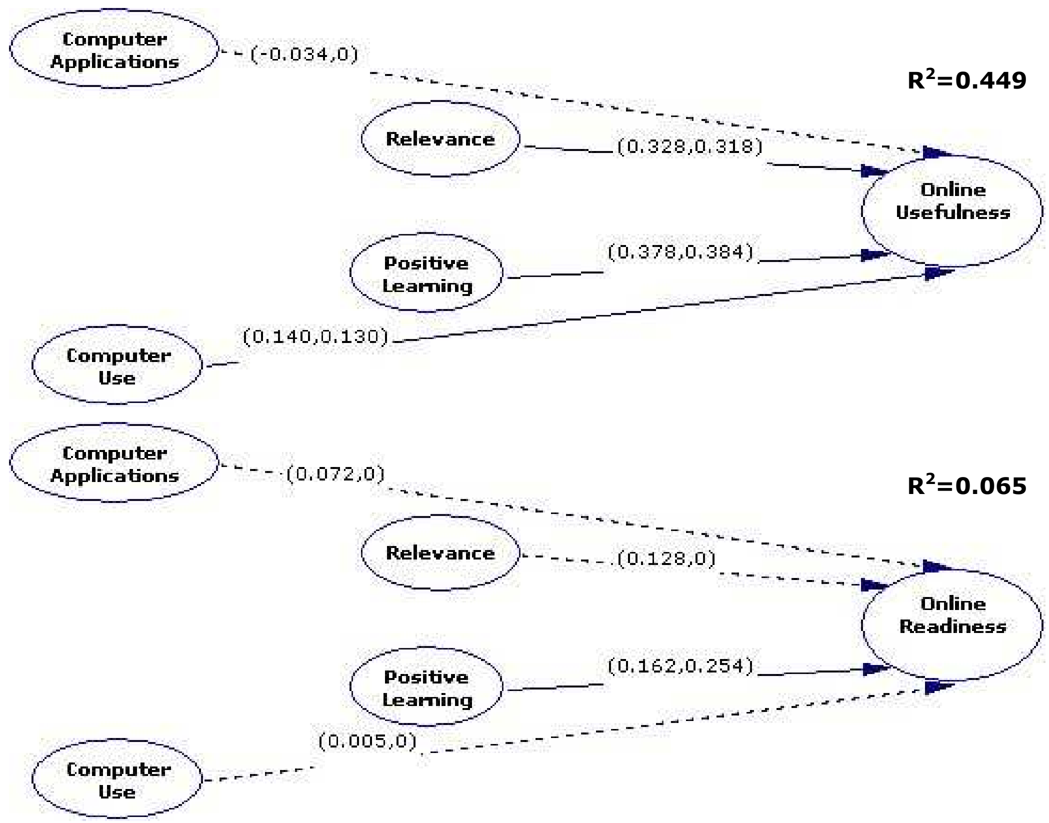


Figure 6.27: Path diagrams for students at school 8 showing relationships with Online Usefulness and Online Readiness

The inability to form a strong relationship between the independent variables and the dependent variable Online Readiness is consistent with findings for other schools in this study and may point to students' perception that the school environment was ready for a greater learning experience over the Internet.

6.5.4 General Description - Teachers

This school has a total of 59 teaching staff and 20 (34%) accepted the invitation to participate in the survey. The 20 participating teachers were made up of 7 females and 13 males consistent with the gender ratio of this school's staff. The teachers were drawn from the key learning areas of English (3 teachers), Mathematics (4 teachers), Science (2 teachers), Human Society in its Environment (5 teachers), Technological and Applied Studies (3 teachers), Creative Arts (1 teacher) and

Support (1 teacher). The mix of subject areas appear to be well represented and specific subject requirements should not unduly influence the results. The time employed at the school for the participating teachers was recorded as 1-5 years (12 teachers), 6-10 years (6 teachers), 11-20 years (1 teacher) and 31-45 years (1 teacher). The time employed at the school is compared to the total teaching experience of the teachers shown in Table 6.9. This comparison shows that some very experienced teachers have recently been employed at the school.

Table 6.9: Total years of Teacher Experience for Participating Teachers in School 8

Years of Teacher Experience	Number of Teachers
1 – 5	3
6 – 10	3
11 – 20	8
21 – 30	3
31 - 45	3

As with previous schools, the teacher experience may be a telling factor in their use of the computer applications as with teacher induction programs. All but two teachers had a computer at home and 16 of those computers were connected to the Internet.

Word processing, databases, spreadsheets, desktop publishing and presentation software were the computer applications which the teachers considered themselves to be between ‘very good’ to ‘ok’. Their claimed proficiency with spreadsheets was better than the overall teacher trend and can be seen in Figure 6.28. The use of the other applications was consistent with the overall teacher sample.

With similar patterns to the teacher computer proficiency, the majority of teachers identified the applications of web searches, databases, presentation software and word processing contributing to the learning process. This teacher observation conflicts with the some of the identified computer use in year 10 where web design and software design were prominent. Factors contributing to this observation will be some of the year 10 teachers responsible for those year 10 classes did not complete the survey and the reluctance of some more experienced teachers to integrate the technology into their classroom practice.

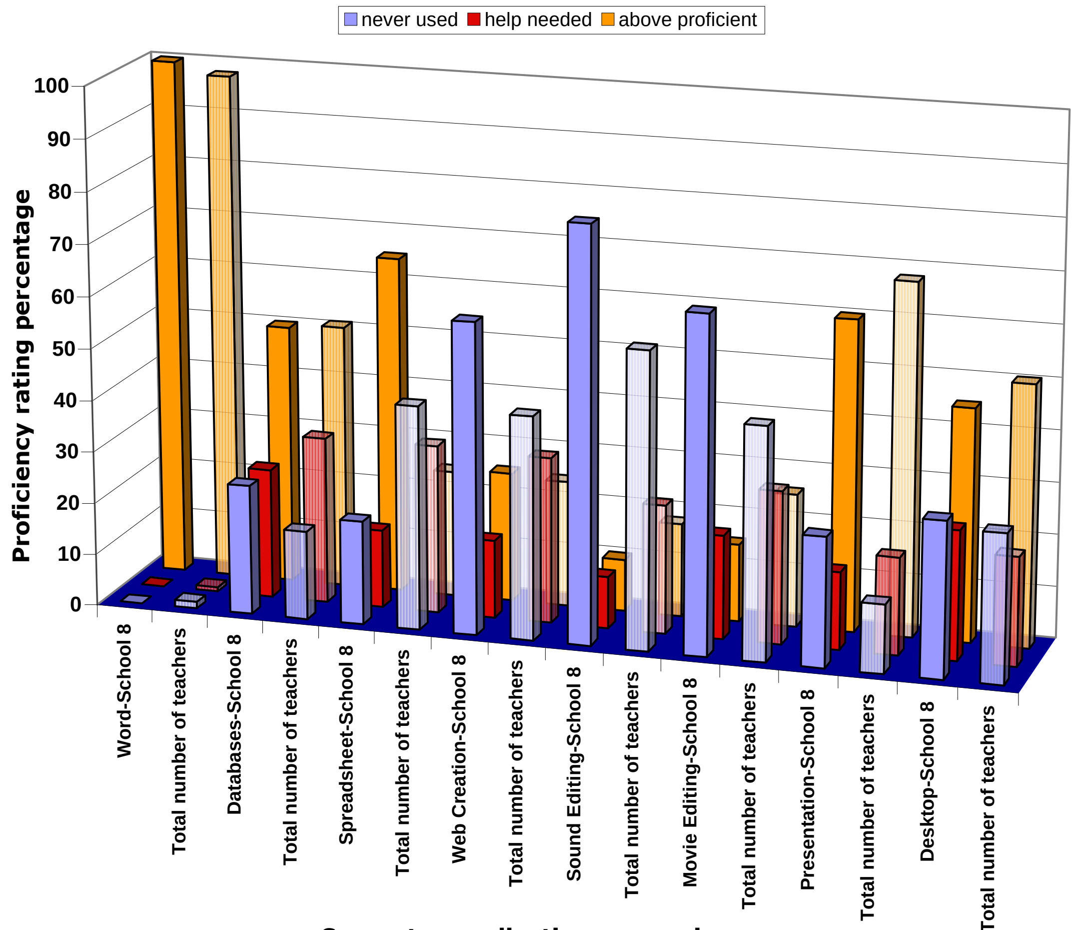


Figure 6.28: School 8 teacher proficiency rating compared to the total teacher sample

6.5.5 Relationship between variables for the teacher model

The paths established for the teachers in school 8 are at variance with the overall trend. With 31.5% of the variance explained a stronger relationship is established for Online Usefulness rather than Online Readiness with only 17.2% of the variance explained. Both the independent variables of Positive Learning and Relevance make a contribution to Online Usefulness, however; only Positive Learning's contribution is significant (Appendix 12). Positive Learning is also the only independent variable to make a contribution to Online Readiness. The path models can be seen in Figure 6.29.

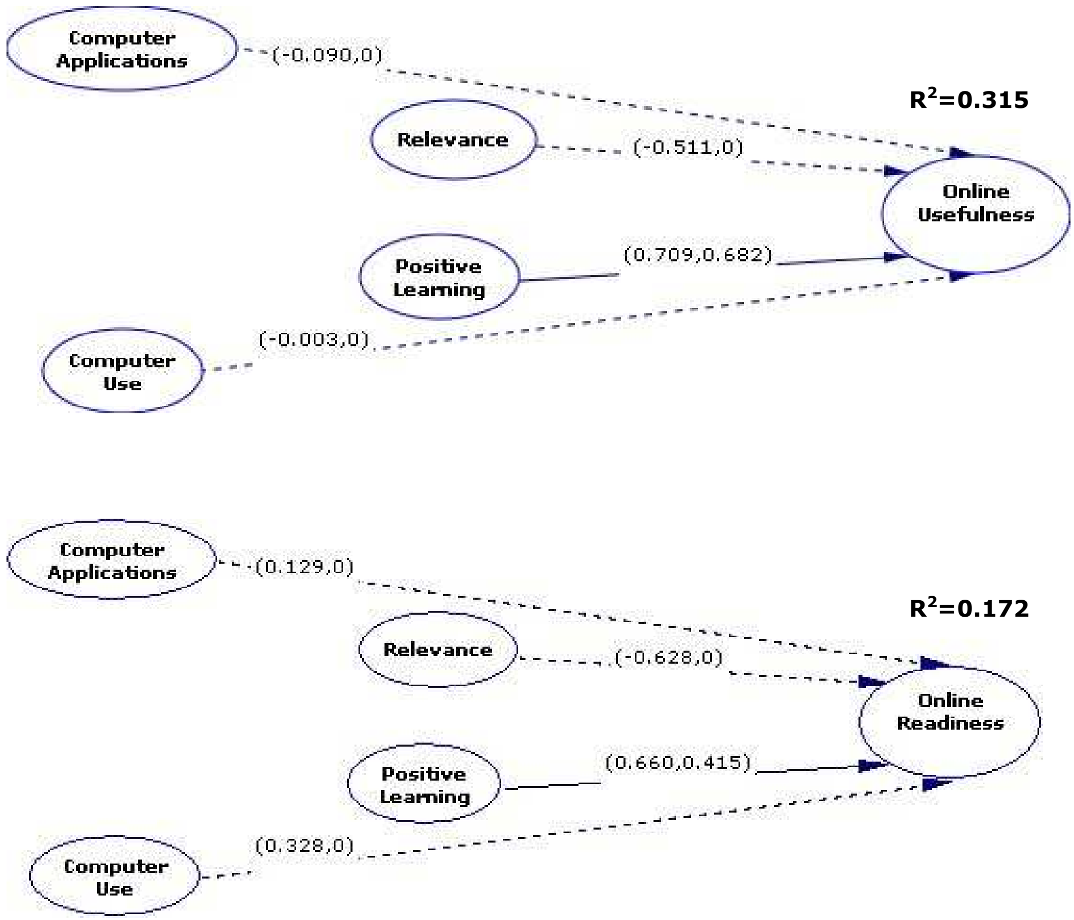


Figure 6.29: Path diagrams for teachers at School 8 showing relationships with Online Usefulness and Online Readiness

The contribution of Positive Learning to the dependent variable does reflect the practice in the year 10 class and the fields that the teachers have selected in the computer applications. It shows that teachers do perceive a positive outcome and this may transcend to other components of virtual learning other than Internet researching and web pages.

6.5.6 eFactor for School 8

This school's eFactor (0.4) places it in the lowest category. There were two learning postings in 2005 and this grew to 15 in 2006. Given the small number of teachers involved in posting learning material and given the proficiency rating of the number of teachers involved in the sample, one could assume that the school web page is not a priority at the present time. With the emphasis that the teachers have given to positive learning surrounding the online environment, it is possible that teachers will be embracing this avenue of learning in the near future.

6.5.7 Summary School 8

Some anomalies occur when analysing the data for this school and it is unfortunate that the principal was unavailable for an interview to elaborate on certain details. There appears to be some interesting computer application work taking place in year 10, as identified in Figure 6.26, with web projects and application design. A significant minority of students, in year 10, recorded positive use of computers in two subjects.

The student perceptions and application use matches with some of the teacher skills and perceptions about the positive impact of computer technology. The majority of teacher responses indicated that they did attribute positive learning to technology. It does, however, raise the issue about the uneven levels of computer engagement between year 8 and year 10. There is also the lack of school web page postings by the teaching staff. Several factors may be at play here from the nature of the strategic implementation plan to the lack of such a plan as it seems that the school is well equipped in terms of the technology infrastructure.

6.6 Identifying features of the Low eFactor Cluster and Summation

The four schools identified as being in the low eFactor group, schools 4, 6, 7 and 8, varied in size, type and socio economic background. All four schools appeared to direct their computer work to a laboratory environment, although two of the schools did have a flexible learning room accommodating computers. It is only school 7 where a physical factor, the major building program, can be identified as a potentially significant influence in the use of the computers at school.

There are similarities across the four schools when examining student computer practice. The majority of students had access to computers outside school with internet connection. Student use of computer applications on those computers was in the main similar to the total student sample use. In general gender did not impact on student use of application categories, except in games. Consistent with the total student sample, internet use at school was high as was the use of word processing but with few exceptions the student use of harder applications at school was below that of the total student sample. Differences in student use of computers were apparent between the years. The types of computer applications used seemed to be influenced either by the curriculum programs at the specific school or the teacher's ability with the application, rather than the students' lack of ability with the applications.

The majority of teachers surveyed owned a computer and most of those were connected to the internet. The teacher use of computer applications measured at school showed the most common programs used were word processing and to a lesser extent spreadsheets. The differences in the proficiency of teachers in using certain applications may impact on the integration of technology into the schools' learning program. The difference between the teachers in the low eFactor group of schools and the total teacher sample in computer applications, is seen in figure 6.31. The difference is presented as a percentage on the vertical axis

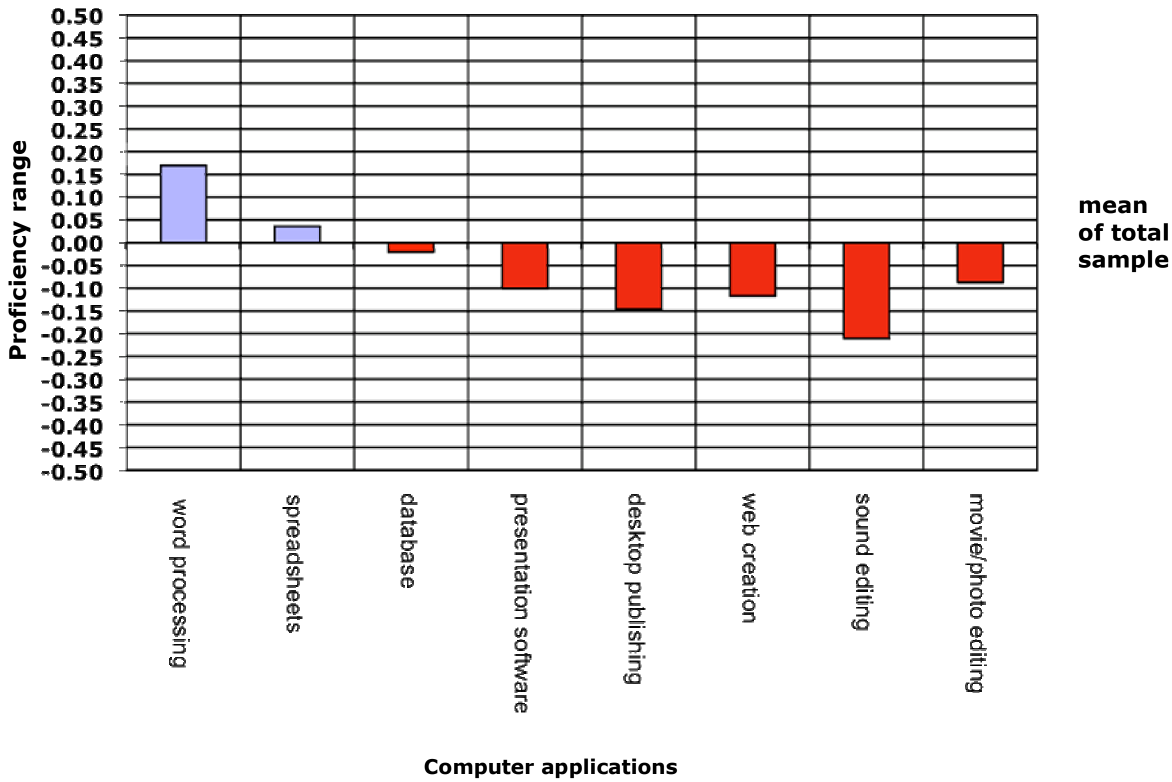


Figure 6.30: Comparison of the means of the low eFactor teacher group to the total number of teacher in computer application proficiency

The claimed teacher proficiency for this group in the use of the easier applications, word and spreadsheets, was above the mean for the total sample. As the applications become harder in terms of time taken to learn how to use them, the proficiency level for this group falls below that of the total sample. The lack of proficiency reflects a number of issues from the time taken to learn the application, the applications perceived relevance for learning (Bell, 2001) and the motivation of certain teachers to learn the computer application. These three identified areas impact on teachers' ability to implement school technology strategies and their confidence in using the computing facilities for learning at school. The teacher attitudes towards technology are evident in the student indication of the computer applications used at the school and there was subsequently less exposure to computers at the school.

Whilst the infrastructure for school 7 has been highlighted by the principal as totally inadequate for the school, the other three schools have adequate resources according to the two principals interviewed and the resources information available at the Catholic Education Office. Indeed one of the schools had the highest number of computer laboratories for all ten schools in the study. In their interviews, the principals displayed an active interest for technology to be used but placed that technology in the context of proficiency in computer application skills. Two of the principals benchmarked the progress of technology to the school's performance in the NSW ICT literacy tests. The principals' vision did not appear to extend to a web presence and the use of the presence as a learning exchange. When speaking of the web, the principals spoke of its use for administration and did not really see it contributing to the flexibility of the curriculum offered. The only exception was the school undergoing major renovation with the principal extolling the need for technology in learning but not wanting to start any programs for fear of frustrating teachers as they would not be able to successfully implement any significant learning technology. The principals did not indicate any wider purpose or benefit for integrating technology into their school's learning platform and their technology strategy was influenced by achieving the computer skills proficiency benchmarks.

Schools classified in the low eFactor group displayed certain characteristics that when combined, served to place them in this category. The technology focused strategies of the schools tended to focus on a single application competency. The technology connection to the curriculum appeared to be teachers' using the application in classrooms and students' using the application for assessment. In these four schools the majority of teachers whilst claiming that students were interested in class when computers were used, did not attribute any learning benefit to the use of computer technology. Two of the three school principals interviewed placed importance on computer technology for school administration and students and teachers achieving competency in the use of computer applications. The use of the web was really seen by the principal as a place to advertise the school presence and activities and its learning benefit was as an information-gathering tool.

In Chapter Seven, the focus will be on a group of schools that have integrated a wider range of computer applications into the curriculum instead of a more narrow focus. The results presented and discussion examined the perceptions and computer practices of students and teachers in four schools as well as the strategies employed to integrate technology into the curriculum. The chapter concludes with characteristics that are distinctive to the schools in the medium eFactor group to enable the same characterisation of schools with similar practices.

Chapter Seven: The Medium eFactor Group

7.1 Introduction

This is the second chapter addressing the characteristics of an identified group within the efactor grouped schools. The perceptions and practices of the students and teachers of the medium eFactor group about using a wider range of computer applications in a learning context are discussed. Use of a wider range of learning applications differentiated this group from the low eFactor group and it is essential to this discussion that all contributing factors to this practice are identified. The strengths of the linear relationships between the independent and dependent variables, analysed for the whole model in Chapter Five, are discussed for this eFactor group.

This chapter adopts a similar structure to Chapter Six, to allow for the comparison of similarities and differences between schools in the different eFactor groups. A profile of each school is detailed followed by an explanation and interpretation of the analyses used. Elements defining each school's membership of this group are discussed and conclude with common characteristics of schools in this group.

The four schools identified in the medium eFactor group, are described by location, size, school facilities, student and teacher population and the curriculum offered at the individual schools. Given the focus of this study, specific information about each school's computing facilities and arrangements is also included.

As with the low eFactor group the relationships between the contextual factors were evaluated through regression analyses for each individual school. Consistent with the overall model, the purpose of the analyses was to determine the strength of the linear relationships between the six independent variables and the dependent variable of the eFactor. The details of the significance test results are outlined in Appendices 6 and 7 for the students and teachers respectively.

Explanation for teacher classroom computer practices and strategic technology direction within individual schools is provided by interviews with the principals of those schools. Following the same process used for the low eFactor schools, the qualititative analysis package NVivo was used to tag the responses similar to the construct descriptors used for the development of the student and teacher scales. The trends emerging from the grouped data were examined and related to the quantitative data.

The last stage in establishing the profile of each school is their membership of the medium eFactor group. The posting of learning material on each school's webpage was examined for patterns of similar category postings across the four schools, noting also the proportion of teachers posting the specific material. The final eFactor position for each school is discussed with attention given to those elements that distinguished each school's membership in this group as distinct from the other two groups.

The chapter concludes with common similarities and differences emerging from these four medium eFactor schools. In particular the common characteristics of computer practice for students and teachers, both similarities and differences, are addressed. The comments from the principals are synthesised to identify common areas of school direction for this group. Finally the common features from each level of analyses are collated to form the basis of identification of schools in the medium eFactor group.

7.2 School 2

7.2.1 School Structure

School 2 is a large outer metropolitan co-educational school with a total enrolment of over 900 students. The school was opened in the late 1990s to cater for the rapid residential growth in that area of Sydney. The school is administered by the Catholic Education Office Sydney and operates a secondary curriculum for years 7 to year 12. Whilst there are State Government high schools in the area, the school has maintained a steady enrolment since opening with above-average results in the New South Wales year 12 post-compulsory exam, the Higher School Certificate. Good results in post-compulsory examinations are a particular criterion used by parents in the selection of high schools (Glatter, Woods & Bagley, 1997; Cosser & Du Toit, 2002).

The school is situated on a large block of land with a primary school adjacent and is surrounded by residential development and some tracts of bushland. The buildings are relatively new with the oldest building less than 10 years old. A staged construction was implemented to coincide with the stepped enrolment as the school grew. As well as the general purpose learning areas, the school facilities accommodate creative and performing arts, hospitality and industrial arts. The school has extensive playing areas as well as ovals for sport that are shared with the adjacent primary school.

The school currently has three computer laboratories with 30 personal computers in each all connected to a central curriculum server. Each room has computers positioned around the walls with additional work table space situated in the middle of the room. Two laboratories share a scanner, whilst the third has its own scanner and is used for the senior computing classes where possible. All three rooms have a data projector and a printer. There are two additional areas with desktop computers, the library and the science area. The library has 30 personal computers in a space that can be partitioned off to form a classroom. Some computers are positioned around the walls and the rest are in a kiosk style. This area has its own printer, scanner and data projector. The science room has 15 personal computers that are situated between science benches around the room. The room configuration is conducive to group work and the room has its own printer and data projector. At the time of the survey, over half the personal computers were new with the rest not exceeding two years of service. There were laptops available for staff to use and the feasibility of incorporating a wireless network into the school was being examined.

7.2.2 General Description-Students

In the 2004 enrollment, 12% of the school students were identified from a Language Background Other Than English, no indigenous students were recorded and the remainder of the student population indicated an Anglo-Saxon heritage. In years 8 and 10 there was a total of 132 female and 107 male students surveyed, with the response rate being 69%.

Only one student from this school did not have access to a computer outside of school with the remaining students' access described in Table 7.1.

Table 7.1: Student use of away from school computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	90	99
Able to access the Internet	92	99
Used for school work at least half the allocated time	75	68

The data shows that a slightly higher proportion of year 10 students had greater access to these non-school computers with a similar proportion of access for the internet connected computers. This school is also the only school in the sample where, proportionally, computer use by year 10 for school purposes is less than that of year 8. A possible reason may be found in Figure 7.3 which shows that year 10 spend more time in the library than the total year 10 sample across all schools and could use this time for their school work.

The most commonly-used applications for students away from school were Internet use, word processing/spreadsheet, games, powerpoint and multimedia. The popularity of powerpoint was particularly notable as it was approximately 30% higher than the total student sample. To some extent, the use of the application is explained by the school principal, who said that powerpoint was a focus application used by the teachers as part of the school's overall technology strategy. Part of the strategy required students to produce and present their work on powerpoint which would then be assessed by the teachers. The number of students using other applications was the same across all schools, with the usage only slightly higher. In this particular school, the use of other applications is also notable as the computer software used were different types of music composition software. There was only one other student in another school indicated the use of this software and explains why this application remains in the 'Other' category. A total usage pattern comparing this school to the total student sample is shown in Figure 7.1.

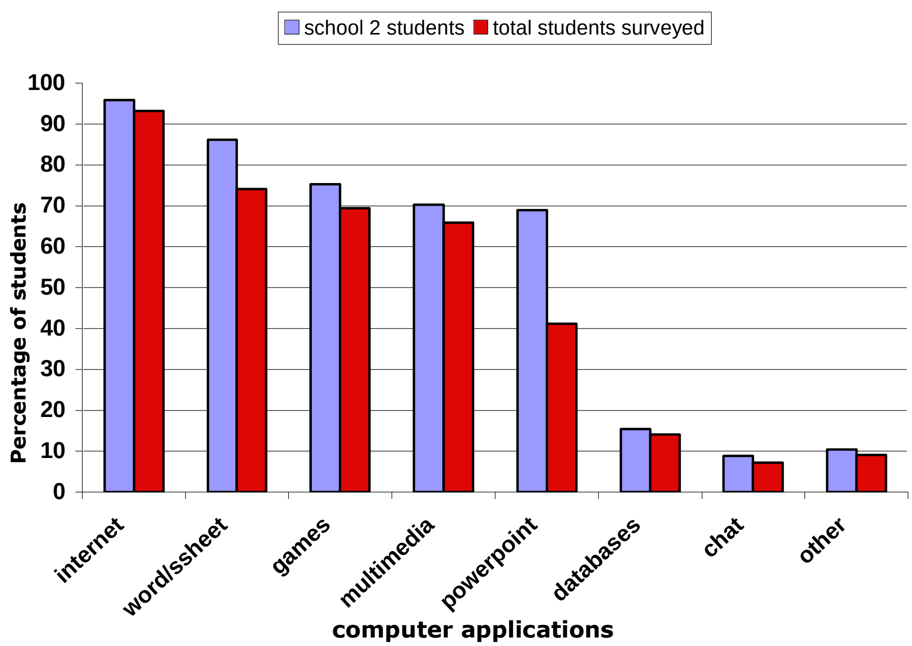


Figure 7.1: Comparison of school 2 students to total number of students surveyed in the use of computers away from school

Class computer use at the school can be seen in Figures 7.2 and 7.3 for year 8 and year 10 respectively. Some differences are apparent between the years and against the total sample. More year 8 students indicated they were enrolled in a computer class than year 10 and also considerably more than the total student sample. This may be due to a misinterpretation of the survey question by the cohort at this school. The year 8 students may have interpreted the question as any class where computers were used. There was, however, a school leadership decision giving year 8 the opportunity to study computer basics that were part of the NSW Board of Studies curriculum requirements. This is also supported by the results for the other categories where year 8 usage is higher than the total sample. Both years also indicated (by approximately 10%) using the library more for research than the total student sample. There was also a lower use of computers, in year 10, in programmed units on a consistent basis when compared against the total sample.

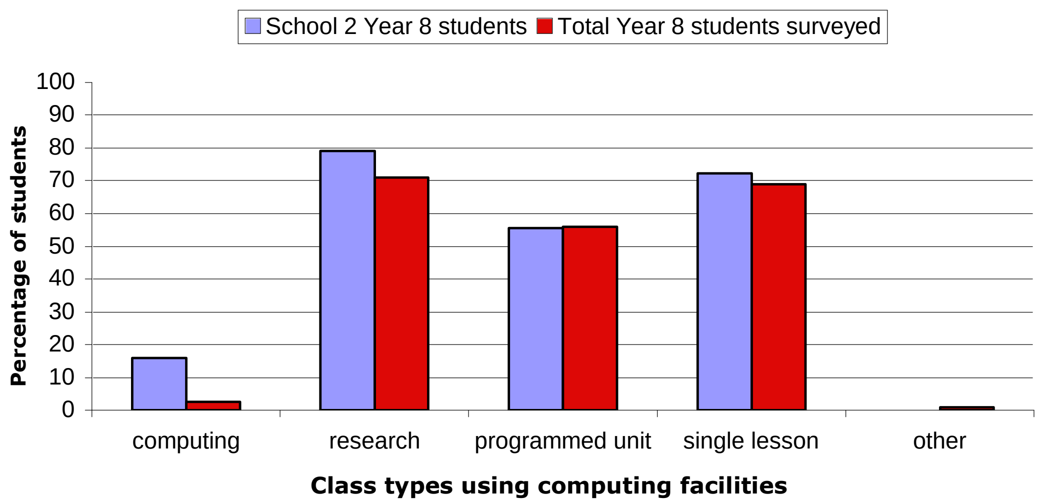


Figure 7.2: Computer use by class activity for year 8

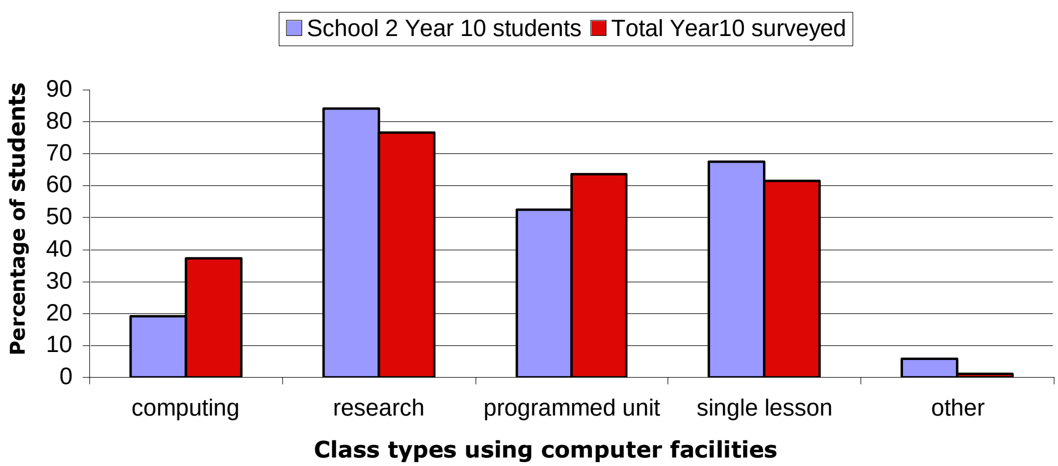


Figure 7.3: Computer use by class activity for year 10

The range of application use by students on the school computer can be seen in Figures 7.4 and 7.5. Differences to note in year 8 are the Internet researching, use of powerpoint and the use of email. Whilst the Internet research difference is only slight, powerpoint and email differences are substantial. The use of powerpoint has been explained earlier in this chapter as a technology focus in the school. The use of email by year 8 can possibly be attributed to some school students enrolling and communicating with the Virtual School for the Gifted. The principal said in the interview that some year 8 and 9 students were using the programs offered by that school as enrichment. Differences to note for Year 10 show a similarly higher use of powerpoint, as in Year 8, but the use of word processing/spreadsheet was surprisingly lower than the overall student sample as was the slightly lower Internet use. This is possibly explained by students using the powerpoint application to publish their work rather than in essay form.

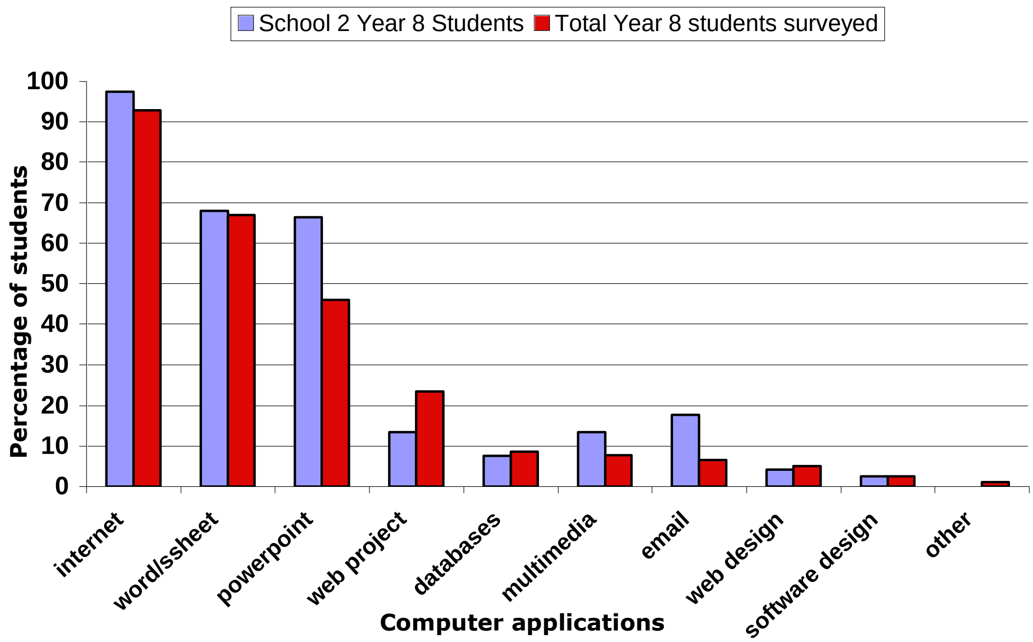


Figure 7.4: Year 8 school computer application use

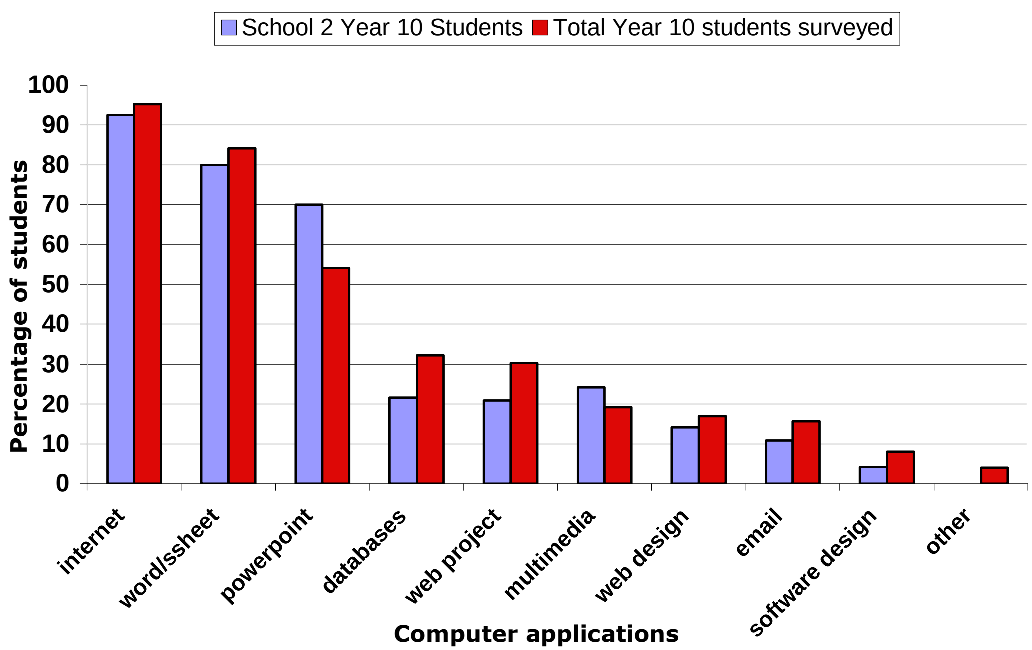


Figure 7.5: Year 10 school computer application use

The students from this school have indicated some computer activities that are different from other schools in this study, Virtual School for the Gifted and composition software. Despite these differences, the students from this school did not record any positive comments about the use of the technology with the exception of a small number of students for the subject of English. This reaction may be as a result of the school technology emphasis on powerpoint. Whilst the application may be challenging for teachers to master, its linear passivity does little to engage the students (Tufte, 2003).

7.2.3 Relationships between variables in the student model

The regression model presented in this section is consistent with the trend for the overall student model shown in Chapter Five and the Low eFactor group identifying the relationships with the dependent variable Online Usefulness. The linear relationships for school 2 students, shown in Figure 7.6, differ from the total student regression model, having a greater percentage of the variance explained by the contribution of the independent variables. The model explaining Online Usefulness shows 46% of the variance was explained by the contribution of the independent variables, Relevance and Positive Learning. The first number shown in the parentheses indicates the value of the standardized regression coefficients when all variables are included in the model and the second coefficient indicates only the significant paths. Similar to the overall model, the beta coefficient identifies Relevance as the primary contributor and both variables were significant at the .05 significance level. However, there was no significant relationship between the independent variables and Online Readiness.

The linear relationship identified as well as the student use patterns, indicate that students perceive Relevance as important in using an online environment. The fact that a relationship was unable to be established for Online Readiness coupled with student computer use patterns provides a strong indication that students prefer to be actively engaged in the computer environment. These data also raise an area of concern for older students in the school, because there is currently a policy of less computer use for these students so that more 'good teaching' may occur. There would appear to be an assumption at the teaching and leadership level that, at the very least, computers are a distraction to learning.

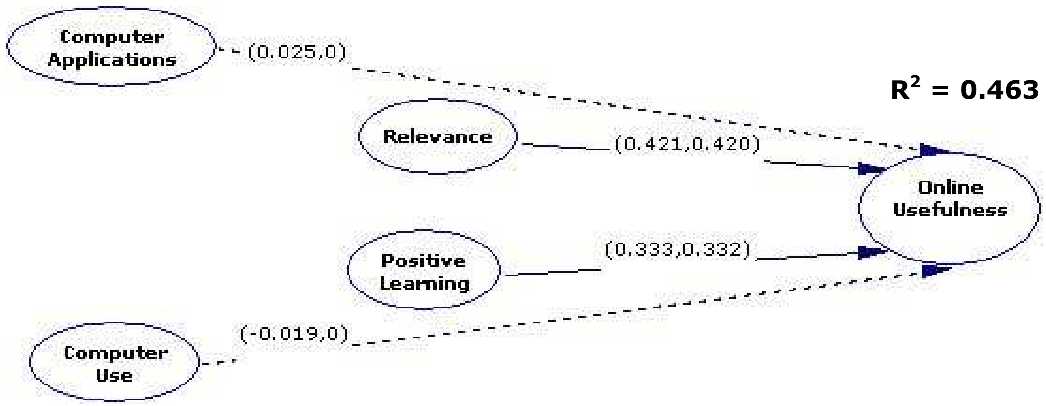


Figure 7.6: Path diagrams for students at school 2 showing relationships with Online Usefulness and Online Readiness

7.2.4 General Description-Teachers

From a total of 73 teaching staff, 56 teachers (77%) accepted the invitation to participate in the survey, making this one of the largest teacher groups involved in the survey. The female/male composition of the teacher group showed a larger proportion of females participated (72%), which was consistent with the total teacher sample. The large group of teachers participating ensured a wide representation from the curriculum areas. The specific numbers were English (10), Mathematics (9), Science (6), Human Society in its Environment (10), Technological and Applied Studies (5), Creative Arts (6), Physical Education (7) and Support Staff (3).

The time employed at the school for 42 of the participating teachers was 1-5 years and for 14 teachers was 6-10 years. These employment levels are compared to the overall levels shown in Table 7.2.

Table 7.2: Total years of Teacher Experience for Participating Teachers in School 2

Years of Teacher Experience	Number of Teachers
1-5	20
6-10	10
11-20	17
21-30	7
31-45	12

It is to be expected that when a school has been operating for a short period of time there is a corresponding short employment record. Having such a large proportion of experienced teachers would be beneficial in mentoring those new to the teaching profession. However, it may also mean that these experienced teachers miss vital in-school training (OECD, 2008) for technology strategies on the assumption that they already have the competencies. Most teachers had a computer at home and most of those had the Internet connected to those computers.

When teachers at school 2 self-rated their skill at computer applications, they rated their proficiency in spreadsheets higher than the total teacher sample. There was also a slightly higher rating of their proficiency for presentation software and desktop publishing. The full range of claimed proficiencies can be seen in Figure 7.7. The difference in presentation software use is explained with the use of this application as a whole-school technology focus. In the interview the principal said that staff had been given training in the use of the application as part of the school's technology focus. The high proficiency in spreadsheet use may be explained with the targeting of year 8 in computer skills. As Figure 7.2 shows, year 8 has more computer classes than the total student group and the spreadsheet application is one of the applications that can be used in those computing classes. Other proficiencies were similar to the use pattern for the total teacher group.

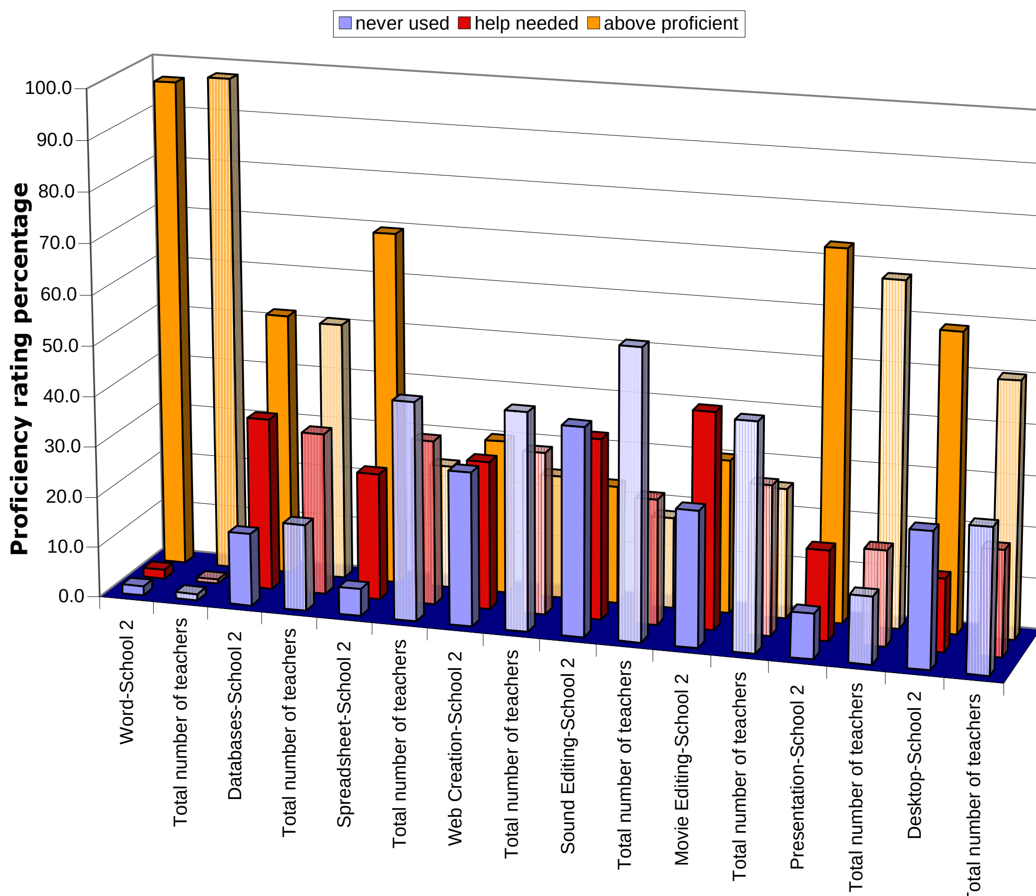


Figure 7.7: School 2 teacher proficiency rating compared to the total teacher sample

Teachers from this school were asked to rate the learning value of computer applications. Given the strength of the teachers in some applications and the school focus, it was not surprising that word processing, presentation software, spreadsheets, and web searches all rated from 'ok' to 'very good' for learning stimulus. For movie editing, creating web pages and email the group was split with half indicating there was no value but the other half indicating there was at least some value. One explanation may be the training process that the staff was currently undertaking and their exposure to various applications. Interestingly, however, the responses from the Technological and Applied Studies teachers indicated that all but two teachers favoured the use of these applications. Databases, desktop publishing and web creation did not rate highly amongst this group of teachers even though their proficiency on desktop publishing was high. There was also a comment by the principal that teachers of students in the senior years had to concentrate on 'good teaching'. Technology was seen as good for the presentation of assessment tasks for those senior students but otherwise it could be viewed as a distraction.

7.2.5 Relationships between variables in the teacher model

The multiple regression analyses indicated that the model (see Figure 7.8) with Online Usefulness as the dependent variable explained 21.5% of the variance. The standardised Beta coefficient confirms Positive Learning as the primary contributor significanl with $p = .000$. This path may reflect the school's focus on particular technology requirements as well as the preferences of teachers from some of the curriculum areas referred to in section 7.2.3 and may also explain why the paths established for this school vary from those in the overall teacher model.

The contribution of the independent variable Positive Learning to the dependent variable Online Readiness explained 14% of the variance and was significant with $p = .001$. The identification of Positive Learning as the primary contributor may reflect the school focus about discerning when to use the computer and its impact on the curriculum. The focus was evident in the predominance of computer use in the junior secondary years. This type of strategic policy at the school does also consider the readiness of the school's online environment to contribute to student learning. The regression analyses of the data for teachers in this school indicate definite groupings of teacher opinion and skill about the use and benefits of computer technology within the school.

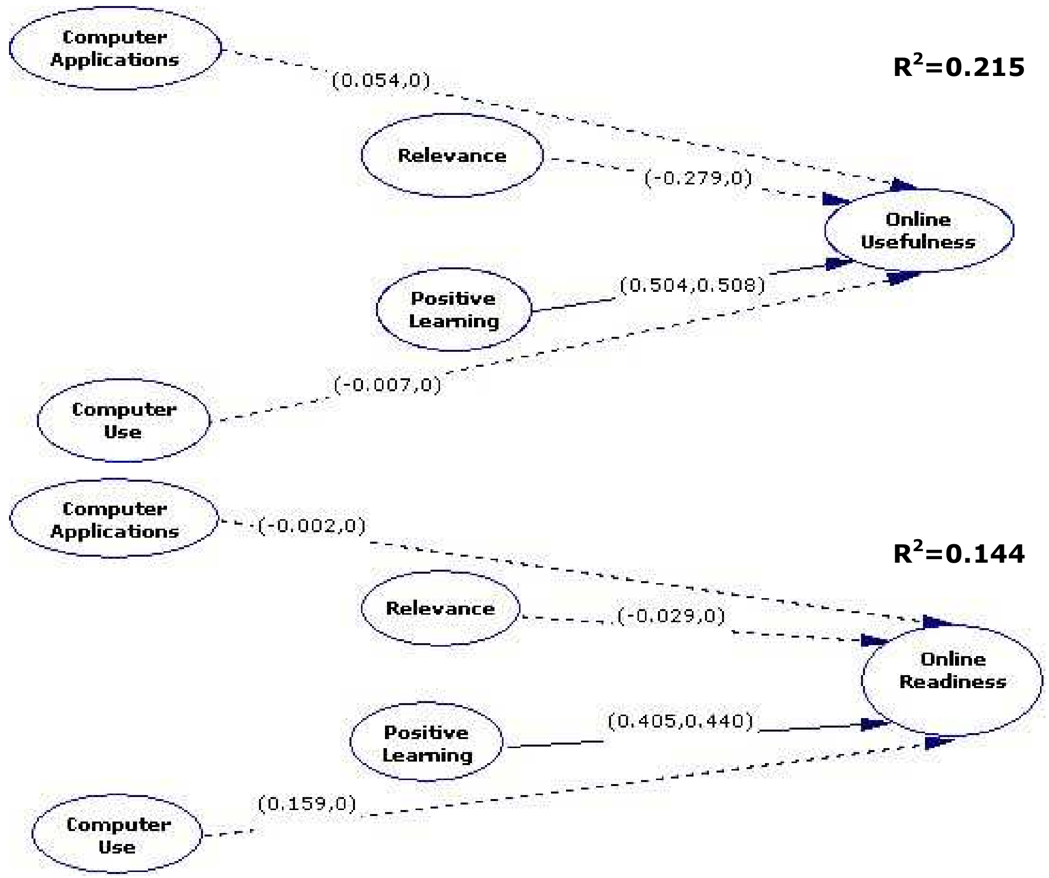


Figure 7.8: Path diagrams for teachers at school 2 showing relationships with Online Usefulness and Online Readiness

7.2.5 eFactor for School 2

The learning presence (eFactor) on this school's website was limited at the time of the study though it had expanded from two postings in 2005 to 73 postings in 2006. The eFactor of 4 places this school in the middle group. As discussed in Chapter Five the gap between the middle and top groups (Appendix 14) was large and it reflected not only the lack of postings with sufficient learning scaffolds but the small number of teachers who were using this avenue of learning in the middle group. Perhaps one of the main reasons for the lack of teacher uptake was the school focus had only just moved to an internet presence. The posting of learning material on the school webpage was not currently part of a school strategy, as confirmed by the principal, but was entirely voluntary for individual teachers. The school's strategic technology focus was on applications rather than web-based learning on the school website. There was some recognition, however, that the Internet does provide access to courses not available at the school as in the Virtual School for the Gifted. As mentioned previously, there was also the belief that for the senior years there should only be 'good teaching' and an online presence could be a distraction that diverts teachers from their core purpose.

7.2.6 Summary School 2

This school had one of the highest percentage returns for the teachers as well as a return of over 69% for the students. Despite a low ratio of computers to students (1:8) in comparison to other schools in this study, there were some strong computer technology practices and emphases in the school. These practices were particularly evident in the lower secondary school with strong computer use in year 8 and use of extension programs through the Virtual School for the Gifted in years 8 and 9. It did seem, however, that the school technology focus and practice was stunted in its strategic use. The computer technologies were not harnessed in an interactive manner but viewed with what could be considered a tunnel vision such as implementing the technology through a single application i.e. powerpoint. As the students progressed through the school there was a decreasing use of computers. This type of strategic approach may change as teachers move to a proficiency with a range of computer applications and the school decides on the next technology direction.

7.3 School 5

7.3.1 General Description

School 5 is a medium metropolitan co-educational school with an enrolment of over 700 students. The school, opened in the late 1990s, is an amalgamation of a regional systemic high school and a senior high school established and operated by a religious teaching order. The schools were amalgamated due to the parents' wish for a continuous education from years 7 through to 12, despite the presence of government high schools and easy transport to other Catholic and independent schools. With the school retaining its regional status and the area facing a burgeoning population, enrolments are strong.

The school is situated on a large block close to busy roads and is surrounded by a mixture of businesses, a large shopping complex and residential area. Owing to its history, the school site is sprawling and there is a mixture of some modern facilities with some buildings that are more than 50 years old. The school has substantial industrial arts and creative arts facilities. Recreation spaces for this school are extensive with a combination of asphalt and grassed areas for both active and passive activities. The school has ovals for the students to practice and play sport on.

The school has converted four general classrooms into computer laboratories. Each room has 28 personal computers that are networked to a central curriculum server and positioned around the walls. Each room has a networked printer and a data projector was available from the library on request. The school had also modified five other rooms into multi-purpose rooms and each room has five personal computers networked to the central curriculum server. These rooms do not have a set configuration but can be modified according to the needs of the particular class. The library can also be used as a computer laboratory with 35 personal computers networked to the central curriculum server with a networked printer and a scanner connected to one of the computers. There were also ten laptops available for teachers to use in their classes. The library computers were configured in a kiosk arrangement which meant that the area could not be completely partitioned off as a teaching space and was used more for class research and group activity. The computers were not more than three years old and it was school policy to replace computers at the end of the fourth year. There was wireless coverage in the building that housed the school administration and this also included some classrooms. At the time of writing, investigations were underway for the wireless network to incorporate the entire school site. However, due to the sprawling nature of the school, there were concerns about the security of the wireless network with some businesses as well as residential areas surrounding the school.

7.3.2 General Description-Students

The 2004 enrolment identified a large multi cultural student population with over 80% identified from a Language Background Other Than English and less than 1% from an indigenous background. The students in years 7 to 10 are all male but the school is co-educational in years 11 and 12. In years 8 and 10 there was a total of over 252 boys and 234 students (93%) accepted the invitation to participate. Student access and use of a computer away from school is described in Table 7.3.

Table 7.3: Student use of away from school computer

Use Categories	Year 8 (%)	Year 10(%)
Able to access the computer at least most of the time	79	81
Able to access the Internet	98	100
Used for school work at least half the allocated time	64	91

All but two students had access to a computer away from school and approximately 80% of the students were able to access the computer either all or most of the time. The use of the computer for schoolwork was higher for year 10 and as with most of the other schools in the study this higher use is attributed to year 10 assessments.

The most commonly-used applications for the students were Internet use, games, multimedia and word processing/spreadsheet. The usage pattern comparison for this school against the total number of students surveyed can be seen in Figure 7.9.

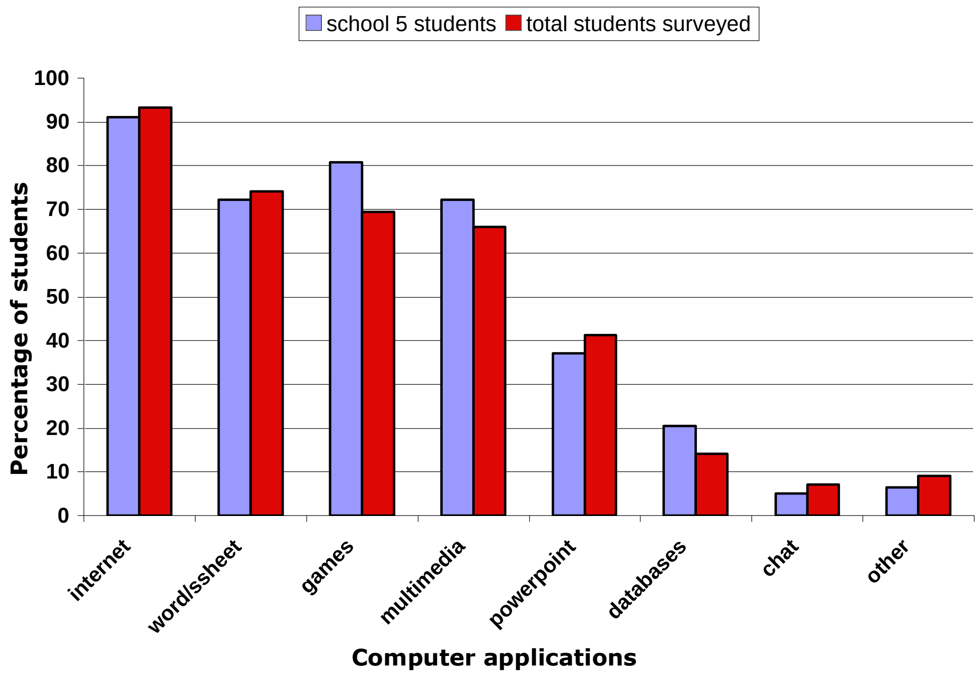


Figure 7.9: Comparison of school 5 students to the total number of students surveyed in the use of computers away from school

The use of games, multimedia and databases by the students of this school is higher than the total student sample, with games showing the greatest difference. The greater use of games by the male students adds to the research about boys' preference for computer games. Subrahmanyam et al. (2001) state 'Boys continue to spend more time playing computer games', indicating boys liking for adventure in an environment they can take many risks with games with little consequence. The slightly higher use of databases and multimedia is possibly connected with the year 8 cohorts' increased use of those applications at school. Just 12 students identified using a chat program on the away from school computer and one student identified using an architectural drawing package.

The use of the school computers, reported by year level, indicates some differences between the years and from the total number of students surveyed. The usage pattern, seen in Figures 7.10 and 7.11, shows that more year 10 students have chosen a formal computing class as an elective subject. This pattern of usage supports the commonly-held view that boys prefer computers (Anderson et al. 2005). However, the year 10 enrolment in computer studies classes could also be seen as a means of interesting boys in their schoolwork. This approach to learning utilises engaging popular student trends to focus the students in their academic work (Lingard et al., 2003). The percentages of students who are using the library for research, using computers to study topics in integrated curriculum units and to a lesser extent using the computer in single lessons are below those for the total year 10 student sample. By contrast, in year 8, the use of computers for research and to study a unit of work is the same as the total student sample. Their use of computers for a single lesson, to enhance the study of a particular topic, is higher than the total year 8 sample. The use of computers by teachers appears to decrease as students progress through the school.

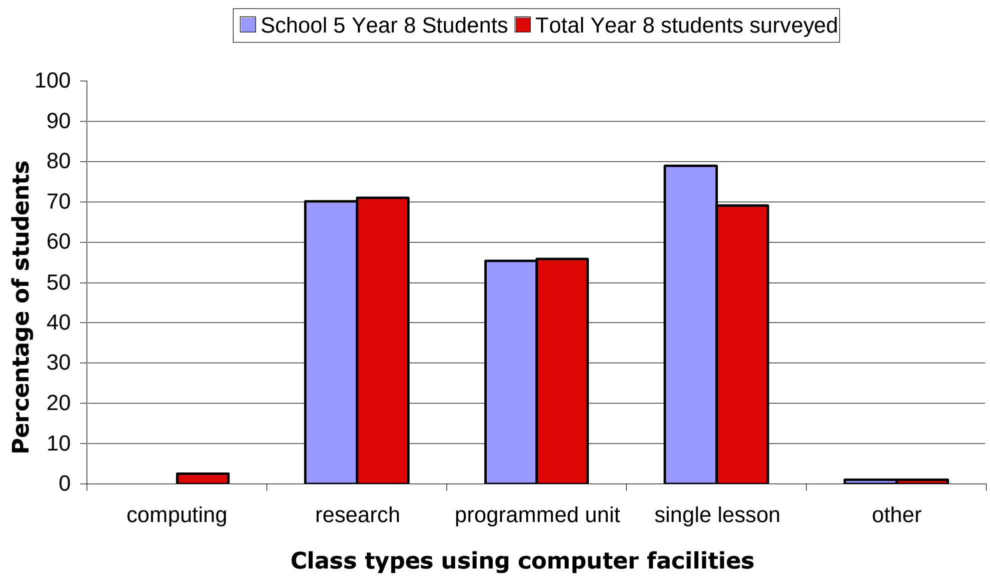


Figure 7.10: Computer use by class activity for year 8

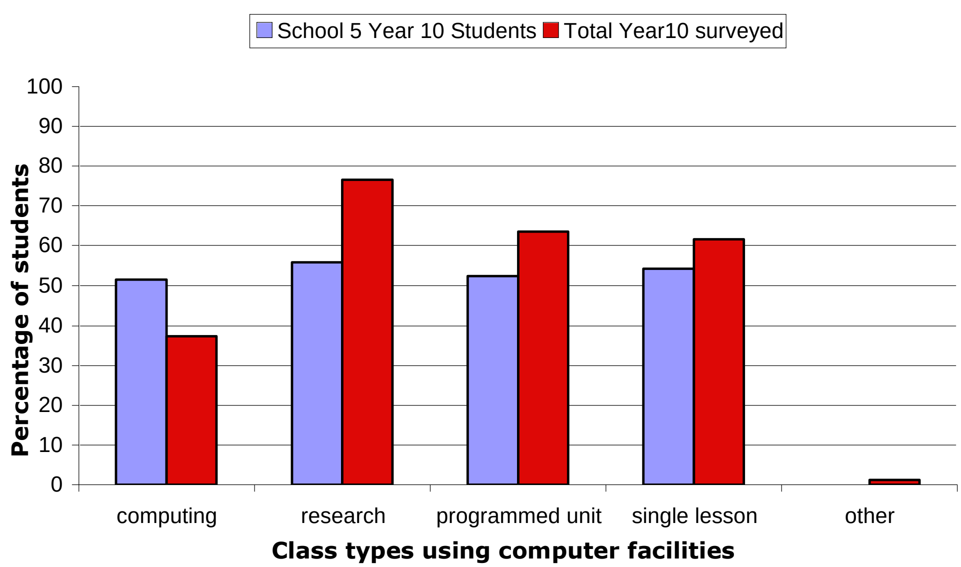


Figure 7.11: Computer use by class activity for year 10

The overall usage pattern for computer applications at school, seen in Figures 7.12 and 7.13, show a lower use of the two most popular applications for the total student sample, Internet use and powerpoint. The use of databases by year 8 at school 5 is higher than the total student cohort and reflects the technology integration strategy in the school. The use of web projects and multimedia applications is also higher than the total sample and is indicative of a group of teachers who are skilled in these applications.

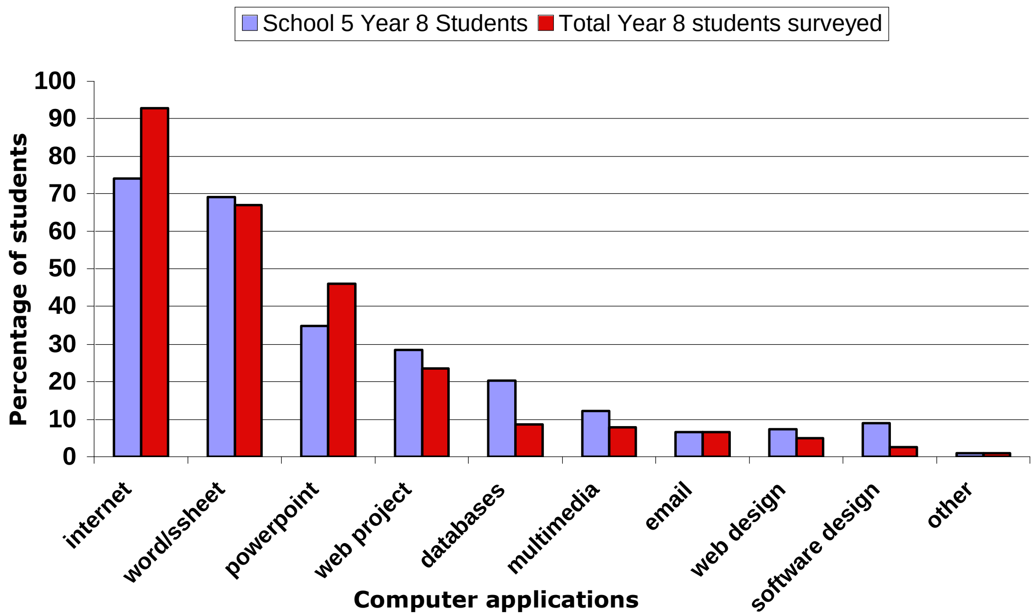


Figure 7.12: School computer application use

With the exception of web projects, the use of all other applications by year 10 at school 5 is lower than the total student cohort. The application use in year 10 reflects some of the uncertainty about the best way to implement a technology strategy for the higher years at the school with the current teaching staff. It may also be indicative of some of the difficulty teachers have in applying technology to the learning process that was mentioned by the principal in the interview. The use of web projects again indicates the desire of a small group of teachers to integrate some aspect of technology into the curriculum.

Overall the amount of student comment about the positive effect of using computers in their subjects was very small and in accord with the total student sample. In two subject areas, however, there was a small grouping of students that reported a positive effect when using computers.

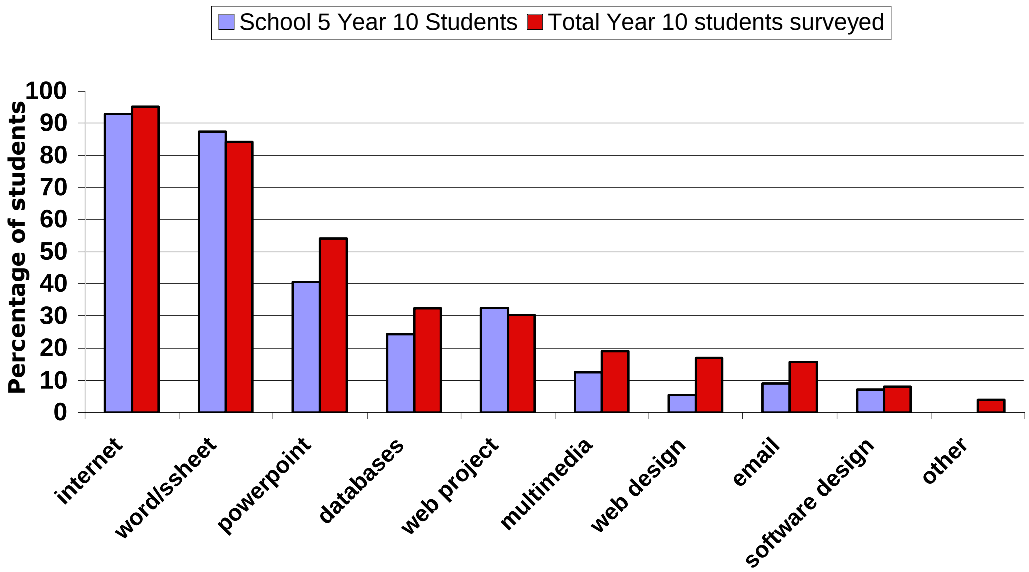
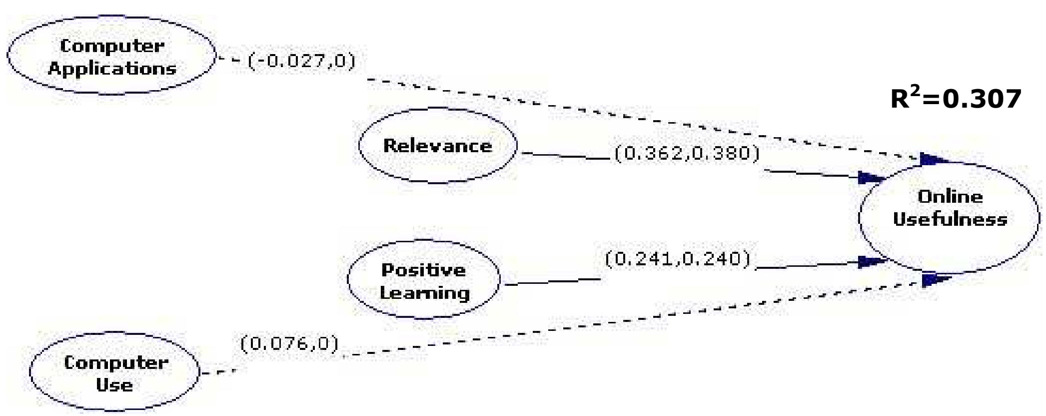


Figure 7.13: Year 10 school computer application use

Students recorded a positive effect without comment for English (49) and Technical and Applied Studies (68), which may be reflected in Figures 7.12 and 7.13 with student use of certain applications.

7.3.3 Relationships between variables in the student model

In keeping with the overall student model, the model explaining Online Usefulness was stronger with 30.7% of the variance explained as seen in Figure 7.14. The variance is explained by the contribution of Relevance and Positive Learning. Relevance is identified as the primary contributor and was significant with p=.000. The established relationship adds to the research (Moursund, 2002; Venesky & Davis, 2002; Bolstad & Gilbert, 2006), that students are engaged with the online environment as a matter of daily routine. Students perceive the Internet as one of their usual conduits for their various levels of interaction and it may require just a small adjustment for them if their education was conducted on the Internet.



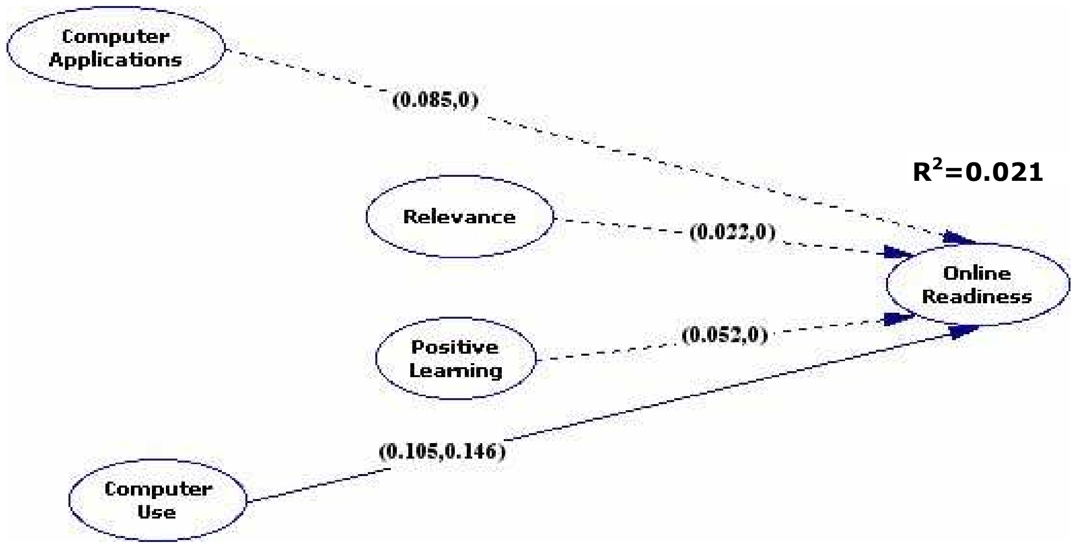


Figure 7.14: Path diagrams for students at school 5 showing relationships with Online Usefulness and Online Readiness

The model with Online Readiness as dependent variable explained 2% of the variance all attributable to Computer Use. Even though the contribution is significant with p=.002 its effect is tenuous with such a small percentage of the variance explained. Overall student computer practice in their outside school environment, shown in Figure 7.9, demonstrates students ease with the computer environment and indicates that students are participating in an online environment and not waiting for a decision whether they should be.

7.3.4 General Description-Teachers

There were 24 teachers (38%) out of a total teaching staff of 63 who accepted the invitation to participate in the survey. In keeping with the overall trend of participating teachers from the study schools, more females completed the questionnaire even though the gender balance of this school’s staff is approximately equal. The teachers were drawn from the key learning areas of English (4 teachers), Mathematics (2 teachers), Science (2 teachers), Human Society in its Environment (9 teachers), Technological and Applied Studies (1 teacher), Creative Arts (3 teachers) and Physical Education (2 teachers). There was a much better response from teachers in the humanities but a poor response from the sciences and no response from language teachers. The uneven distribution of teachers from the various curriculum areas may impact on the data derived from the teachers’ skills and perceptions at this school.

The time employed at this school for the participating teachers was 1-5 years (15 teachers), 6-10 years (6 teachers) and 11-20 years (3 teachers). These figures are compared to the full range of teaching experience shown in Table 7.4.

Table 7.4: Total Years Teaching Experience for Participating Teachers in School 5	
Years of Teaching Experience	**Number of Teachers**
1-5	6
6-10	2
11-20	5
21 – 30	9
31 – 45	2

This table shows there were some quite experienced teachers participating in the survey and that some of these staff have been employed in the last couple of years. This employment pattern may reflect a particular emphasis by the school executive to target areas of development within the school such as deficiencies in particular key learning areas. More importantly, however, the time employed at a school versus total teaching experience is starting to emerge as a consistent trend affecting the integration of technology in the schools. The pattern emerging in the previous case study schools has been that these experienced teachers, in their own curriculum area, have had difficulty in attempting to integrate computer technology. There has been a tendency to overlook these experienced teachers in new teacher induction programs (Delahaye, 2000). Whilst certain familiarisation has been given for administrative computing procedures, some other computer technology mentoring in their own curriculum areas has been lacking.

The computer ownership of this group of teachers was high with only one teacher not owning a computer and only three other teachers not having an Internet connection. In the use of computers, over 60% of the teachers considered themselves in the ‘ok’ to ‘very good’ category for the computer applications of word processing, databases and spreadsheets. The last two applications differ from the overall sample, seen in Figure 7.15, and confirm the increased use of databases by year 8 as a technology focus. As expected from the student use of powerpoint, the teacher proficiency in presentation software is not as high as the overall sample of teachers. This pattern of proficiency may point to the motivation that teachers have to make themselves adept in the use of applications according to a school agenda. It may also explain the lower use of computer applications by year 10. Another interesting finding is the proficiency of a small group of teachers in some of the multimedia areas. This group, which rates higher than the overall sample, may account for some of the computer application trends indicated in Figure 7.12 for year 8.

The principal was critical of the Catholic Education Office for their failure to provide an overarching strategy in the use of technology at school. The principal’s argument was that, whilst some of the professional development provided was excellent, the whole approach was piecemeal. Some priority was given by the education system to the administrative, financial arm of the organisation but technology for curriculum purposes tended to be ad-hoc and not supportive of school initiatives.

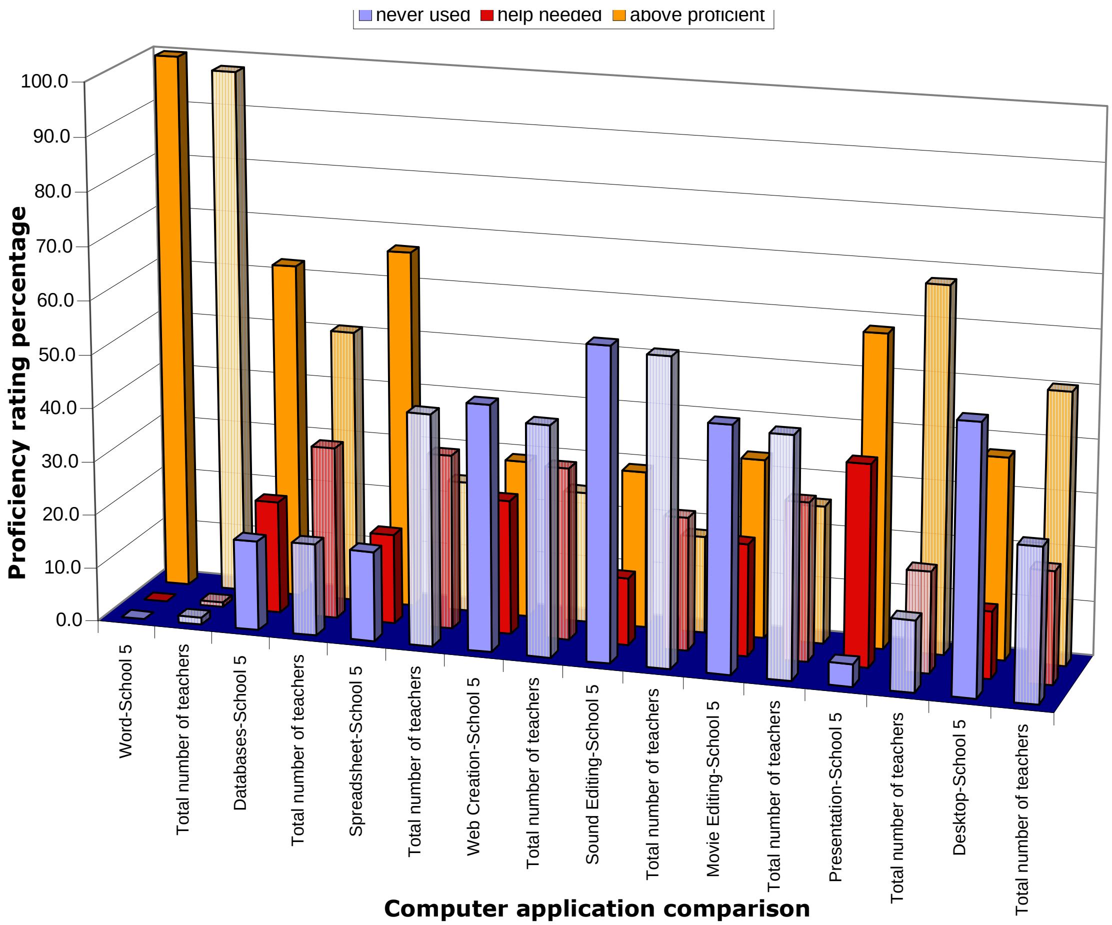


Figure 7.15: School 5 teacher proficiency rating compared to the total teaching sample

In identifying applications that stimulate learning, this group of teachers were divided in their opinion. There was unanimous agreement that word processing and web searching stimulated learning. It was in the use of email feedback, creating web pages, multimedia, email projects and presentation software opinion that the division occurred. Half of the teachers thought that the applications did not contribute to learning compared with 40% who thought they did. These opinions are also reflected in the teacher proficiency in using such applications. There is evidence from the student use of computer applications at both year levels, that the teacher perceptions are influencing the technology integration in classroom practice.

The identification of a group of teachers within the school who promote the use of technology for learning may point to a departure from the single application competency that has been the hallmark of other schools' teacher technology strategies. The work of this group of teachers was possibly starting to have some effect in the junior secondary school. There is a propensity for the numbers of staff implementing a broad range of technology to increase thereby moving towards the cohesion of learning, technology and the curriculum that the principal was alluding to.

7.3.5 Relationships between variables in the teacher model

The relationships established between the variables, for teachers, shows some consistency with the overall teacher model but with much higher levels of explained variance. The model explaining Online Usefulness, seen in Figure 7.16, shows 32.4% of the variance explained by the contribution of the independent variable Relevance which was significant with p=.001. The relationship indicates the work of teachers who expressed proficiency in web applications and integrated those applications into the year 8 program.

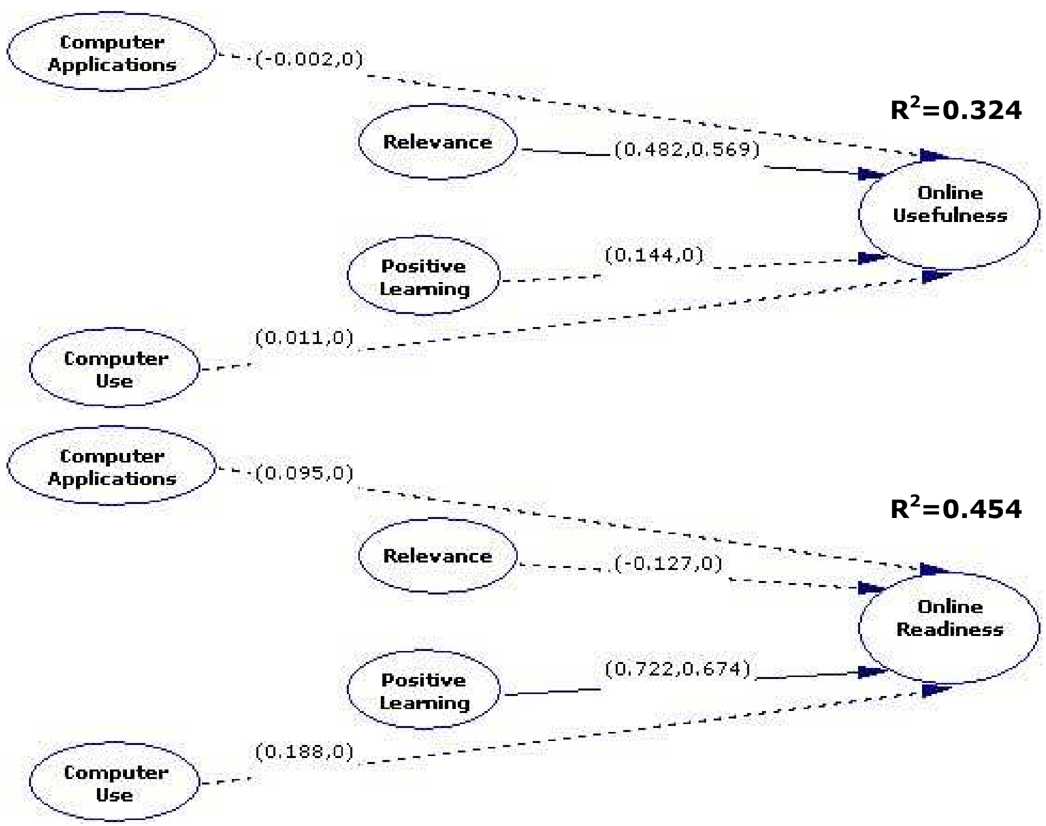


Figure 7.16: Path diagrams for teachers at school 5 showing relationships with Online Usefulness and Online Readiness

The model explaining Online Readiness was even stronger with 45% of the variance explained by the contribution of the independent variable Positive Learning. The path was significant with p=.000 and indicated teacher views that positive learning affects the school's readiness for an online environment. The different teacher perceptions about computer applications enhancing learning do indicate the uncertainty of the teaching staff about the benefits to education from an online environment. Whilst it was clear that a group of teachers did favour the use of computer technology, the overall group lacked a common agreement about computer technology benefiting learning. The proposed benefits of the online environment to learning should be considered by schools and learning authorities (Holzl & Khurana, 2000). The adoption of an online environment becomes a question of what benefits do schools want and the best methods and strategies schools need to incorporate in order to implement the technology.

7.3.6 eFactor for School 5

In 2005 there were 63 learning related postings on the school website. The number of postings increased by 62% (102) for 2006, with the postings concentrated mainly around supplementary and formative, with a slight increase in dependent and the resultant eFactor calculation of 7 places it in the middle category. The eFactor for this school was much lower than schools in the high eFactor group due to the increase in postings being clustered in the middle eFactor categories. The teacher regression path in Figure 7.16 showed evidence of teachers' understanding the importance of an online environment that may have accounted for some of the increased postings. Teacher perceptions also indicated that a slightly larger group of teachers in the sample did not agree that web practices enhanced learning. The number of postings on the school webpage was made by just 20% of the staff indicating that the school target of achieving integrating technology with learning still had some distance to travel.

7.3.7 Summary School 5

This school was the only school where the assistant principal was also present at the interview because of that person's expertise with technology. The school was one of contrasts, with the technology vision articulated by the principal only apparent in some of the teacher perceptions and some class practices. One of the causes of the disparate technology implementation may reside with the person leading the technology integration. The assistant principal led the technology strategy at the school and, whilst committed to the technology cause, was unable to devote enough time to technology implementation owing to other school commitments.

The use of computer applications by the students at home was notable in gaming software and multimedia use was also higher than for the total student sample. Some of the applications that would also be used for school-related work were less than the total sample. Computer use at school also showed slight differences from other schools. The use of web applications and databases in year 8 coupled with the decreased use of presentation software indicated a different focus for strategic technology integration. The use of computer applications by year 10 at this school was lower than the total sample mirroring teacher classroom technology practice.

The teachers' skills with computer applications are similar to some of the other schools. Approximately 40% of the teachers surveyed in this school identified themselves as skilled with some multimedia and web applications. It is uncertain whether this percentage was typical of the school's entire teacher population and examining the use of computer applications by both years - one would suspect not. The proficiency of this small group, however, influences some of the perceptions and practices about computer applications and school web presence. It would also appear that the small group of teachers had some influence on the greater number of postings on the school web page from 2005 to 2006. The school's eFactor indicates a slight increase in the learning complexity of the posting reflecting the work of the small group of teachers as well as the fledgling technology strategy.

7.4 School 9

7.4.1 General Description

School 9 is a large single-sex school for girls in the metropolitan area, with approximately 900 students. The school, opened and operated by a religious order of nuns, delivers a secondary curriculum for year 7 through to year 12. This school has a long tradition and was made a regional high school for girls in the early 1960's. Demand for female single, sex-schools is high in the area and this school has maintained a reputable standard in the year 12 post-compulsory exam results for a number of years. As a consequence enrolments at the school are strong despite competition from several government high schools.

The school is situated on a large sprawling block and shares the site with a primary school, church and residences for nuns and priests. Recreation areas seem adequate for a school this size and they are a combination of turf and concrete with some basketball courts as well. Other areas for sport are a short distance away and these parklands and ovals are only used for scheduled classes. The school offers a broad curriculum and has specialist areas in hospitality and creative arts with provision for students to attend a local technical and further education college for courses in industrial arts and entertainment.

The school has chosen to equip three rooms as computer laboratories. The cost of refurbishing rooms and decreasing the number of general learning spaces were the main influences behind the decision to limit computer provision. The school has increased computer access by laptops on trolleys and a wireless network despite the principal's concerns about security. The computer laboratories have 26 computers in each, with one set of computers just purchased and the others approximately two years old. The rooms are configured with the computers around the walls of the classroom and tables in the middle. Data projectors are mobile and available from the library. The printing arrangements are such that students can pay for printing in the library and teachers are able to print work from the laboratories in the staff room. The computers are networked and the data are stored on a central curriculum server. The staff currently has access to 11 laptops to use in the classroom and approximately 75% of the school is covered by wireless broadband connection. The library, too, can be used as a computer laboratory and there are 43 computers all linked to the same network with a printer and scanner available as well. The computers in the library were the oldest in the school and the school had initiated a tender process to replace them with a combination of desktops and laptops.

7.4.2 General Description-Students

The community surrounding the school is characterized by its large ethnic composition. In the 2004 enrolment, 56% of students were identified from a Language background other than English and less than 1% from an indigenous heritage. In years 8 and 10 there was a total of 307 students and 180 students (59%) accepted the invitation to participate in the survey. Only 54 (34%) of this number were from year 8 as there was an excursion on the day nominated by the school. Overall 85% of year 10 participated in the survey.

All but one of the students involved in the survey had access to a computer outside school and it is described in Table 7.5.

Table 7.5: Student Use of Away from School Computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	100	97
Able to access the Internet	96	97
Used for school work at least half the allocated time	90	99

The data indicate high rates of computer access and use. Year 10 followed the trend of most survey schools with a greater use of the computer for school purposes than year 8. The most popular applications used on these computers, seen in Figure 7.17, were Internet, word processing/spreadsheet and multimedia. This school also had the highest incidence of chat use and used programs such as Dreamweaver which was recorded in the 'other' category. Most of the students preferred to use the away from school computer to the school computer.

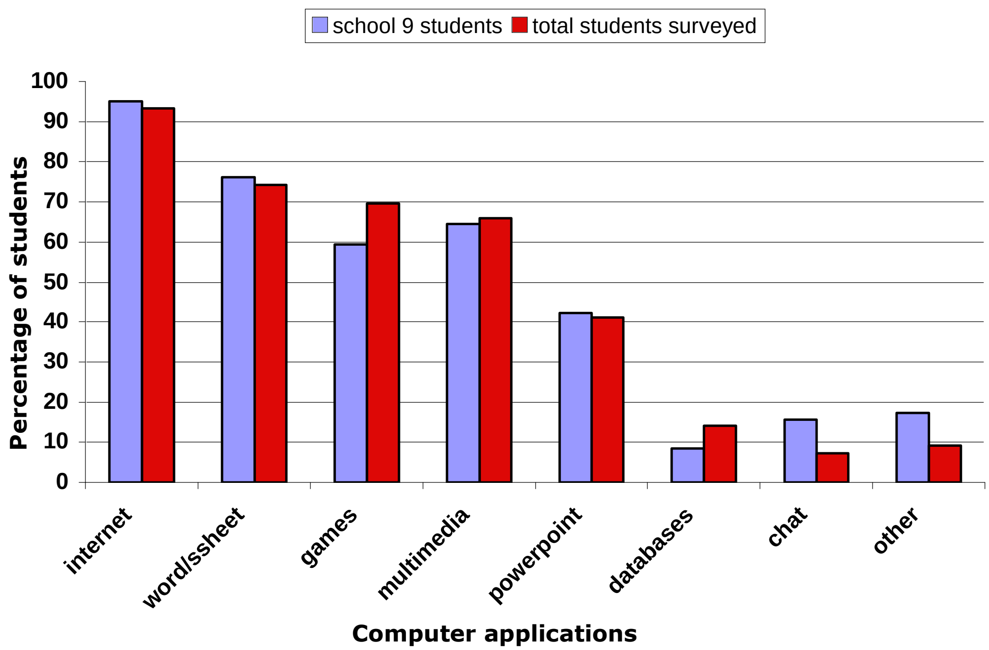


Figure 7.17: Comparison of school 9 students to the total number of students surveyed in the use of computers away from school

The limited computer resources have impacted upon the school's strategic technology plan evident in the use of computers at school by teachers for student learning. The use of the computers differs from year 8 to year 10 and can be seen in Figures 7.18 and 7.19.

Compared to the total student sample, year 8 students at this school used computers more for library research, programmed curriculum units and single lesson work by teachers when needed. In year 10 there was a slightly higher use of computers for programmed units. These particular class use patterns reflect the school's technology strategy of maximising the limited computing resource. The focus appears to be concentrated at the year 8 level with computer use as an integral part of their subject structure. The computer application use on the school computers for each year, shown in Figures 7.20 and 7.21, displays a similar pattern for the two years.

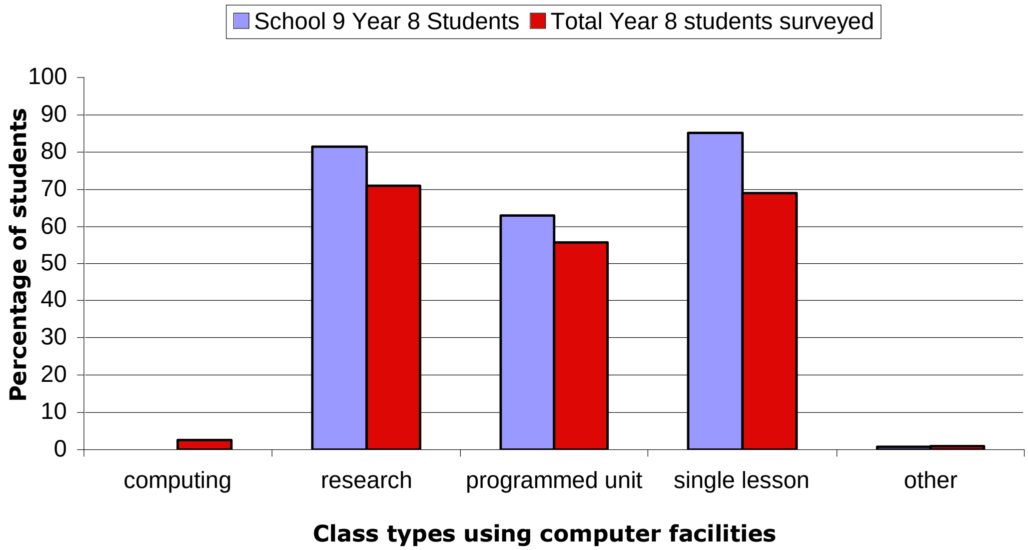


Figure 7.18: Computer use by class activity for year 8

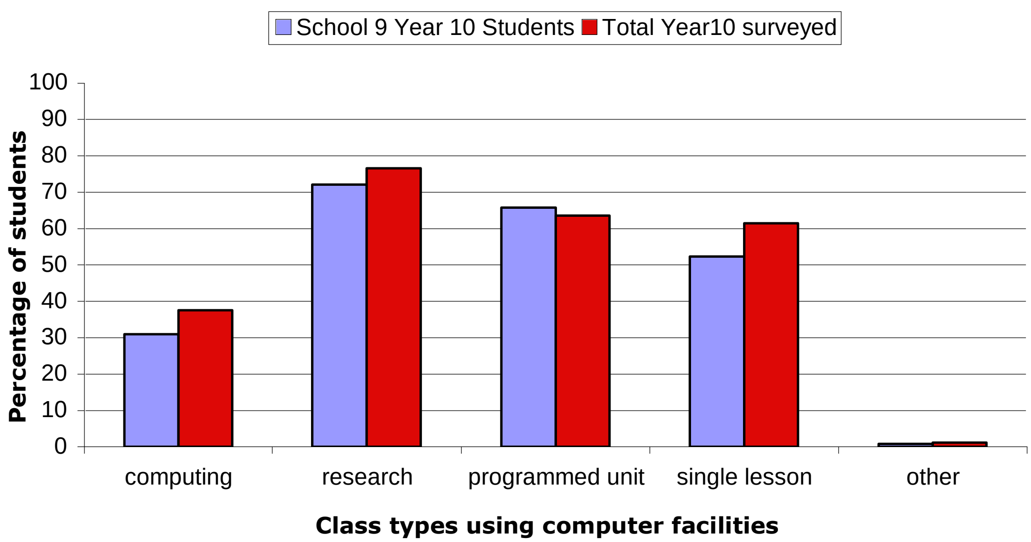


Figure 7.19: Computer use by class activity for year 10

In year 8, powerpoint use was higher than for the total student cohort and there was no recorded use of multimedia applications or email. In year 10 the use of databases, word/spreadsheet, multimedia, software design and email was lower than the total year 10 sample. These usage patterns are somewhat perplexing as in the interview with the principal, the use of powerpoint as a technology strategy was confirmed as was the impression that certain teachers were extensively using computer technology. The principal's understanding of extensive technology use may be interpreted as teachers using a wide range of technologies to demonstrate to their classes and the lower use of powerpoint in year 10 was perhaps a result of restricted access to computers.

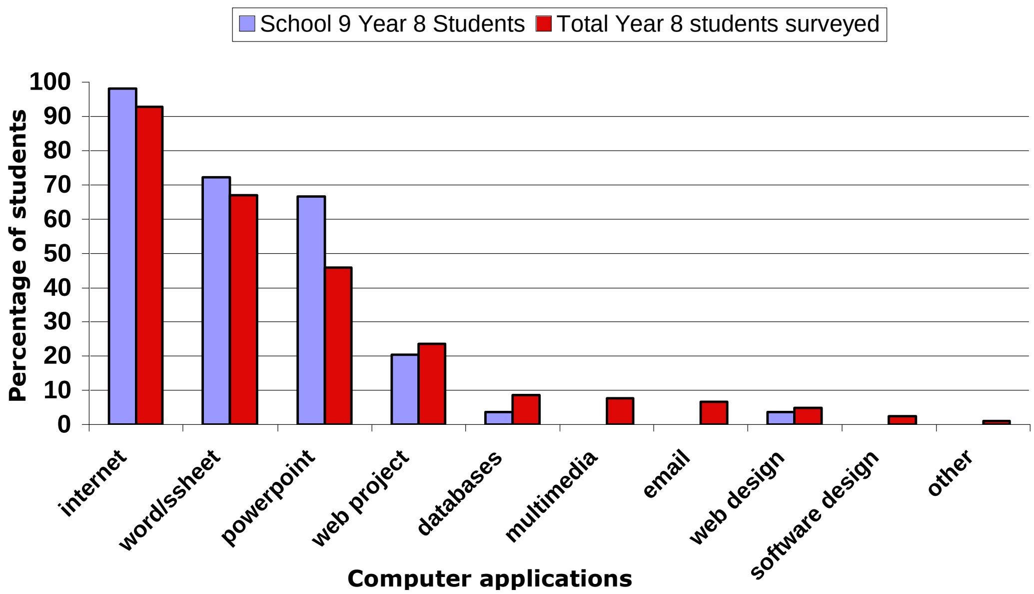


Figure 7.20: Year 8 school computer applications use

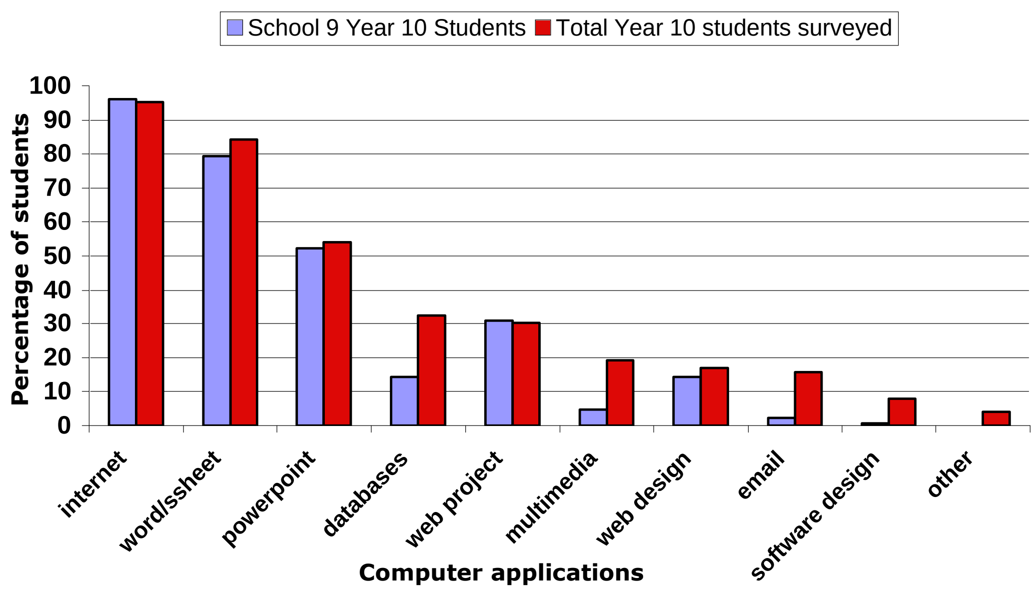


Figure 7.21: Year 10 school computer applications use

7.4.4 Relationships between variables in the student model

Similar to other schools in the study, the model explaining Online Usefulness was stronger with 27.8% of the variance explained by the contribution of the independent variables of Computer Applications, Relevance and Positive Learning. The standardised beta coefficient, in Figure 7.22, shows that Relevance was the primary contributor. Relevance and Positive Learning were significant with p =.000, while Computer Applications and Computer Use were not significantly related to

Online Usefulness. The established path supplements existing evidence that students find a currency in using the Internet as part of their daily interaction and highlights the difference between the students' use and experience of computers outside and at school. A comparison between Figures 7.17, 7.20 and 7.21 demonstrates that students have a much wider experience of computer application use outside school. Student use of web creation applications and chat was the highest of any school in the survey.

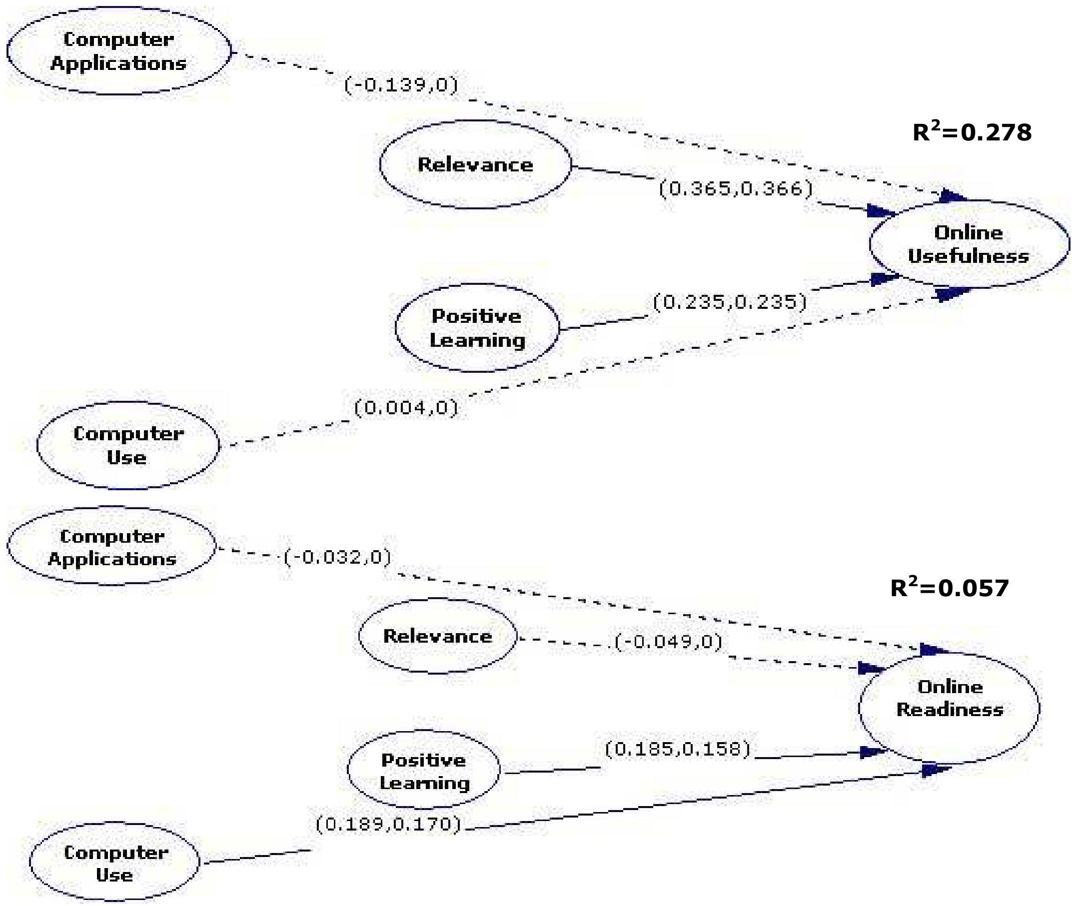


Figure 7.22: Path diagrams for students at school 9 showing relationships with Online Usefulness and Online Readiness

For the model explaining Online Readiness, 5.7% of the variance was explained by the contribution of the independent variables Computer Use and Positive Learning. Consistent with paths established in the student models for other schools, the small percentage of the variance explained serves to establish students as online users rather than waiting to be connected to it.

7.4.3 General Description-Teachers

This school had the second highest participation rate of teachers. From a total of 65 teaching staff, 50 teachers (77%) accepted the invitation to participate in the survey. There were predominantly more females on staff and it is reflected in the survey group with 44 females and 6 males participating. The teachers were drawn from the key learning areas of English (10 teachers), Mathematics (7 teachers), Science (4 teachers), Human Society in its Environment (12 teachers), Technological and Applied Studies (6 teachers), Creative Arts (3 teachers), Physical Education (4 teachers), Languages (2 teachers) and Support (2 teachers). Again the large staff representation meant that all curriculum areas were well represented. The comparison of school employment to total years of experience replicates the pattern in some of the other schools where there has been a sizeable intake of experienced teachers in recent years. The time employed at the school for these teachers were; 1-5 years (20 teachers), 6-10 years (9 teachers), 11-20 years (17 teachers) and 21-30 years (4 teachers). In comparison to the total years of experience shown in Table 7.6, there were high numbers of teachers with more years of experience.

Table 7.6: Total Years of Teacher Experience for Participating Teachers in School 9

Years of Teacher Experience	Number of Teachers
1 – 5	5
5 – 10	4
11 – 20	22
21 – 30	15
31 – 45	4

The number of experienced teachers in this school may, as in other schools, impact on technology use with less time for technology familiarisation as well as their reticence in using the technology. This lack of technology familiarisation makes teachers reluctant technology users (Valmont, 2003) as teachers are apprehensive about making mistakes with the technology thereby making them appear inadequate in their specialised subject area. It is interesting, however, that all but one of the teachers had a computer at home and all but one of those computers were connected to the Internet.

The computer applications for which the majority of teachers considered themselves 'ok' to 'very good' were word processing, presentation software, desktop publishing and spreadsheets. In comparison to the total teacher sample, seen in Figure 7.23, this school's teacher ratings were slightly lower with the exception of spreadsheets. The claimed proficiency with these applications is also reflected in the teachers' opinions about the use of applications to stimulate learning. Only two applications, web searching and word processing, were rated by teachers as stimulating learning and, as with multimedia, their opinion was divided. The majority of teachers had not used the remaining applications in class. This may mean that the teachers do not know how to use the application or it may mean that the teachers do not attribute any learning stimulation to that application. The teachers who had used the applications were divided in their opinion about how much the applications stimulated learning which was evenly spread from a small amount to very good.

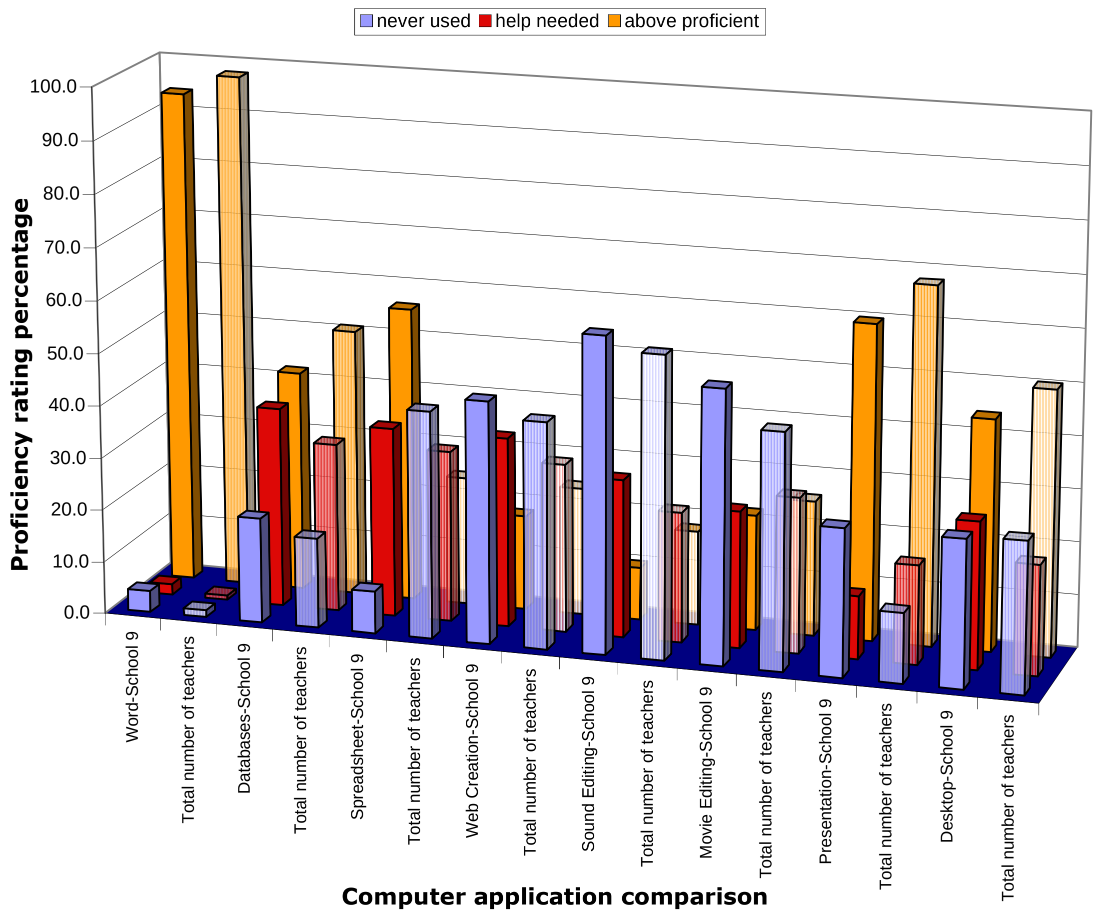


Figure 7.23: School 9 teacher proficiency rating compared to the total teacher sample

7.4.5 Relationships between variables in the teacher model

As with School 7, a relationship could not be established between the independent variables and the dependent variable Online Usefulness. However, consistent with the teacher models for other participating schools, a higher proportion of the variance in Online Readiness is explained compared with Online Usefulness. The model for Online Readiness is shown in Figure 7.24 and indicates that 31.1% of the variance explained by the contribution of the independent variables of Computer Use and Relevance. Both variables were significant with

p = .000. The established paths provide additional evidence about teacher uncertainty as to the contribution of the online environment for schools and was reflected in their perception and use of computers at school. The current development of the teacher's technology skills and the associated application to school opens a window to teacher thinking about the relevance of using computers and the implication of an online environment.

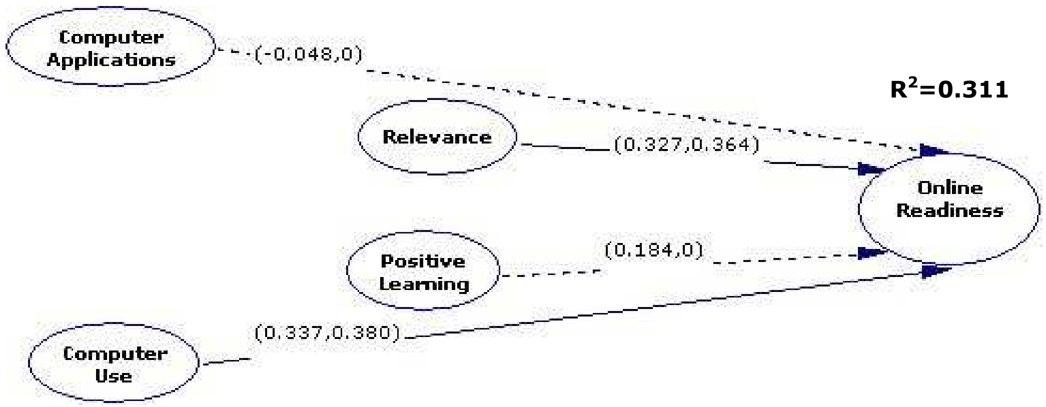


Figure 7.24: Path diagrams for teachers at school 9 showing relationships with Online Usefulness and Online Readiness

The primary contribution of computer use is not unexpected in this school given the limited number of computers and, as the principal said, the clamoring of teachers to get more. Whilst most of the teachers have Internet capable computers at home, it is not surprising that no significant relationships between the independent variables and Online Usefulness given the small amount web related activities at school apart from Internet searching.

7.4.6 eFactor for School 9

The eFactor for this school (18) places it as by far the highest of the middle group. There were 19 learning postings made in 2005 that rose to 170 postings in 2006. Approximately 30% of the teachers were involved in posting the learning material. The results indicate the work of a small group of teachers whose commitment to computer use was evident in year 8 but it also shows a possible outcome for the technology direction at the school. As previously explained, this school has achieved excellent examination results for many years owing to the learning emphasis at the school actively led by the principal. Another attribute alluded to by the principal was staff dedication and the willingness of a few staff to champion technology. Staff training sessions in technology had been implemented for the past two years and although skill development had been the focus, there appears to be a movement towards a more integrated solution.

7.4.6 Summary School 9

The students at this school appear to utilise computer resources more away from school than at school. The use of the computer for year 10, in particular, was lower at school than the total student cohort. However, the non-school computer was used by this group (99%) for school work at least half the available time. Whilst the principal was convinced that the student work generated on the computer was evidence of the teachers' technology implementation, the actual school computer use appeared to contradict this.

There are some factors inhibiting the integration of technology at this school. The relative paucity of computer resources at this school when compared to other schools in the survey has hampered both student and teacher access to and use of the computers. The focus of technology as a competence in teacher training has done little to interface technology with the strong learning culture at the school. There are some encouraging signs, however, indicated by the use of computers in year 8 and the number of posting on the school web page. The use of the school web interface as a learning interchange was growing in popularity, with signs that it may be an increasing focus in teacher technology development.

7.5 School 10

7.5.1 General Description

The only year 7-10 school in the survey, school 10 is a medium-sized single sex school for girls with an enrolment of approximately 600 students. This school, originally owned by a religious order, now owned by the Sydney Archdiocese, has a long history in the area and, as a regional school, has established a firm tradition with its ex-students. Enrolments remain steady despite strong competition from government and other private schools in the area.

The school is situated on a large block and shares the facilities with another high school, primary school, parish hall, church and priest residence. Commercial and small business precincts of a small city surround the school block. The school buildings are compact which minimises movement between the classrooms.
The school offers specialist learning areas in creative arts, technological and applied studies and hospitality. The recreation areas for this school are compact, consistent with the school design. These areas are either concrete or asphalt with shade provided by sails and some trees. There is a nearby park that is used for some recreation, class and physical education but for more vigorous activities the students need to be transported to ovals.

The school has three computer laboratories with one just recently completed. The new laboratory was built as an alternative to employing an additional teacher. The decision was made after consulting with staff who were prepared to maintain their current workload to gain increased access to computers. Each laboratory has 27 computers all networked with the data stored in a central curriculum server. Each has a networked printer and a data projector, and one room has a scanner. Currently half the school has wireless connectivity and there are five wireless laptops for staff to use in the wireless classrooms. The library can also be used as a computer laboratory with 50 computers and two printers all networked to the central curriculum server. All computers are relatively new and the school management plan is to replace the computers every three years.

7.5.2 General Description-Students

The community sending their children to this school comprises people from diverse cultures. The 2004 enrolment had 56% of its students identified from Language backgrounds other than English. In years 8 and 10 there was a total of 331 students and 139 students (42%) accepted the invitation to participate in the survey, 18 students from Year 10 and 121 students from year 8. The day nominated by the school for the conduct of the questionnaire was also a day where the majority of year 10 was out on excursion.

All students who participated in the survey had access to a computer away from school, a fact that surprised the principal who thought that there were quite a few students that would not have such access. Access and use of the computer is described in Table 7.7.

Table 7.7: Student use of Away from School Computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	98	100
Able to access the Internet	97	100
Used for school work at least half the time	82	87

Whilst all year 10 indicated unimpeded access to the computer and the Internet, the data may be somewhat misleading as just 23 students participated in the survey. The majority of Year 8 students indicated high rates of access and Internet use and both years usage of the computer for school purposes was amongst the lowest of the ten schools. The most popular applications were Internet use, word/spreadsheet, multimedia and games, (Figure 7.25). The high computer games use, a trait normally associated with boys, illustrates that there are aspects of computer games that interest girls (Isbister, 2006). Without competition from boys, many girls find computer games just as appealing as boys (Jenkins & Cassell, 1998; Jacko & Sears, 2003) and are able to explore the gaming world. Even though these games are played outside of school, the fact that the girls are able to discuss their computer play away from boys at school could encourage their practice. With the exception of databases, the usage pattern of the students was either slightly above or the same as the total student sample. The usage pattern demonstrates the popularity of the applications with these students, a fact noted by the school principal and belies the traditional belief that girls do not like computers and that they do not engage with games.

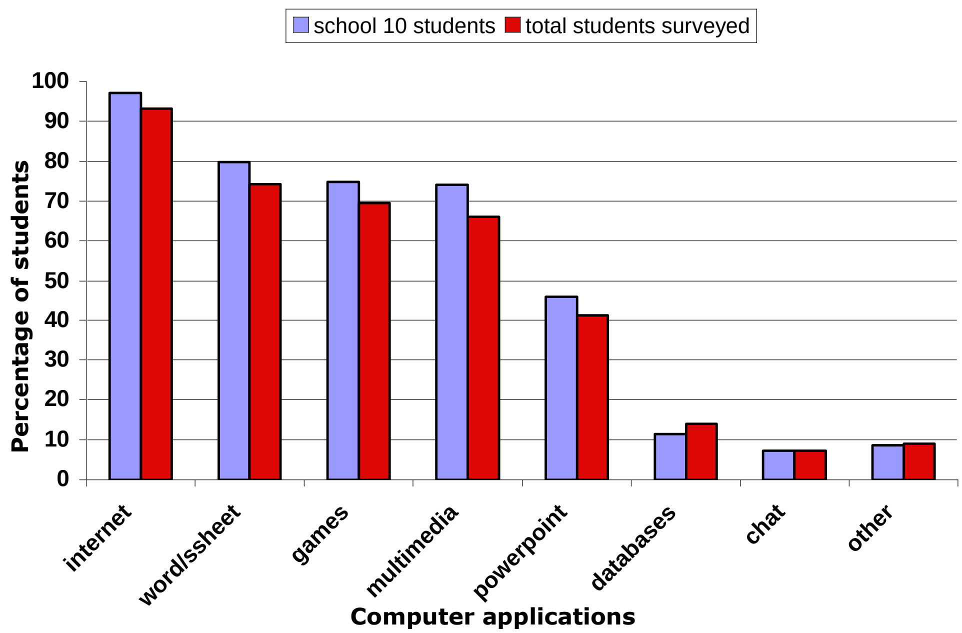


Figure 7.25: Comparison of school 10 students to the total number of students surveyed in the use of computers away from school

Year 8s use of the library computers is well above the general usage pattern and the use of computers for certain topics is approximately equal. The year 10 class use of school computers supports the principal's view that school computer facilities are in much demand. Figures 7.26 and 7.27 display a usage pattern that is above for all categories, except other, in year 10 and above for library internet research in year 8. In year 10 it appears that teachers have strategically integrated computers for certain topics and there is also use of computers when needed in single classes.

The higher use of computers by teachers in various curriculum areas in year 10 is confirmed in greater application use. Figure 7.29 indicates higher levels of usage for all applications except email and other. This pattern of usage reflects a wider deployment of applications for the various curriculum areas. Correspondingly, Figure 7.28 shows year 8 usage of applications is only slightly above in the areas of Internet, word processing/ spreadsheet, web projects and web design. This may mean that lack of access to computer facilities, indicated by the principal, required prioritising the computer resources for the more senior students.

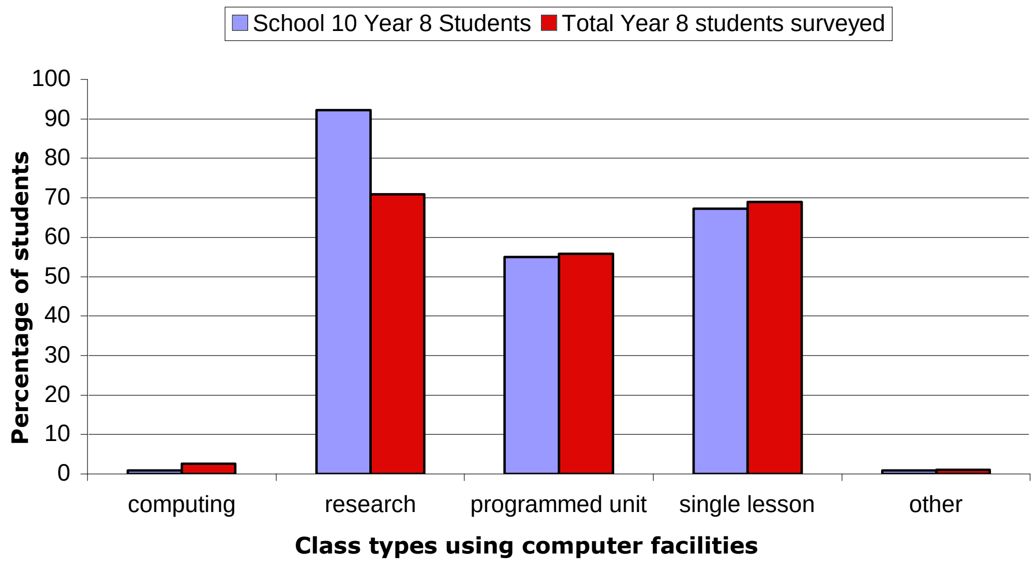


Figure 7.26: Computer use by class activity for year 8

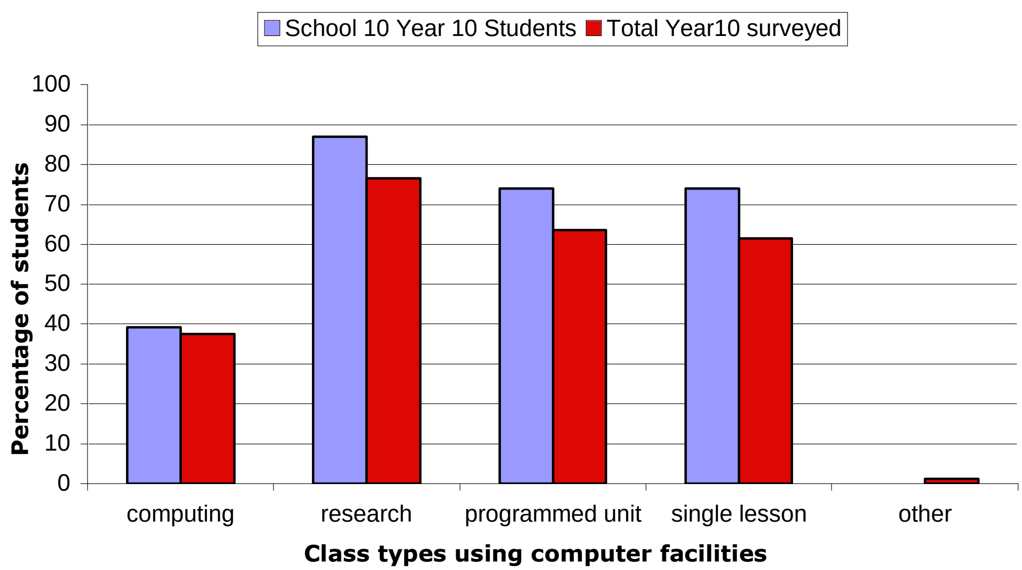


Figure 7.27: Computer use by class activity for year 10

Interestingly, given the increased computer activity, only one subject recorded a significant number of students with a perception that computers made a positive impact. One third of the students indicated that computers made a positive impact in Technological and Applied Studies. The numbers for all other subjects was below 10%.

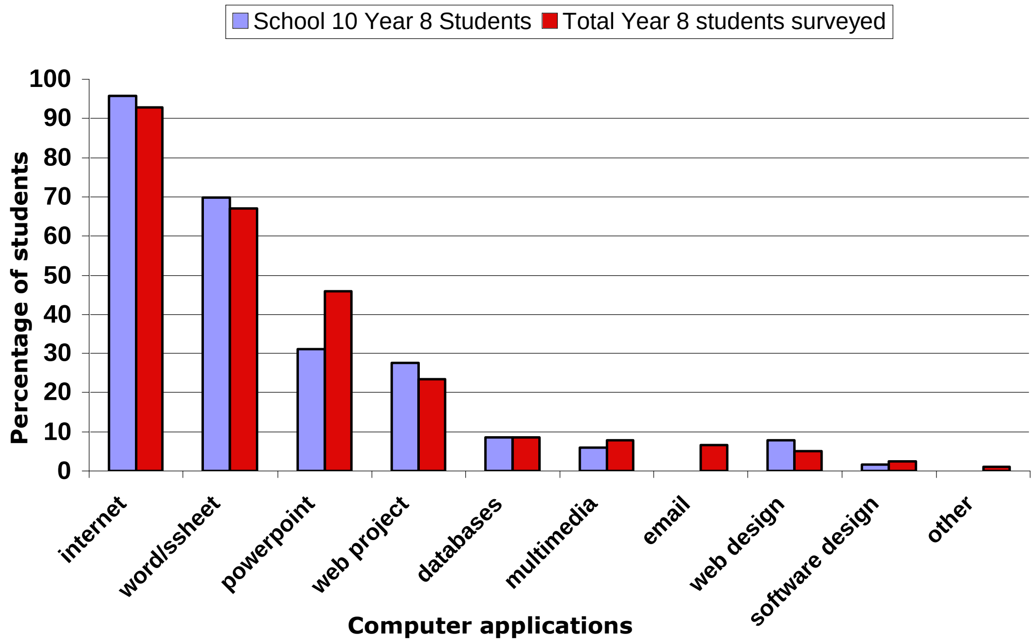


Figure 7.28: Year 8 school computer applications use

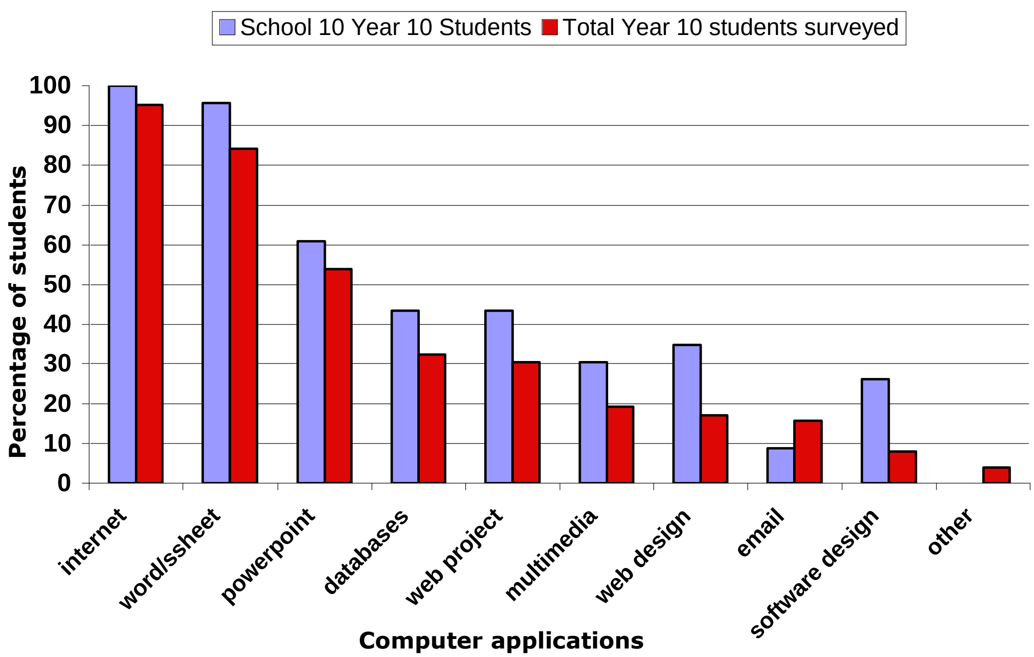


Figure 7.29: Year 10 school computer applications use

7.5.4 Relationships between variables in the student model

The model explaining Online Usefulness shows that 29.8% of the variance was explained by the contribution of the independent variables Positive Learning and Relevance, seen in Figure 7.30. The standardised beta value identified Positive Learning as the primary contributor and both independent variables contribution were significant with p = .000. This established relationship is consistent with the overall model and reflects both the students' away from school computer usage pattern and the research of Oblinger & Hawkins (2005), Earle (2002) and Swan et al. (2005) who are strident about the engagement students can find in the virtual world.

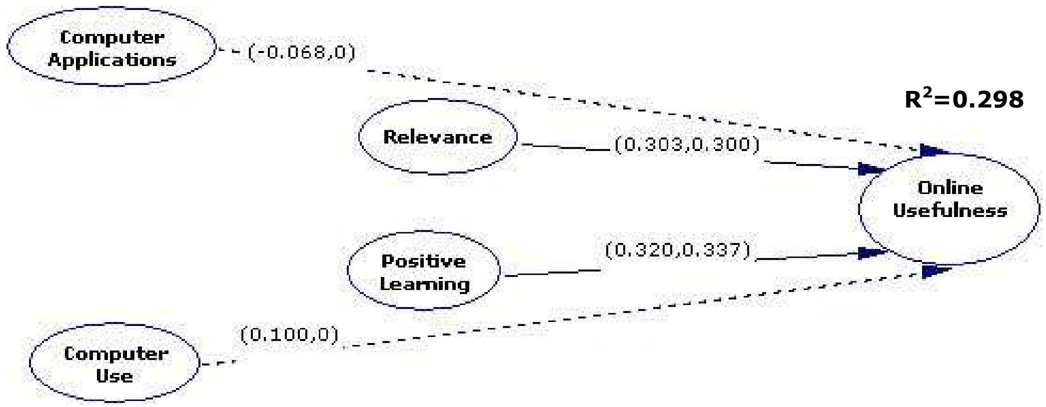


Figure 7.30: Path diagrams for students at School 10 showing relationships with Online Usefulness and Online Readiness

The independent variables could not form a significant relationship with the dependent variable Online Readiness. This finding is consistent with two other schools and in the seven other schools where a significant relationship could be established with Online Readiness, the explained variance was less than 7%. This result demonstrates that students are interacting in an online environment and not waiting for the technical ability, computers or Internet connection to participate online.

7.5.3 General Description-Teachers

There were 49 teaching staff at this school and 12 teachers accepted the invitation to participate in the survey, making this the smallest sample with one other school. Whilst the size of the sample limits the usefulness of the data, the data itself were not inconsistent with the overall findings and are therefore appropriate to report.

With the majority of staff female, it is not surprising that of the teachers participating 10 were female and this proportion reflected the general participation trend. The teachers were drawn from the key learning areas of English (3 teachers), Science (2 teachers), Human Society in its Environment (3 teachers), Technological and Applied Studies (2 teachers), Physical Education (1 teacher) and Languages (1 teacher). There is an even representation across the humanities and sciences from this small group of participating teachers. The time employed at this school for the participating teachers were; 1-5 years (7 teachers), 6-10 years (3 teachers) and 11-20 years (2 teachers). These data are compared to the total teaching experience of the participating teachers shown in Table 7.8.

Table 7.8: Total Years of Teacher Experience for Participating Teachers in School 10	
Years of Teacher Experience	**Number of Teachers**
1 – 5	4
5 – 10	1
11 – 20	5
21 – 30	2

Experienced teachers new to the school may not receive the same computer skills training in staff orientation programs as well as in ongoing technology skill development. The principal did say in the interview that the school's technology strategy targeted teachers who were relatively new to the profession. This may mean that experienced teachers are assumed to have the necessary technology skills. All the teachers had a computer at home and nine teachers had their computers connected to the Internet.

The computer applications which the teachers rated their proficiency from 'ok' to 'very good' were word processing, databases, spreadsheets, desktop publishing and presentation software. As can be seen in Figure 7.31, the proficiency claimed with spreadsheets and sound editing were higher than those of the total teacher sample.

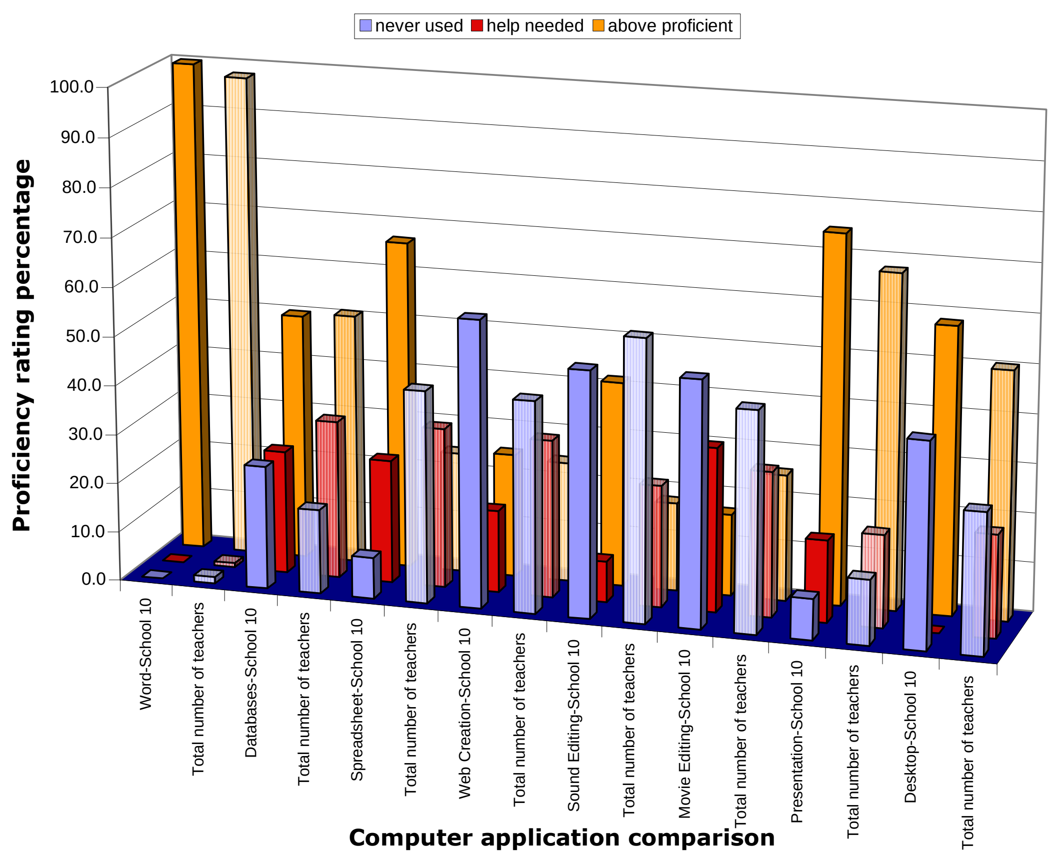


Figure 7.31: School 10 teacher proficiency rating compared to the total teacher sample

The skill proficiency may be a result of specific teacher professional development, targeting those applications, that the principal alluded to. When asked to rate the applications for their propensity to stimulate learning, teacher opinion was split. There was unanimity that web searching and word processing enhanced learning. Whereas with the majority of the remaining applications approximately half the teachers had not used the application but the remainder considered the applications did stimulate learning. This dichotomy in the sample group, replicated in other schools, may be as a result of teacher's specific skills in computer applications or related to reluctance in using technology by more experienced teachers. However, the principal did acknowledge that whilst some of the older teachers were not prepared to touch the computers, there were many teachers eager to utilise the technology.

7.5.5 Relationships between variables in the teacher model

A simple correlation analysis is presented as there were insufficient teacher responses, taken as less than 20, to perform regression analyses. The correlation analyses were used to test the strength of the relationship between the variables. The analysis results, shown in Table 7.5 indicate highly significant correlations with two asterisks and significant correlations with one asterisk.

Table 7.5: Correlations showing relationships between the independent variables for teachers in School 10

School 10	N	Use	Application	Relevance	Positive
Application	12	.630*			
Relevance	12	.409	.741**		
Positive	12	.471	.413	.102	
Readiness	12	.549*	.652*	.171	.763**
Usefulness	12	.154	.267	.236	.585*

The highly significant correlations between Computer Applications and Relevance, Positive Learning and Online Readiness and Online Readiness and Online Usefulness indicate the strong focus of some of the teachers at this school to computer integration. The various training and in-service time devoted to computers may well have an impact on this group of teachers.

7.5.5 eFactor for School 10

The number of postings on the learning section of the school web page was 35 in both 2005 and 2006. There were changes in the type of postings and the number of teachers making the postings. The change in postings, Appendix 9, indicates that in 2006 teachers were posting material that involved some learning sequences as opposed to posting information notices in 2005. The number of teachers posting material also grew from 15% to 28%. These two factors have contributed to this school's placement in the middle eFactor group with a score of 4. The growth in the number of teachers using the web page accentuates the focus that has been placed on technology at the school. The change in the type of postings demonstrates that a small group of teachers have started to integrate technology into a web-learning program. The difference in the type of postings may also be a result of the increased computer momentum, evident in year 10, that is taking place at the school.

7.5.6 Summary school 10

The use of computing facilities by various subjects for integrated units and student use of computer applications indicate a growing movement to the adoption of technology within the school. Use of computer facilities for year 10 classes demonstrated a willingness by teachers to incorporate technology into the curriculum. The shift to integrate technology into subject units, along with the principal's comment that the school was doing more than just powerpoint, indicated that the use of a singular competency based focus may have been the previous technology strategy. The use of such a technology strategy has inhibited the technology deployment into the curriculum in previous years. The principal alluded to using the year 10 computer competency assessment as one benchmark to develop teacher computer in-service as well as taking an active interest in how teachers were using computer laboratories and facilities.

The teacher utilisation of the school web page as a learning interface was limited at the time of the web evaluation. There was, however, an increase in the number of teachers posting material and an increase in material that required a learning sequence. The increase in material that required the use of higher order thinking by students is indicative of teacher understanding about the use of technology to enhance and engage student learning.

7.6 Identifying features of the Medium eFactor Cluster and Summation

The four schools belonging to the medium group have defining characteristics that underpin their categorisation. The categorisation requires more than just analysing the available computer resources and teacher technology skills. Whilst adequate resources are certainly needed, some of the schools portrayed had more computer resources yet their eFactor was less than schools with fewer laboratories and computers.

The same could be said for the teachers' skills with computer applications. Whilst the knowledge of certain applications is beneficial from a curriculum sense, when the application is treated as a competence it may simply be used as a means to an end. This approach to teacher in-service, a characteristic of the low eFactor group of schools, proved ineffectual in sustaining the integration of technology into the curriculum program. Whilst there were some similar approaches adopted in the medium eFactor schools, the approaches were supplemented with an explicit focus on more specific learning methods incorporating technology. There has been an unintended effect of merging the two approaches by a small group of teachers in each school who have initiated real change for a technological infused pedagogy. The effect on online learning by such a small group of teachers has been particularly noticeable in School 9. The eFactor for this school was much higher than the other three schools. The higher score indicated that the teachers involved are using pedagogy to compile the learning material and are using the web as a focal point for their teaching. The online teaching practice for this school was confined to a small group of teachers which forms one of the distinctive characteristics of the medium eFactor group.

Certain similarities have emerged in the discussion of the analyses for the four case study schools, which define this group. There was evidence of teachers integrating technology into the curriculum in either year 10 or year 8. This involved the use of more than one application that was higher than the total student sample (shown as zero on the vertical on the vertical 'Proficiency Range' axis in Table 7.32) and more use of computer resources for integrated unit teaching or classroom work. Overall the teacher application proficiency is lower than the total teacher sample in more common applications such as word and spreadsheets. The proficiency is higher in web and multimedia applications. These proficiencies may also reflect the focus of this group of teachers around utilising applications that engage students more (Erwin & Rieppi, 1999).

The method of utilising computer application, in the medium eFactor schools, was also present in the learning sections of each school's web page. There were also indications of a growing tendency to use the web applications by teachers in each school. These practices highlighted the perceptions of some teachers that web applications as well as multimedia applications enhanced learning. The deployment of learning on the school web page was not part of the schools' technology development identified as the school strategy by the school principals. The school strategies were focused on a using more than one application in teaching programs used in the classroom. The school leadership actively monitored the technology strategy for each school but there was not an explicit link to the strong learning focus vigorously promoted by each principal.

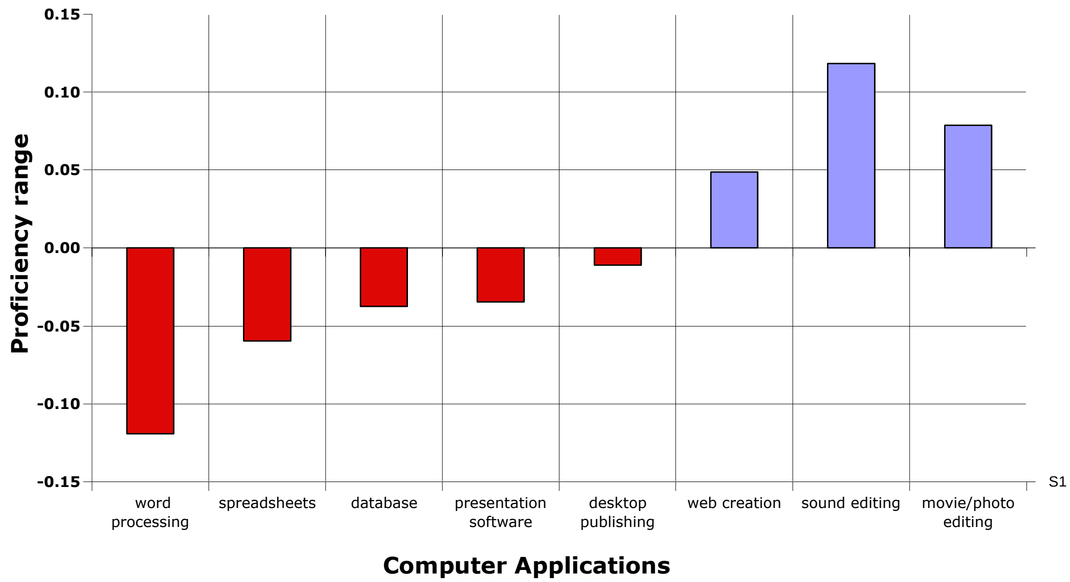


Figure 7.32: Comparison of the means of the medium eFactor teacher group with the total number of teachers in computer application proficiency

At the time of the data collection, a momentum towards the wider adoption of technology-infused programs existed in each of the four schools. This was evident in school strategies utilising more than one computer application, greater use of the school web page and more teachers using multimedia and web creation in their teaching. These three characteristics differentiated the low and medium eFactor groups.

The achievement of greater technology use depends upon more teachers making stronger links between technology and learning. More importantly, however, school leaderships need to move beyond acknowledging such practices and placing undue importance on skills competency as almost the sole indicator that technology is present in the school teaching programs. The school leadership should further strategise, including appropriate teacher in-service, the educational importance of linking learning with computer technology that also involves a web interface.

Chapter Eight, focuses on schools that have demonstrated a more consistent approach to a technology-infused curriculum and web page interface. The chapter examines the characteristics of the student and teacher computer practices and perceptions as well as the strategies employed to achieve a greater learning focus in each school's learning deployment. The chapter concludes with characteristics common to schools in the high eFactor group.

Chapter Eight: The High eFactor Group

8.1 Introduction

The case study descriptions and analyses of the groups identified with the eFactor are completed in this chapter. The previous two case study chapters have focused on the low and medium eFactor groups respectively. The perceptions and practices of the students and teachers, in the low and medium eFactor groups, about computer use in a learning context were described. The strength of the linear relationship between the independent and dependent variables were established for those groups.

This chapter adopts a similar format to the previous two chapters, allowing for the comparison of similarities and differences between the different eFactor groups. The two schools identified in the high eFactor group, are described by location, size, school facilities, student and teacher population and the curriculum offered at the two schools. Given the nature of this study specific information about each school's computing facilities and arrangements are also included in this chapter. As with the previous two eFactor groups, the relationships between the contextual factors were evaluated through regression analyses at the individual school level. Consistent with the overall model, the purpose of the analyses was to determine the strength of the linear relationship between the six independent variables and the dependent variable of the eFactor. The significance test results are outlined in Appendices 15 and 12 for students and teachers respectively.

Teacher computer practice and schools' strategic technology direction within the high eFactor group are confirmed by interviews with the principals of those schools. Following the same process used for the other groups of schools, the qualitative analysis package NVivo was used to tag the responses similar to the construct descriptors used for the development of the student and teacher scales. The trends emerging from the grouped data were examined and related to the quantitative data.

The chapter concludes with the similarities and differences emerging from these two high eFactor schools. In particular, the common characteristics of computer practice for students and teachers, both similarities and differences, are addressed. The comments from the two principals are synthesised to identify common areas of school direction for this group. Finally the distinctive features from all the analysis levels are collated to form the basis of identification of schools in the high eFactor group.

8.2 School 1

8.2.1 General Description

School 1 is a medium sized metropolitan single sex school for boys with a total enrolment of over 600 students. The school, opened and operated by a religious teaching order of brothers, delivers a secondary curriculum for years 7 through to 12 and has developed a strong tradition with ex-students from both inside and outside the local enrolment drawing area. This tradition of strong academic results and school identity has prompted ex-students to send their sons to this school as well as attracting students who miss selection at either Government Selective High schools or the private independent high schools.

The school is situated on a block with a church, primary school and residential buildings for brothers and priests. The school site is compact resulting in minimal movement between classrooms for students and teachers at the change of lesson. Apart from the general purpose learning areas, the school has industrial arts, hospitality, visual and entertaining arts areas. Recreation areas for a school of this size are not extensive and consist mainly of asphalt and concrete covered spaces between the building complexes. There are ovals nearby for students to practise and play sport on.

This school has opted for fewer computer laboratories and preferred to have the flexibility to operate laptops on the network anywhere in the school via a wireless environment. There are three computer laboratories with 28 computers in each. The laboratories are networked to a central curriculum server and the average age of the computers is two years. Each of the rooms has a networked printer and scanner as well as a data show projector. The configurations of the rooms are similar with computers around the external walls of the rooms and working space provided in the centre. There is also a multi-purpose room with 15 networked computers. This room is designed to be re-configured to suit the curriculum requirement of the teachers and students depending upon the type of learning involved. The computers in this room are newer than those in the rest of the school. The school has chosen not to configure the library as a computer laboratory and has only terminals for students to search the library database. There is a dedicated print server in the library, however, and printing is done through a debit system on a student card. Currently half the school has wireless coverage and there are plans to make that network accessible to all areas of the school.

8.2.2 General Description-Students

In its 2004 enrolment, a high percentage of students were from an Anglo-Saxon heritage with only 11% of students identified from a Language Background Other Than English and no indigenous students identified. In years 8 and 10 there was a total of over 160 boys however due to an administrative misunderstanding only 15 students (9.2%), five students in year 8 and 10 students in year 10, accepted the invitation to participate. This was the smallest sample from all the schools in the survey and severely limits the usefulness of the information from this school in the sample. However, the findings about student practice are reported given the nature of this school's particular web presence.

The students from this school all had access to an internet-capable computer away from school. They were able to use this computer either all or most of the time. The usage pattern of the computers for school purposes in a one week period was identified as half the available time or less for the year 10 students and half the available time or more for the year 8 students. The most commonly-used applications for both years 10 and 8 were games, multimedia and word processing/spreadsheet. A total usage pattern for the students of this school is compared to the rest of the students in the sample in Figure 8.1. Notable in the computer use was that the students of this school used their computer in music composition, web design and web maintenance. This usage, although from a small sample, is not atypical generally and is recorded in the 'other' category. Most students preferred to use this computer to the school computer.

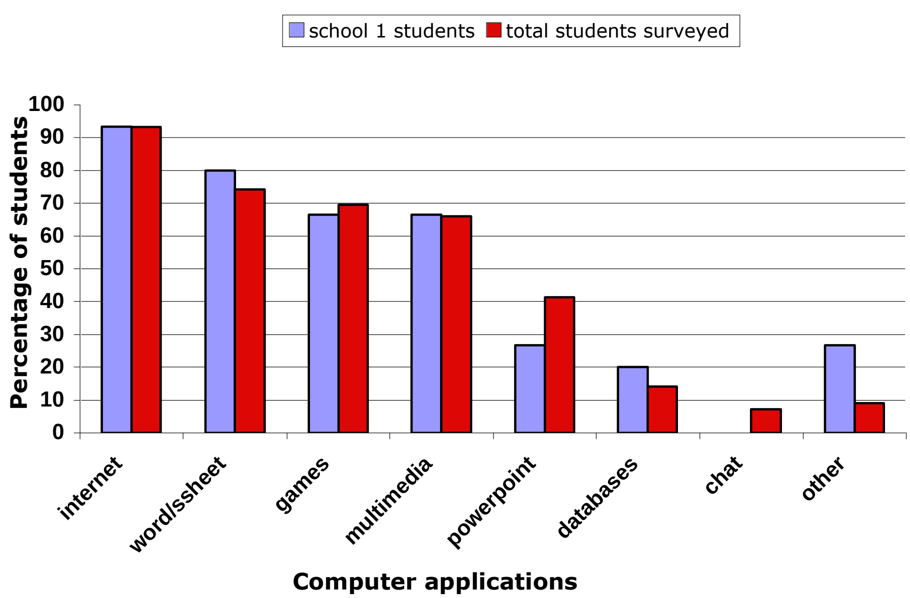


Figure 8.1: Comparison of school 1 students to the total number of students surveyed in the use of computers away from school

The use of the computer at school has been reported by year level to determine if the curriculum delivered at a particular year level had any impact on the use of the school computer by the student. The strategic computer use for the year levels indicates a particular implementation plan that is different for both years and against the total student sample. The usage, displayed in Figures 8.2 and 8.3, shows evidence of computer integration in year 8 with higher levels of computer classes and integrated unit work. The strategic deployment is further confirmed by the principal interview. There were also higher levels of computers used for research, which did not take place in the library but utilised available computing time. Correspondingly there was slightly less use of the computer for research and integrated unit work by year 10 than the total student sample. There was also a higher level of computer use for single lesson shown for year 10.

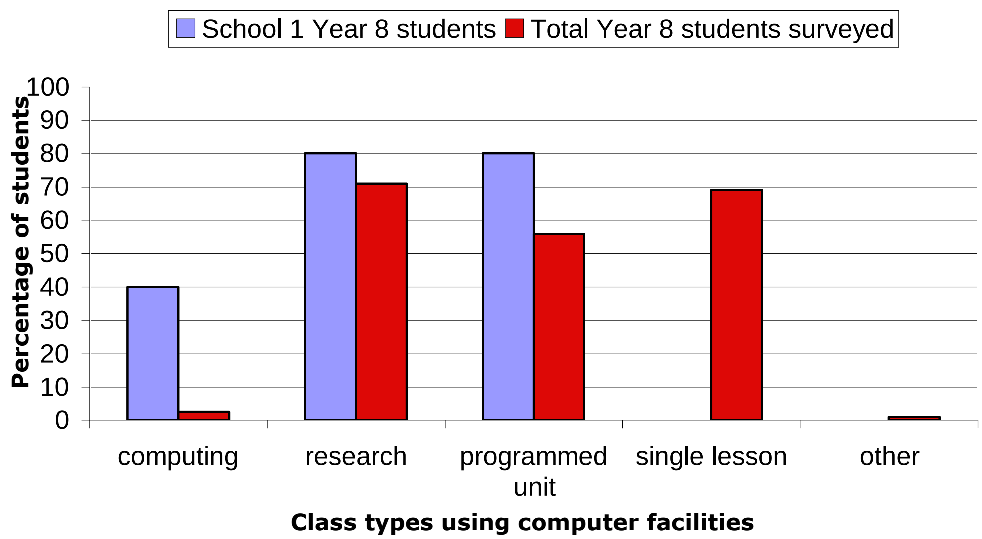


Figure 8.2: Computer use by class activity for year 8

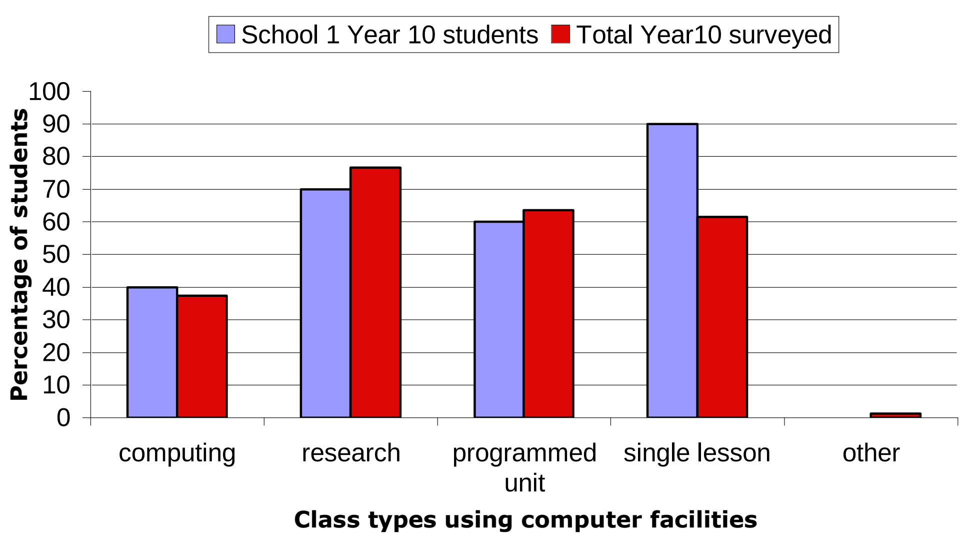


Figure 8.3: Computer use by class activity for year 10

The student use of applications on the school computer was also identified and their overall usage pattern can be seen in Figures 8.4 and 8.5. The use of applications confirms some of the strategic computer use indicated in Figure 8.2 with a much higher use of databases, multimedia and email applications in year 8. There is also evidence of higher use of web projects in year 10, which is confirmed later in this chapter by the amount web use for this school.

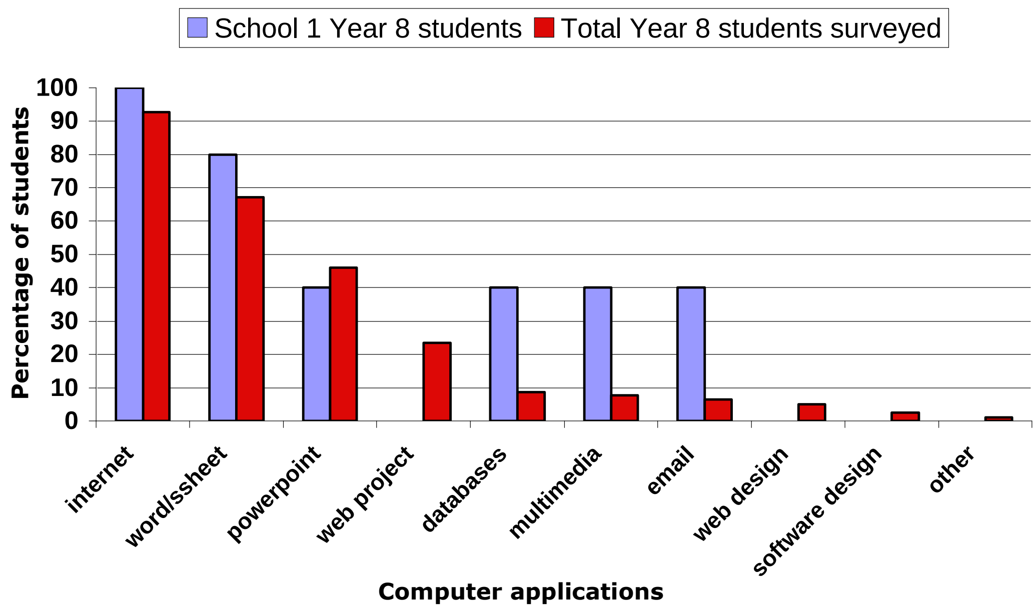


Figure 8.4: Year 8 school computer application use

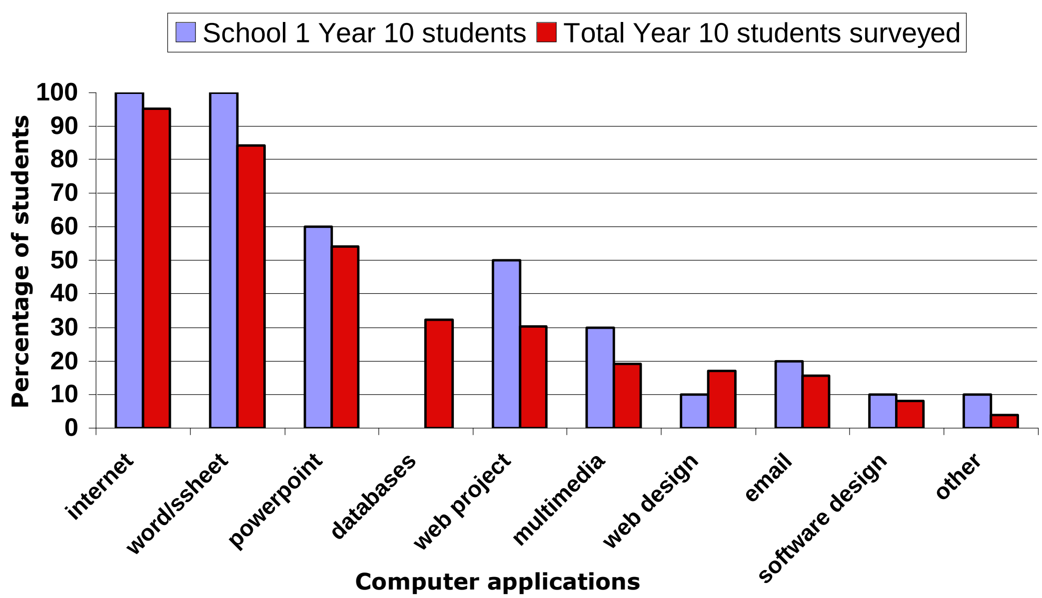


Figure 8.5: Year 10 school computer application use

In Chapter Five, the evidence demonstrated in Figure 5.4 that most students surveyed did not perceive that using computers significantly contributed to the subjects they studied. However, allowing for the small number of students that participated, a positive impact was recorded by the students of this school in Technological and Applied Studies, Science, Mathematics and English. This finding demonstrates that the strategic use of computers in a learning environment can enhance the engagement of students in their study of the school curriculum. Findings corroborate that teachers who mould the learning environment with the use of computers can engage students and stimulate their learning (Heath et al., 2005; Franklin & Peat, 2001; Oliver & Omari, 1999).

8.2.3 Relationships between variables in the student model

As stated previously, the student sample for this school was small in comparison to the other participant schools. However as the results obtained for school 1 were consistent with the overall results, it was thought that reporting the results for this school would add to the overall interpretation of the analyses model. As the student numbers were less than 20 it was considered that the results of a multiple regression analysis would be unstable and simple correlational analyses were used to provide the strengths of the bivariate relationships between the constructs for this school. The results (see Table 8.1) indicate a relationship between the independent variables Positive Learning and Relevance and Online Usefulness and Relevance.

Table 8.1: Correlations showing relationships between the independent variables for students in School 1

School 1	N	Use	Application	Relevance	Positive
Application	15	-.080			
Relevance	15	-.418	-.081		
Positive	15	-.123	-.439	.513*	
Readiness	15	-.262	.044	-.029	-.513
Usefulness	15	-.007	.038	.734**	.369

The highly significant relationship of Online Usefulness to Relevance suggests a connection between students familiarity with computers, the online environment and their learning. The student path is noteworthy as it confirms the current research literature that children are tending to operate and feel comfortable in an online environment, (Holm-Sorensen, 2005). It signals that students perceive a logic in conducting at least some of their learning in an online environment without knowing exactly what that may entail. The principal indicated that the students were very eager to use computers and sited evidence of student work accomplished via home computers as well as the demand for the school computers. The principal also discussed the use of peripherals such as iPods and mobile phones which students were seen using going to and from school. The use of these devices substantiated for the principal that students have potential access to realms of information and the school should utilise this medium.

There was one other significant relationship of Positive Learning to Relevance. Examining the student computer use pattern for this school indicates that students prefer to be engaged in the computer environment and the correlation established suggests that students perceive that positive learning in such an environment should be relevant to their needs and curriculum. According to Freebody & Muspratt (2007) it is this type of environment that encourages higher levels of motivation and engagement.

8.2.4 General Description-Teachers

From a total of 53 teaching staff, 12 teachers (22.6%) agreed to participate in the survey. Whilst the proportion of males to females on staff is approximately equal, eight males and four females participated. This participation differs to the overall teacher sample which was predominantly female. These teachers were drawn from the key learning areas of Mathematics (4 teachers), English (3 teachers), Human Society In its Environment (3 teachers), Physical Education (1 teacher) and Languages (1 teacher). The lack of representation from the subject areas of science and Technological and Applied Studies may affect some of the teacher application proficiency reported in other schools.

The time employed at the school for these teachers was; 1- 5 years (6 teachers), 6-10 years (4 teachers) and in the 11-20 years (2 teachers). This compares to the overall experience levels shown in Table 8.2.

Table 8.2: Total years of Teacher Experience for Participating Teachers in School 1

Years of Teacher Experience	Number of Teachers
1 – 5	3
11 – 20	4
21 - 30	5

The total years of experience indicates that over the past few years, some experienced teachers have been employed at the school. In the low and medium eFactor schools, technology in-service training for experienced teachers may have been minimized or waived on the assumption that these teachers already have the necessary technology skills. In this school as teacher practice has unfolded in this study, particularly in the posting of learning material on the Internet, it appears that teacher induction does not assume these teachers are already experienced technology practitioners. Most of these teachers had a computer at home and most had Internet connection.

The computer applications in which the majority of teachers considered themselves either 'very good', 'good' or 'ok' were word processing, spreadsheets, databases, presentation software and desktop publishing. For the remaining applications, the majority of teachers sought help for web creation and had not used sound editing or multi-media software. Comparisons to the total sample can be found in Figure 8.7 showing that for spreadsheets and presentation software (powerpoint), teachers at school 1 rated themselves at a higher level of proficiency.

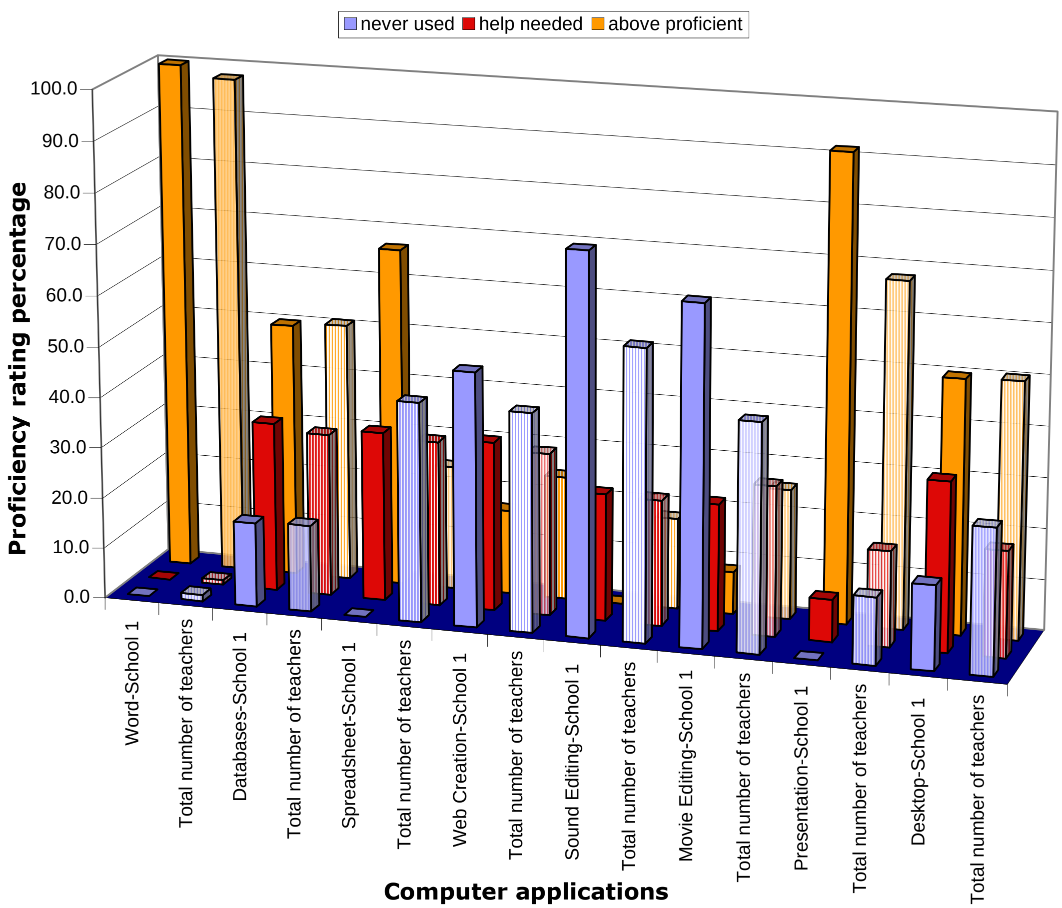


Figure 8.7: School 1 Teacher proficiency rating compared to the total teaching sample

The lack of teachers from the sciences may impact on the finding mentioned on the previous page as the school's web site indicated the presence of sequential learning material from the science area. The material also displayed a teacher proficiency with multimedia and web applications. The computer applications for multi-media, web searches, presentation software and word processing were identified by most teachers surveyed as useful in stimulating learning. The following applications were identified by the majority of teachers as not stimulating learning; creating web pages, movie/photo editing, web creation, spreadsheets, databases and email. At the time of this survey a web presence was just becoming part of the school's focus on technology.

In the interview with the principal, it was stated that every encouragement was used to assist teachers in their adoption and use of technology. This was one of the main reasons behind the implementation of a wireless network and teachers being able to acquire laptops through the school to use both in the classroom and in their homes. The principal emphasised that a mobile technology solution had been promoted amongst the teaching staff. Key staff had modeled mobile solutions whereby technology was taken to the students or learning area not students taken to a laboratory to learn a competency.

8.2.5 Relationships between variables in the teacher model

As for other schools in the study where there were insufficient teacher responses, simple correlational analyses were performed. Whilst the small group sample limits the usefulness of the information obtained it is reported as it provides some confirmation to the web posting activity by the teachers in this school. The results (see Table 8.3) indicate a high correlation between some of the variables. Using Cohen's (1988) guidelines, the strongest relationships identified are between the independent variables Relevance and Positive Learning, Relevance and Online Readiness and Computer Use and Relevance. Each of these relationships is highly significant and the correlation is positive. The use of computer applications by the students under teacher direction tends to confirm the relevance in using computers for learning. The significant result for Online Usefulness may reflect the direction the school is taking with its web presence but this is tempered by the highly significant correlation between Relevance and Online Readiness. The results may reflect the anxiety of the teaching group with 11-20 years of experience.

Table 8.3: Correlations showing relationships between the independent variables in School1

School 1	N	Use	Application	Relevance	Positive
Application	12	.283			
Relevance	12	.685**	.378		
Positive	12	.248	.357	.719**	
Readiness	12	.549*	.561*	.777**	.625*
Usefulness	12	.486	.425	.567*	.266

The direction of the Online Readiness path tends to confirm teacher anxiety about the readiness of themselves, school and students to participate in an online learning environment (Stevens & Switzer, 2005).

The difference between the significant paths highlights the varying levels that students and teachers operate in technology. These levels of skill and dexterity in computer and online use could be mapped into a linear scale with student ease with and use of the technology above that of teachers. This scale is what Kulik (2003) refers to as a continuum of comfort and skill dexterity in the use of technology and operating in an online context.

8.2.6 eFactor for School 1

The eFactor (30) for this school was the second highest for the ten schools involved in the study. There were 18 postings on the learning section of the school website in 2005 and this grew to 291 postings in 2006, the highest number of postings for the ten schools. The proportion of staff posting the material was approximately 46% (see Appendix 9) which was the second highest for the ten schools.

As with the other school in the high eFactor group, there was more material posted categorised at the 'Dependent" and 'Variable Interactive' than other schools in the study. According to the rubric developed and discussed in Chapter 5, the two categories involved stages of interaction, collaboration and higher order thinking. The greater emphasis on developing the learning in the postings, that may be a result of the school's technology focus, is likely to engage the students more in this environment. Students have greater involvement and interest when the online learning moves from simple information retrieval to more complex tasks, (Palloff & Pratt, 1999; Cheaney & Ingebritsen, 2005).

Two factors of high proportion of staff involvement and greater learning stimulus in the web postings have set this school apart from the low and medium eFactor groups. Despite the poor response rates from both the students and the teachers, the website postings represent substantive evidence of technology and learning infusion. The postings demonstrate that the school has moved from a competency based technology program for teachers to a program emphasizing learning underpinned by technology.

8.2.7 Summary School 1

Whilst student numbers were atypical of the general student participation, there are some computer use trends that differ to the overall student results and bear comment given the school's eFactor. The use of databases, multimedia and email by year 8 students and web projects by year 10 students suggest a different school technology strategy to other schools in the study. At the year 8 level there was use of applications such as powerpoint, similar to other schools, but there was also the inclusion of applications requiring creative ability and dissemination. The use of email too is unique for the schools in the study and may indicate either a learning of the communication application or a wider use for group participation. Year 10's use of web projects demonstrates a strategy to use the Internet for a purpose other than information gathering. It shows the utilisation of a greater suite of technology to engage the students.

The small sample of teachers also rated themselves more highly in the areas of word processing, spreadsheets and presentation software. The teachers appear to be encouraged in the main to use what technology skills they have. The principal has championed technology's cause with a number of strategies. Additional ancillary staff were employed for administrative duties thereby allowing greater time for teacher preparation for program development including the development of online content. This would also include time for teachers to develop their technical skills. Laptops were available for staff to use and eventually own but staff had to justify the allocation with a strategic use plan which was evaluated and monitored. There was also the implementation of a wireless network with portable computers. The intent of the solution was to derail the commonly-held practice of converting classrooms to computer laboratories. One of the key strategies adopted by the school was to encourage teachers to think about why they wanted to use computers. The Principal said that the strategy has promoted thinking about effective computer use that does not necessarily require students to be placed in front of a computer screen the entire school day.

8.3 School 3

8.3.1 General Description

School 3 is a medium sized metropolitan co-educational school with a total enrolment of over 700 students. The school, administered by a religious order, operates a secondary curriculum for years 7 through to year 12. The school has developed a strong pastoral reputation and its compulsory and post-compulsory examination results are above average. Strong community links have ensured a stable enrolment pattern despite several Government schools in the area and easy transport to other non-Government schools.

The school is situated on a large precinct, sharing the area with a church, primary school and another youth facility. With the high school established in the early 1980s the buildings are an eclectic mix of traditional classrooms and more modern learning facilities with flexible internal structures to encourage group dynamics. The school offers a wide curriculum that includes design and technology courses and creative arts as well as the more traditional courses. Due to the proximity of a

Technical and Further Education College, older students are able to attend some of the courses offered at this institution. Recreation areas for this school are extensive with many passive and active recreation areas and there are sporting fields for the students to practice and play sport on.

The provision of computer facilities is a mixture of five traditional computer laboratories and five multi-purpose rooms. The laboratories each have 30 personal computers that are less than two years of age and these have been placed around the classroom walls. Each laboratory has a printer and there are two scanners shared between the five laboratories. One laboratory has a fixed data projector with other projectors available from the library should the need arise. The multi-purpose rooms do not have a fixed configuration, with the intention that the room would be set up according to the particular lesson requirement. The computers in these rooms are two years old with 15 computers in three of the rooms and five computers in the remaining two rooms. Each of the rooms has a printer and a data projector, though not mounted, and there are two scanners to share amongst the five rooms. The library can also be used a computer facility should the need arise and there is a section in the library with computers around the wall that suit this purpose. There are other computers in the library ensuring that students can access computers should a class be using the library as a computer laboratory. Wireless options are being considered for the school and research by a school committee into cost and security as well as valid reasons to implement wireless solution is underway.

8.3.2 General Description-Students

Traditionally this school has a high Anglo-Saxon population and the 2004 enrolment saw this pattern repeated. No indigenous students were identified and only 6% of students came from a Language Background Other Than English. In years 8 and 10 there was a total of 289 students and 261 students (90%), 135 year 8 students and 126 year 10 students, accepted the invitation to participate. The use of and access to a computer away from school is described in Table 8.4 with one student indicating no access to such a computer.

Table 8.4: Student use of Away from School Computer

Use Categories	**Year 8 (%)**	**Year 10 (%)**
Able to access the computer at least most of the time	67	71
Able to access the Internet	89	95
Used for school work at least half the allocated time	62	70

Whilst all students at this school had access to an *away from school computer* that access is the most restricted of the entire student sample. Factors responsible for this restriction may include the current number of school computers being adequate for school work, greater parental monitoring of computer use and competing demands of other users of the *away from school computer.* The restricted access to this computer has contributed to the lower frequency of application use.

The most commonly used applications for both years 8 and 10 were Internet browsing, games and word/spreadsheet. Whilst the popular applications for these students is similar to the total student sample, the overall usage pattern is slightly less than the overall sample. The total usage pattern for the school 3 students compared to the total number of students can be seen in Figure 8.8.

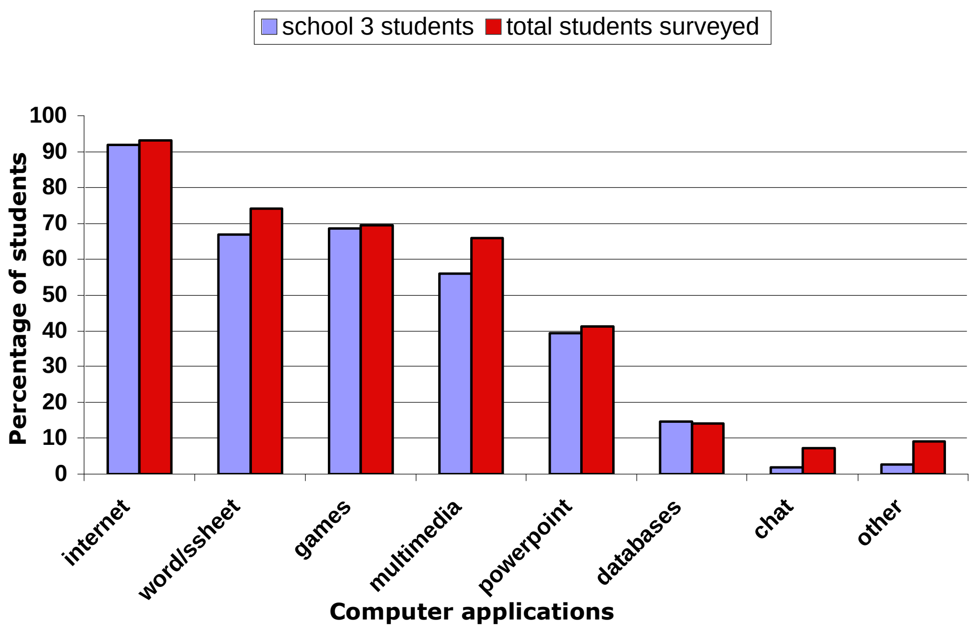


Figure 8.8: Comparison of school 3 students to the total number of students surveyed in the use of computers away from school

In the school setting, the use of computer technologies by teachers for year 8 is below that of the total sample. The pattern of use, seen in Figure 8.9, shows that use of computer technology is below in all categories including student use of computers in the library during their free time. The use of computers for year 8 appears to be compensated by the use of computers in year 10, seen in Figure 8.10, particularly for integrated unit work and single lesson use. Computer use in these two areas indicates a focus by the school on using computers in classes other than computing. Computer usage at the school for these two school years reflected the principal's comments about strategic computer use and the refurbishment of school areas.

Part of the school's technology plan was to introduce and refresh computer skills in the school's lower years through the adoption of school developed computer application standards in the delivery of units. As the students progressed through school they would be encouraged to use a suite of applications to express their learning. The principal stated that the strategy had some failings through the inability of some teachers to deliver the applications in the lower years and accommodate student use of certain applications in the higher years. The school has attempted to address this problem through teacher training but it also required the willingness of all staff to adopt and learn the strategy. There was also the refurbishment of school areas to accommodate group work using Internet and other computer resources. The principal commented that such refurbishments took place only after teacher generated proposals, that were researched and justified, had been placed before the technology committee and the committee had approved the proposal.

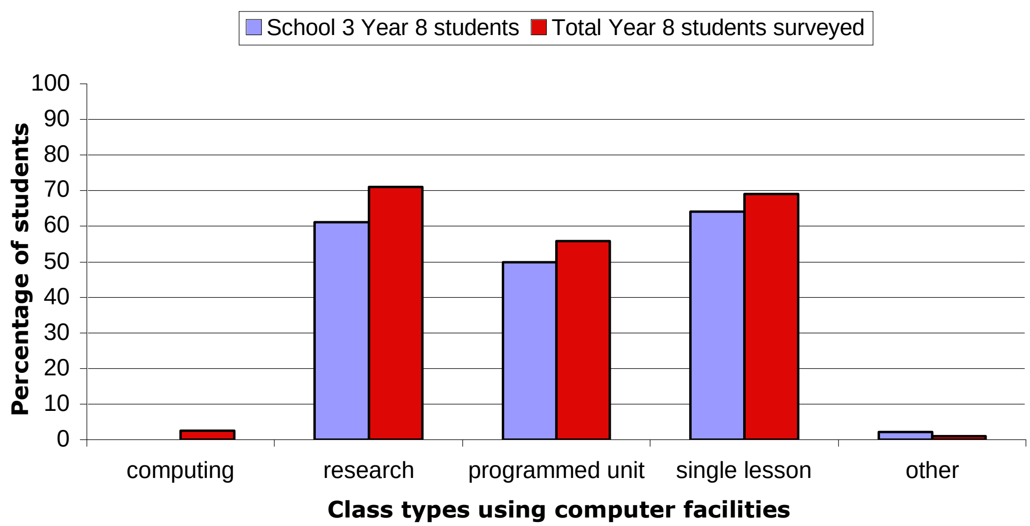


Figure 8.9: Computer use by class activity for year 8

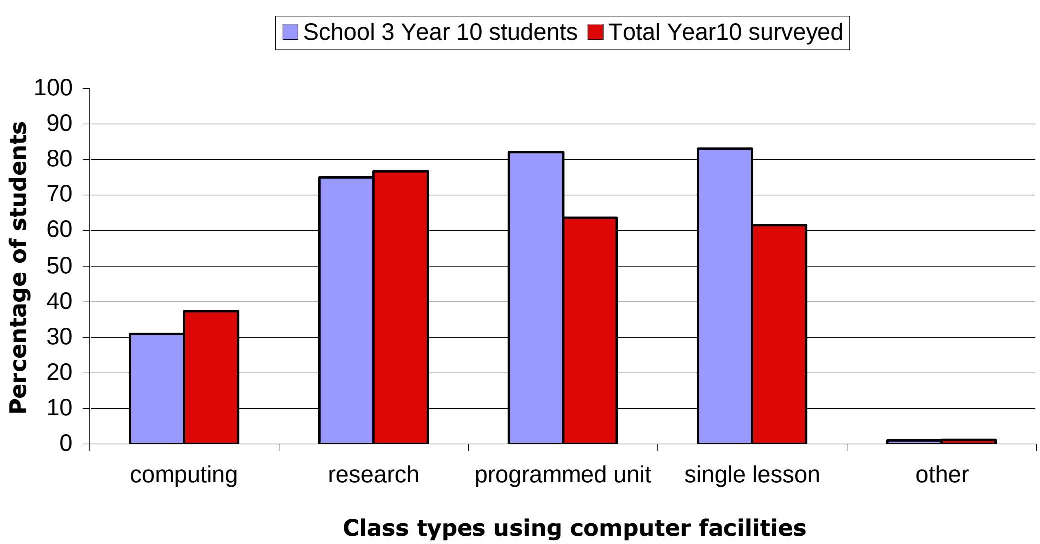


Figure 8.10: Computer use by class activity for year 10

The students' use of a range of applications was identified and the overall usage pattern can be seen in Figures 8.11 and 8.12. Following the previous observations about class use of computers, there are differences in application usage from the total student sample and corroborates the principal's comments made earlier.

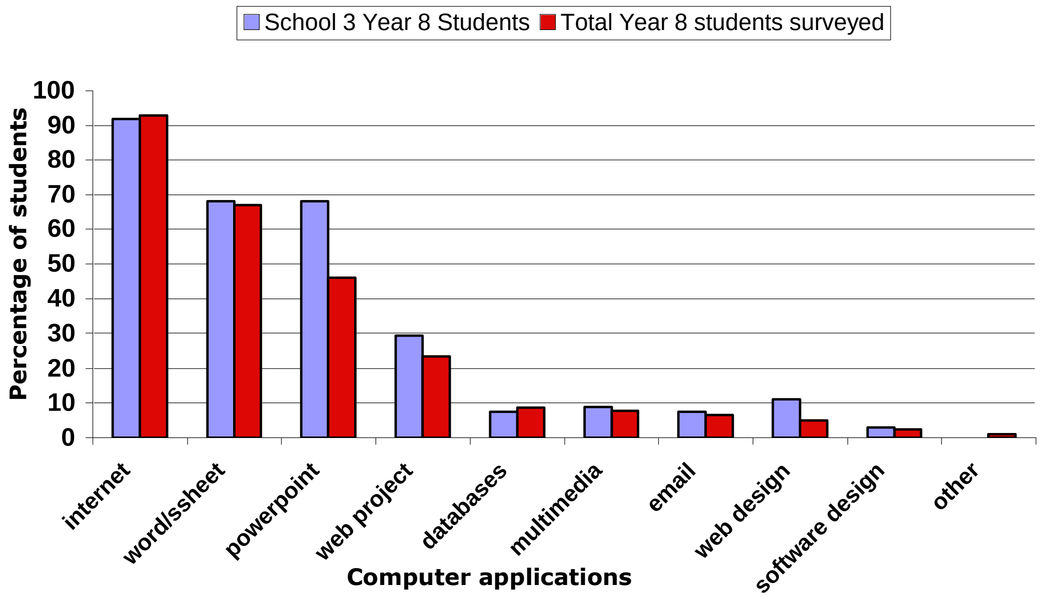


Figure 8.11: Year 8 school computer applications use

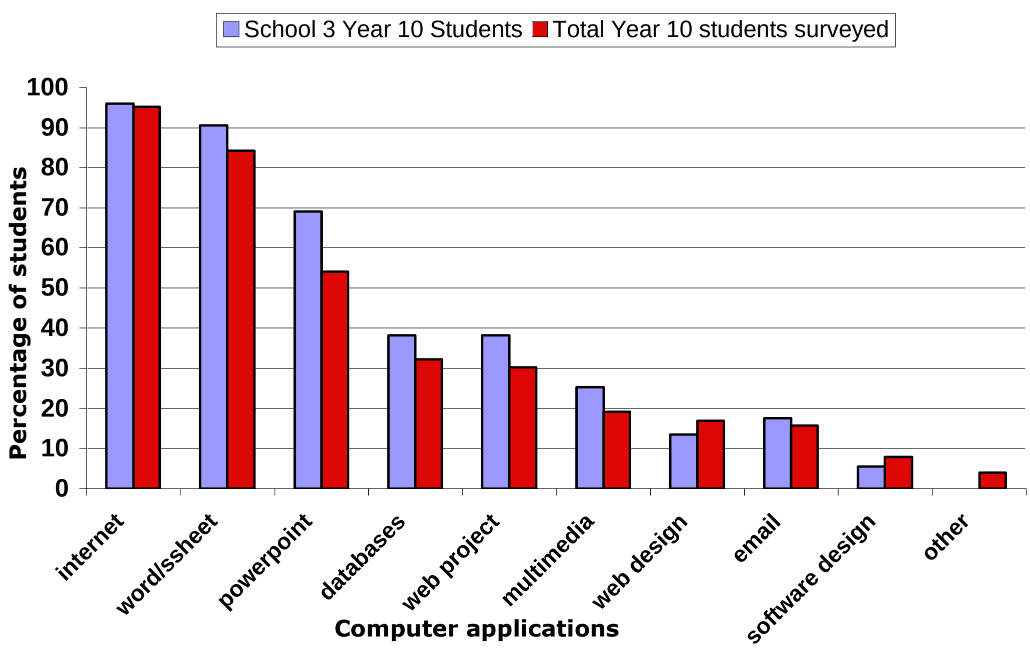


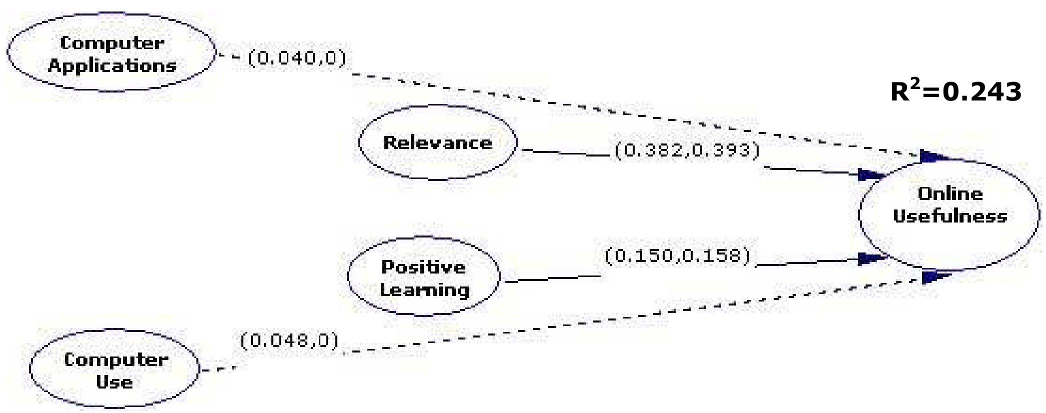
Figure 8.12: Year 10 school computer applications use

For both years there is a greater use of web projects and powerpoint. In year 8 there is a greater use of web design, probably as a preface for the web projects, and in year 10 there is a greater use of multimedia, email and databases. The overall usage of the school computers may explain why the use of the non-school computers for general use and schoolwork was lower for this school.

With the above computer use, 17 students indicated that using computers in English had a positive effect on their learning. A similar positive effect was also noted for Physical Education by just two students. Such a small response from students may indicate that with such prevalent computer use, positive learning was just an expectation or it could indicate that little difference existed in the way the computer was used to previous modes of learning.

8.3.3 Relationships between variables in the student model

The model explaining Online Usefulness was reasonably strong with 24.3% of the variance explained by the contribution of the independent variables Relevance and Positive Learning. The standardised coefficient (see Figure 8.13) identifies Relevance as the primary contributor and both variables were significant with p=.000. These analyses are consistent with the results established for the total student sample, even if the variance explained is slightly less. There are a number of factors that may be responsible for this result. Some of the questions, in the student questionnaire, about online learning were beyond the current school experience for some of the year 8 students. Also the wider use of computer applications at school may satisfy some student demand for school related computer use therefore making online school work less a priority for these students.



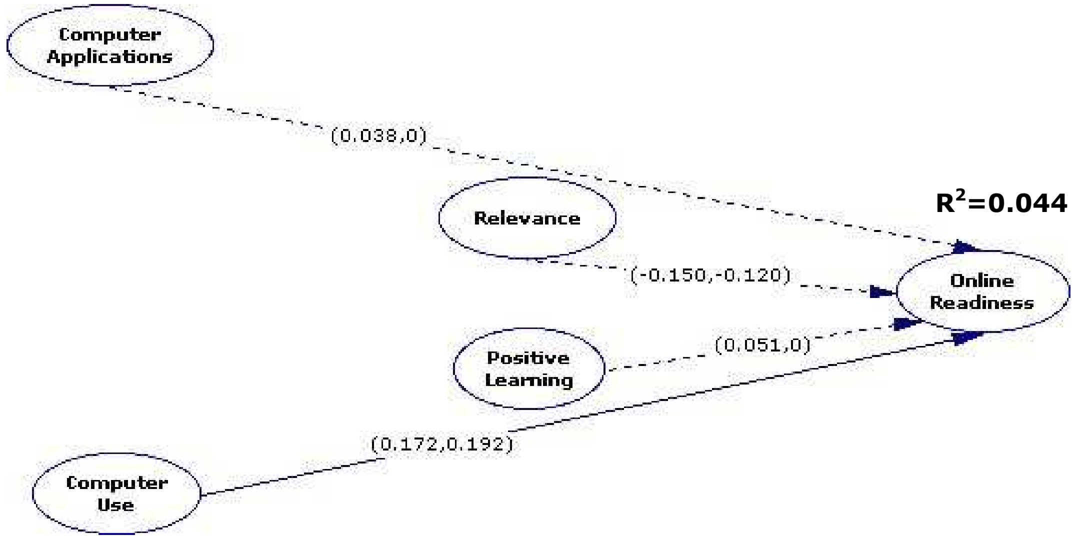


Figure 8.13: Path diagrams for students at school 3 showing relationships with Online Usefulness and Online Readiness

The model with Online Readiness as dependent variable explained 4.4% of the variance attributed to the contribution of Relevance and Computer Use. Only Computer Use was significant with p=.000 and this variable was also identified as the primary contributor by the standardised coefficient. Both models, consistent with the findings of the overall model, indicated student preference for understanding the benefits of using an online environment rather than assessing whether the school is ready for it.

8.3.4 General Description-Teachers

From a total of 56 teaching staff, 13 teachers (23.2%) agreed to participate in the survey. Whilst nine females and four males participated, conforming with the overall trend, this did not reflect the gender balance on staff which was approximately equal. The participating teachers were drawn from the key learning areas of Mathematics (1 teacher), Science (4 teachers), Human Society in its Environment (1 teacher), Technological and Applied Studies (2 teachers), Creative Arts (3 teachers), Physical Education (1 teacher) and Support (1 teacher). The ratio of humanities to the sciences is 4:8 with support unclassified and this proportion may influence some of this sample's responses given the mandated requirements of the curriculum for technology in their key learning area.

Time employed at the school for the teacher group was identified at nine teachers in the 1-5 year category, two teachers in 6-10 and two teachers in 11-20. This data is compared with the total number of teaching years shown in Table 8.5.

Table 8.5: Total years of Teacher Experience for Participating Teachers in School 3	
Years of Teacher Experience	**Number of Teachers**
1 - 5	3
6 - 10	2
11 - 20	7
21 - 30	1

The movement of experienced teachers to new positions in different schools has been a common thread in all the schools involved in the study and has raised a question about teacher induction programs. Experienced teachers certainly may not need all the induction that an inexperienced teacher needs with matters such as administration and classroom practice. However, the experienced teacher in the 21 – 30 year category has previously been identified as one of the most anxious technology users and school technology induction programs should certainly include all teachers. It also confirms the principal's comments that some of the more experienced teachers were reluctant to attend school technology in-service and apply computer technology to their teaching. However, the principal also affirmed the priority of integrating technology into the curriculum and mentioned that different strategies such as mentoring were employed to assist teachers with their technology use. All the teachers had a computer at home and only one teacher did not their computer connected to the Internet.

The computer applications in which the majority of teachers rated themselves very good, good or ok were word processing, databases, spreadsheets, presentation software and desktop publishing. For web creation, movie and sound editing the teacher group in the very good category at this school was above the total group surveyed. This is perhaps a result of the surveyed teachers' subject backgrounds but it also runs parallel to the increased use of computers in multimedia and web projects indicated in Figures 8.11 and 8.12. Comparisons of the applications to the total sample can be found in Figure 8.14.

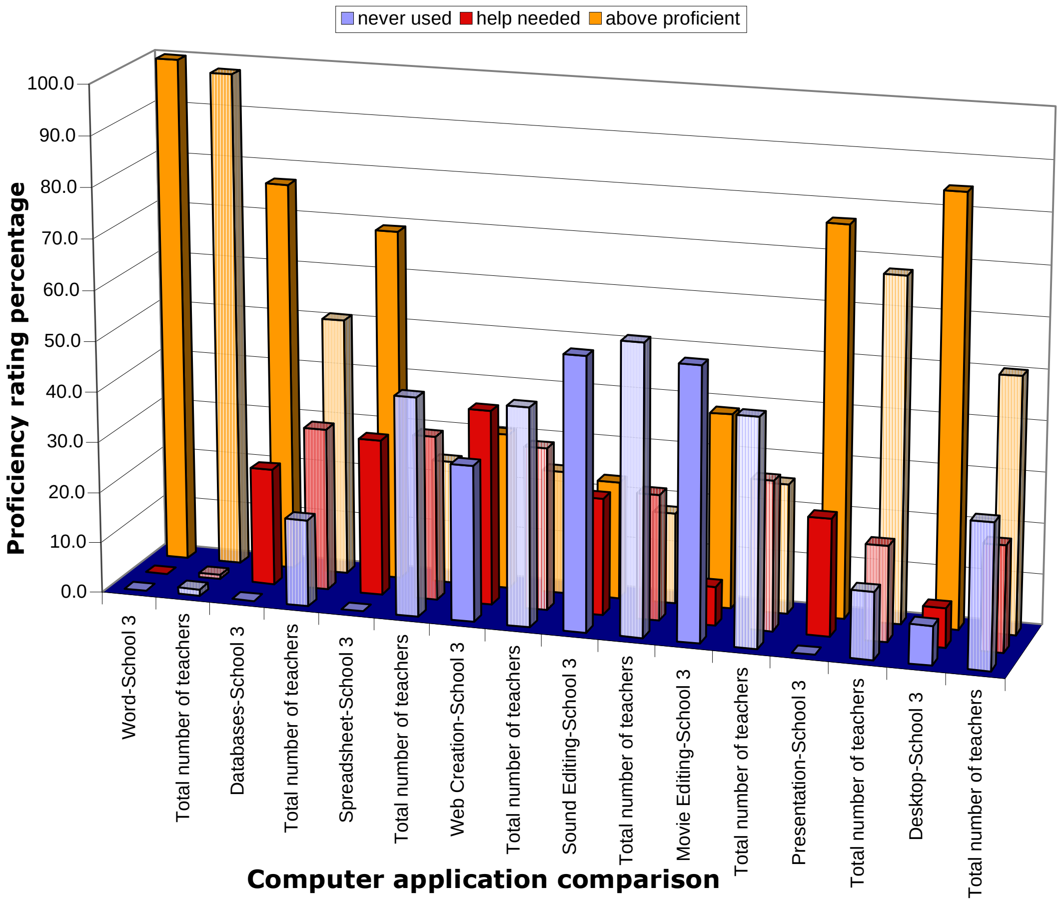


Figure 8.14: School 3 Teacher proficiency rating compared to the total teaching sample

These teachers also identified the following applications as stimulating learning; multimedia, web searches, desktop publishing, email projects, presentation software and word processing. The opinion on spreadsheets was evenly distributed from positive to negative and the other applications did not rate as stimulating learning. There is a notable exception for, although creating web pages and movie/photo editing did not rate as stimulating learning by the majority of the group, four teachers rated these applications very highly and these opinions are perhaps reflective of the key learning backgrounds of these four teachers. The perceptions given by the teachers reflect the principal's philosophy that the technology must benefit student learning and all in-services have that premise as their foundation.

8.3.5 Relationships between variables in the teacher model

As with school 1, owing to the teacher responses being less than 20, simple correlational analyses were performed. The results, shown in Table 8.6, indicate significant correlations between some of the variables. Using Cohen's (1988) guidelines, relationships are identified between the independent variables Computer Applications and Relevance and Positive Learning and Online Usefulness.

The positive correlation between Computer Applications and Relevance is indicative of the in-service work focusing on using computer applications for learning. The positive direction of the correlation is evidence that teachers perceive some benefit in the use of an integrated technology approach to the curriculum.

Table 8.6: Correlations showing relationships between the independent variables for teachers in school 3

	N	Use	Application	Relevance	Positive
Application	13	-.368			
Relevance	13	.265	.445(*)		
Positive	13	.330	-.124	.305	
Readiness	13	.286	-.340	-.138	.011
Usefulness	13	-.340	-.097	-.109	-.529(*)

The negative correlation between Positive Learning and Online Usefulness suggests that some of the teachers surveyed perceived that using an online environment did not enhance the learning process. This type of perception is consistent with findings from other schools in the study where the more experienced teachers are apprehensive in the wider use of technology applications. It also suggests that for this school, when this correlation is compared to the school's web presence and the number of teachers posting material, this result is a distortion from the normal teacher practice.

8.3.6 eFactor for School 3

School 3's eFactor (42) places it not only in the high eFactor group but with the highest eFactor overall. There were 44 postings in 2005 and 179 postings in 2006 on the learning section of the school website. In 2006, 55% of the teaching staff were posting material. This school had the largest proportion of teachers posting learning material for the ten schools involved in the study. The two distinguishing features in attaining the high eFactor are the relatively high percentage of teachers who are posting items and the degree of learning involved in each posting.

The type of learning posted confirms the school's in-service emphasis on the levels of learning that would required to engage students in the online environment.

There was more material in the dependant and variable interactive categories than for schools in the other two eFactor groups. The other school in the high eFactor group also had similar distinguishing features in their web postings. It had more postings by proportionally less teachers posting. School practice is indicative of the procedures that have been put in place by the Principal with technology innovation and procurement planned and researched rather then being implemented on a whim or haphazardly.

8.3.7 Summary School 3

Several features are notable for both students and teachers in this school. The students experienced a greater use and application of computer technology across the curriculum than the total student sample. The strategy of using various computer competencies, rather than one, to deliver the curriculum in year 8 appears to encourage both students and teachers to use a range of applications. The practice is further evident in year 10 with the use of web projects, databases and multimedia. The teachers surveyed, though small in number, have greater skills in a broader range of applications but also appear to place a higher value on the use of computer applications to enhance learning. The school web practice of teachers is further indication of the school's technology strategy to engage student learning through technology practice.

Underlying these practices are the methods adopted by the school principal to implement the use of computer technology in the school. The methods, which undoubtedly reflect some of the principal's educational philosophy, employ a process whereby teachers research, propose and implement/adopt new technologies and practices. This process appears to give teachers greater ownership and momentum in employing educational change.

8.4 Summative discussion for the high eFactor schools

Several features stand out in identifying distinctive features for this high eFactor group. The most crucial one is the stance taken by school leadership to infuse technology into school practice. Whilst both principals professed rudimentary technology skills, they not only rated technology a priority but also actively promoted and monitored the strategic research, implementation and substantiation of the technology program. The principals ensured that all teachers in their schools were included in their respective technology in-service programs. This attention to detail, by the school leadership, differentiates these schools from the other schools in this study where experienced teachers new to the school were assumed to be technically proficient and given at least partial exemption from technology in-service. Another key feature of their leadership, different to the other eFactor groups, was the recognition of technology's potency to engage student learning through a wide range of applications and strategies. Technology use was not capped at any particular year level because it may have detracted from the learning process, but was actively encouraged.

The tactical implementation of computer technology was not done through a single competency but rather through a range of applications and methodologies. School 1 opted for its wireless solution to allow teachers to deliver integrated technology curriculum units in year 8. School 3 teachers focused on using a broad range of applications across all units in year 8. The strategic deployment in both schools has further encouraged teachers to acquire a better understanding of the applications they are using, evident by reported student school application use. Figure 8.15 indicates a higher level of proficiency in six of the eight applications surveyed. The adoption of these strategies as a whole school response to technology may also inspire confidence with teachers in their use of each school's web platform.

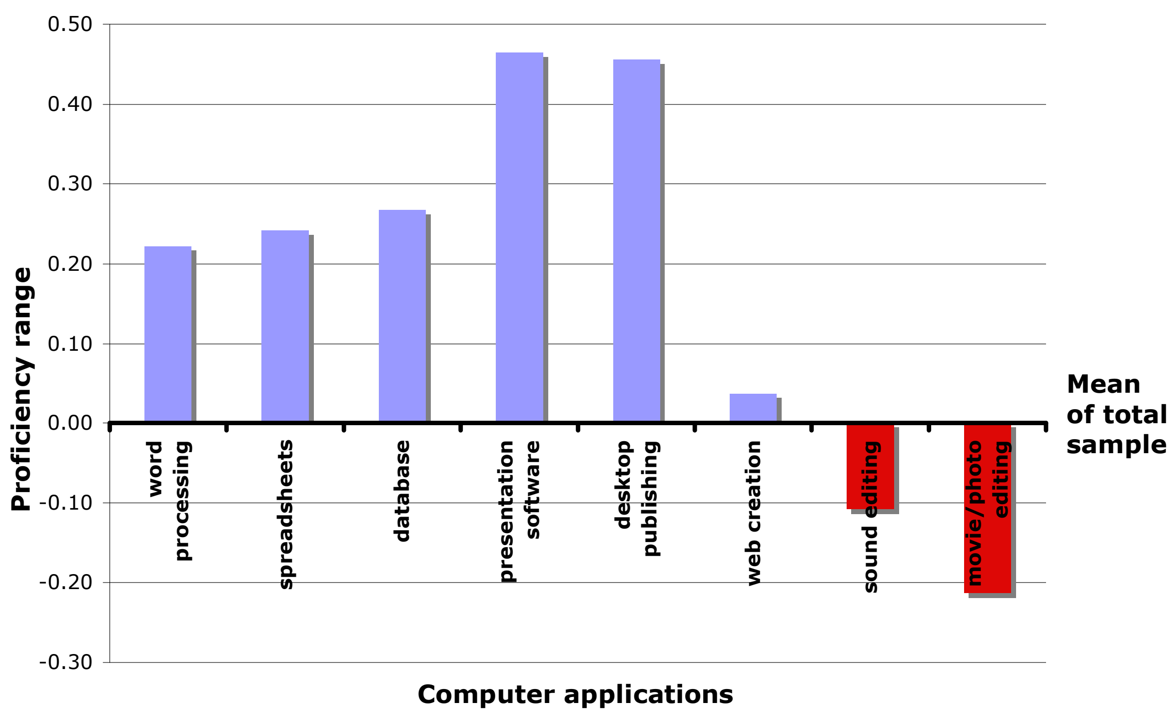


Figure 8.15: Difference of the mean of teachers in the high eFactor group in computer application proficiency to the mean of the total sample

Both schools had more postings in the dependent and variable interactive categories than the other schools in the study. The common characteristic of both categories is the learning structure of the postings. The deployment of higher-order thinking strategies in each activity ensures that students are engaged in a learning process instead of merely being occupied to complete a task.

These three characteristics have combined to place both schools in the high eFactor group. Some of the medium eFactor schools had a focus on learning and there was evidence of deploying a single computer application through the school curriculum program. However, the distinguishing feature of schools 1 and 3 is the integration of a range of applications, not as competencies, but as part of the learning curriculum. This meant that instead of teachers being forced to funnel learning through a single competency, teachers are able to choose the technology most appropriate to the task and student skills. Further differences between the three groups are interrogated in the concluding chapter.

The final chapter recapitulates the entire research process for this study and answers the specific research questions posed in Chapter Four. The premise for this research is revisited along with the literature justifying and expanding the line of inquiry. The choice of data analysis methods is briefly outlined in preparation for the discussion of the research questions. The analyses findings are explained in the context of the three main research questions each with their own sub questions. The third research question also includes consideration of the eFactor developed in response to the question. These findings are further disseminated into three case study groups to extract definitive strategic characteristics of each group. The limitations of the study are also discussed and the possible impact of the limitations on the study’s findings. Finally the conclusion focuses on a series of recommendations and suggestions for further research addressing changing parameters to this study, different research strategies and future technology developments.

Chapter Nine Distilling the Findings

9.1 Introduction

In this chapter the project on the use of computers and eLearning technology at ten secondary schools is summarised with findings and subsequent recommendations to enhance computer technology practice in a learning environment. The research questions and the methods used to investigate the questions are revisited with conclusions drawn in light of the literature reviewed in chapters two and three. The questions, methodology and conclusions are framed according to the key elements of this project and define the structural nature of this chapter according to the three research questions. The reported computer practices for each school and the evidence of learning on the school's web presence are underpinned by student and teacher perceptions and practices and by the principal's interpretation and implementation of technology for learning. These factors form the key elements of this study, and assisted in selecting the most appropriate research methodology and in the construct formation used in the eventual analyses. The following chapter summaries lead to the use of the research findings in providing suggested solutions to the research questions and the directions for further research arising from this study.

The literature review chapters provided an overview of the development of Information Communication Technology in education before focusing on online learning at the school level. The selection of case study methodology using quantitative and qualitative methods was explained and justified in light of the nature of the phenomena under investigation in the study and the practicalities of the school setting. These practicalities included when the surveys could be administered, the amount of time available for the surveys, convenient interview time for the principals and the generally busy nature of schools. The conduct of the study and data collection is described leading to the subsequent data analyses that further corroborated main points of the literature review and importantly introduced the concept of the eFactor. The eFactor, a rubric to identify the breadth and depth of learning exhibited on web pages, was developed to assist in the categorisation of learning implemented on the Internet. The ensuing use of the eFactor to distinguish between the ten schools highlighted various levels of engagement with the Internet by teachers and gave rise to examining the schools' strategic use of the web as a learning interface.

The purpose of this chapter is to answer the research questions, discuss implications of the newly developed eFactor that arose from this research and suggest some direction for further research in this field. The three primary research questions;

1. Do students and teachers believe they have the skills to use online resources?
2. Are teachers setting effective learning tasks for an eLearning environment?
3. How are schools currently employing Online Learning Resources?

are answered in light of the results obtained and the current literature provided. The questions are discussed in turn and, where appropriate, the eight subsidiary research questions are considered within the main research questions. The discussion highlights distinguishing features of teachers' and students' practices and perceptions in a secondary school context for a metropolitan area in New South Wales with comparisons to practices in other developed nations. The research linked the participants' practices to their concept of and relationship to, online learning. The nexus was crucial in light of the dominant theme in the research questions and the connection to the suggested new approaches for online learning as a result of this study.

The discussion of the research questions precipitated a defining point of this study, the development of the eFactor. In chapter four, the examination of eLearning practices for schools uncovered a lack of clarity and guidance in current eLearning definitions upon which schools can evaluate their practice. The resultant eFactor scaffold developed in this study enabled the learning posted on the web for the ten schools involved in this project to be evaluated and categorised. The evaluation of the learning contained in each school's web presence saw the schools grouped into three distinct levels and this chapter focuses on identifying features of school practice peculiar to each eFactor school group.

There followed a consideration of the possible eFactor application across the broader education community. The ensuing discussion focused on developing the suite of eFactor categories across the different education sectors to include tertiary. This is an education policy area that organisations such as BECTA (2005) have started to investigate. The development of eFactor categories, it was argued, would enhance the adoption of eLearning practice as well as facilitate the support necessary to adopt such practice. The evolution of the eFactor concluded this segment, discussing possible category developments as well directions for the role of the eFactor in online learning.

The limitations of the study are then described with reference to the localised nature of the study and the student and teacher data set. The usability of the results is then discussed within the context of the conclusions reached.

Finally this chapter concludes with some recommendations about online learning and the secondary school sector. These recommendations focus on the use of the Internet to enhance and promote flexible learning practice in schools. The main thrust of these suggestions is centred on the possible use of the Internet by students, teachers and school authorities as it impacts on learning. The recommendations also include implications for the traditional school day, school design and school funding as the very nature of learning through the medium of the Internet changes the parameters of space and time.

9.2 Online Skills

The ability of teachers and or students to manipulate the online environment for a learning purpose is critical for an organization's eLearning program. The first research question focused on the ability to use the online environment. The ability to design and facilitate learning in an online environment requires a level of competency with and in interest in computers and associated applications (Salmon, 2003; Stiles, 2007). The prerequisite level to working in an online environment in turn directed attention towards the teachers and students use of the computer with its associated applications and Internet use. The following discussion is focused on the people and areas within schools having the most effect on the use of online resources in the secondary education environment.

9.2.1 Impact of teacher computer use on the school-learning environment

A high proportion of teachers indicated they owned their own computer and used it most days of the week. The teachers' use of the Internet was proportionally half the amount of Internet time indicated by students on computers away from school. Some of the difference in Internet use is attributed to teachers' using the Internet primarily for business or home related activities rather than recreation. The time available for teachers was within parameters of business or home related activities whereas students spend recreation time on the Internet social networking (Katz & Rice, 2002) entertainment and virtual gaming sites. A similar pattern in the amount of computer use was indicated by teachers when using the computers at school. Approximately 75% of teachers used the computer for administrative and work preparation purposes. The school case studies show that the application skills exhibited on the computer were mainly confined to word processing, Internet use and powerpoint. A small percentage of teachers in some schools recorded a high proficiency with multimedia and this was evident in some of the computer class use by students. Overall, however, few teachers were knowledgeable about the type and level of technical support available for the school computing network, whether it could be accessed from home and whether there was technology support for each curriculum area.

Most of the teachers indicated that students showed more interest when computers were used in the classroom and an even greater number of teachers wanted technology training to acquire the appropriate skills. Yet the same group of teachers expressed the opinion that very few applications assisted students in the learning process. Whilst interest is not the same as learning, it can inspire learning (Downes, 2004). These almost contradictory opinions voiced by teachers can be explained by examining the teachers' total years of experience not the number of years employed at the school. The initial impression after looking at the number of years teachers employed at the case study schools was that a significant number of teachers surveyed had been employed with less than five years experience. This may lead to an assumption that inexperienced teachers were unable to utilise technology adequately in their teaching. However, closer inspection found that a number of schools had over recent years employed a large proportion of experienced teachers. Whilst the acquisition of these teachers added greater depth to each school's curriculum resource it also presented schools with a further consideration in their strategic teacher technology planning.

The majority of experienced teachers surveyed, in the 21-30 year experience category, displayed a level of computer competency lower than the rest of the teachers surveyed and were identified by some principals as reluctant users of technology. The same teachers also saw less relevance in the use of computers to enhance the curriculum. Research by Pelgrum (2001) and the National Council for Educational Statistics (2000), identifies these responses as typical of teachers experiencing anxiety about using computer technology. Anxiety amongst the older teachers about using technology is, according to Pelgrum, a significant barrier to teachers acquiring the necessary technology skills and integrating them into the curriculum. So whilst these teachers observe heightened interest amongst students when they use computers, the teachers are unable to capitalise on the student interest due to their apprehensiveness in using technology.

Current school technology integration programs/projects, for most of the ten schools, failed to address the needs of these experienced teachers. School leaders and technology committees need to modify their technology programs to alleviate teacher anxiety as well as incorporating the curriculum expertise and school experience of the same group of teachers. The depth of curriculum expertise is too valuable to ignore and perhaps these particular teachers' curriculum expertise may be the foundation for technology change by promoting technology use across the education platform rather than just as a competency. Programs such as dual mentoring roles may be established, as part of the school's technology strategy, where a technology-proficient teacher is partnered with a curriculum-proficient teacher. The exchange and implementation of expertise should be mutually beneficial given appropriate allocation of resources by the school. Similar technology programs have been conducted for pre-service teachers (Woods et al., 2002), where the anxiety level for new teachers was found to have been significantly reduced. The reduction of anxiety amongst experienced teachers should allow a greater percentage of teachers the opportunity to exploit the skill and familiarity that students have with computers utilising the available resources.

9.2.2 The Role of School Infrastructure affecting Online Use

The school infrastructure to enable teachers to acquire and facilitate computer skills was defined as a mixture of hardware resources and school ICT training policies. The latter was addressed by research question two. A snapshot of each school's resources was obtained through the Catholic Education Office and interview with each school's principal. The principals also outlined the computer training programs implemented in their schools.

All but one school had a computer to student ratio of 1 to 5 and in all schools the average teacher to computer ratio for administration was also 1 to 5. The one school that was outside of the student ratio was in the process of major refurbishment and according to the principal the computing facilities would be state of the art, wireless and 1 to 3 ratio when the building was completed. The principals of nine schools indicated that the computing facilities were in constant use and four of the schools had installed a new computer laboratory within the last six months. The principals also indicated that demand for the computer laboratories exceeded availability during certain periods of the school day and it had been impossible to accommodate requests for access with different timetable models. Approximately 90% of the teachers also indicated that the schools should have more computing facilities for the students (Appendix 2).

The constant demand for computing facilities posed a dilemma for the principals. The current solution employed by schools was either to build new computer laboratories or to commandeer classrooms and convert them to computer laboratories. Both solutions were costly. Most principals stated that they did not have the funds for new buildings and could not keep taking away other learning spaces as that impacted on the timetable and other curriculum demands. Four of the schools were currently in the process of investigating wireless networks or intending to install them in the following year. The wireless solution, however, raised two major concerns with some of the principals; security and teacher use. Most principals were fearful that wireless networks would place school computer users at risk and allow access to school data. principals also acknowledged that they did not understand the setup of wireless technology nor the security issues associated with wireless networks. The principals were also reluctant to accept advice unquestioningly from the school's information technology administrator and were critical of the Catholic Education Office for what they saw as a failure to provide an adequate service in this matter.

9.2.3 A school/system wide approach

There was a tendency for leaders of schools and systems to select an approach to technology that either focused on the infrastructure or the technology competency. The over-emphasis on either of these two tracks tends to blur the consideration of a wider issue of technology and its utility for learning.

Technology needs of schools are certainly expensive in the recurrent phase, let alone capital works. The decision about wired versus unwired environments, laptops or desktops and one-to-one programs should not to be taken lightly. Once taken however, the decision has the propensity to affect the type of learning that takes place in that school's context. One of the schools, with some of the lowest rated web pages, had the greatest number of computers but these were concentrated in a laboratory context. This physical organization tended to concentrate technology learning just in those areas and prevent a more diverse use of computer technology across the school campus.

Similarly, a singular focus on developing the expertise in one particular computer application encourages 'a hurdle' mentality to master the application without considering wider implications for using the application in a learning environment. The singular focus fails to appreciate the flexibility and creativity that technology can offer (Price & Oliver, 2007). There were a number of examples in the case studies where schools focused on the powerpoint application as a competency. The use of powerpoint in these cases was certainly greater than in the other schools and the teachers of those schools did rate their skill in using the application higher than the total teacher sample. Teachers from these schools did not, however, rate powerpoint in the highest category for stimulating learning. Students from these schools made no mention of the application in their comments about technology affecting learning. Whilst the skill level for powerpoint may be high, the lack of a positive response about the application tended to diminish the effectiveness of the technology for learning and the technology training methodology employed for the teachers.

In planning to implement an effective technology program, schools should consider pedagogical solutions that incorporate infrastructure, various categories of computer application and the learning to be enhanced by such technology. This type of solution requires a needs analysis to be undertaken in schools to ascertain what resources and strategies schools currently have and what learning direction schools plan to take. Amidst the various committees, strategy designs and hardware acquisitions that would be planned, there should be acknowledgement and enlistment of student technology skills and resources to optimise school learning strategies.

9.2.4 Student use of and skill with computers

Students' skills with computers were in part due to the amount of access that they have to the machines and belies some institutional impressions (Howe & Strauss, 2000) that there is a paucity of computer access. The students in the case study schools level of computer access although higher than the general population figures (ABS, 2004) was consistent with the high percentage of ownership by families that had 15-year-old children (ABS, 2004). The census data further revealed that the percentage of computer ownership for families with school-aged children in metropolitan areas was higher than other areas. The amount of access by the students was recorded at 90% for at least most of the time (Figure 5.1, p. 89). The census data also pointed to a similar pattern with Internet connections. There were greater rates of connection to the Internet with families that had school-aged children in metropolitan areas.

This amount of access perhaps warrants a rethink about the availability of computers and the use of them, by children, away from school and outside school operating hours. Most of the principals in the ten schools were not aware of the level of computer access for students away from school. Some of the principals had planned to furnish the school with adequate resources to provide what they thought was the only access to computers for the students. There would be financial benefits if schools were able to configure their computer networks to allow students to log on with their own computer rather than continually purchasing enough computers for the student population. As well, most schools' technology strategies were structured only for using school computers during school operating hours where some of those strategies could be utilised away from school. Some of these strategies were influenced by the concerns of principals about the security of the school network and the costs involved in establishing a 'hacker' proof network. In addition to access, there are the continual developments in technology such as mobile technologies and virtual worlds that will change the education landscape. Research into the use of devices such as PDA's and mobile phones has furthered the discussion on where formal schooling takes place (Kukulska-Hulme, Evans & Traxler, 2005; Taylor et al., 2006; Price & Oliver, 2007). The developments in technology and the high level of access that students have to computers are facts that schools should not ignore in their fiscal and hardware planning. Rather than focus on replacing computers in the classrooms perhaps schools should anticipate students bringing their own machines and allow them access to school networks using the range of application skills available to them.

Overall, the students from the case study schools exhibited a high level of proficiency in the use of computer applications. This proficiency in computer applications by school students is common amongst children living in developed nations and reflected in the research reported in Chapter Two by people such as Trinidad (2002), Marsh and Millard (2003) and Sefton-Green (2004). Internet use, word processing/spreadsheets, games and multimedia were consistently the most popular applications used by the students on the non-school computer (Figure 5.3, p. 90). The trend for application use on the school computers was similar for Internet use and word processing/spreadsheet, but the use of multimedia applications was considerably less. Presentation software such as powerpoint was commonly used by the students perhaps due to the application being used as a technology focus by most of the case study schools.

The comparison between the school and non-school computer application practice raises the question of the different utilisation of multimedia applications. It is acknowledged that the use of applications, such as Internet, would not essentially be employed for the same purpose on both machines. Approximately 78% of the students indicated using the non-school computer for school purposes at least half the time, which leaves the remaining percentage use of the applications for other purposes. However, even though the intent of the application use is different, it emphasises that students are developing a general facility with computers. The sense of engagement that may be perceived by teachers because students are using computers at school could be misconceived, as students are not engaged with applications they find appealing. This type of practice may even be counterproductive and could be the reason that less than 1% of the students surveyed made a positive comment about the use of computers at school. Teachers could argue, and it was mentioned by some of the principals, that the current use of computer applications was developed as part of each school's technology response to the curriculum requirements for each year. However, with student demonstration of computing adeptness, schools should consider deploying a broad range of applications and strategies to simultaneously enable students achieve curriculum outcomes and engage them in the learning process.

9.2.5 Differences in student use

In considering the student use of applications on the different computers, the study also investigated whether age or gender impacted on the use of applications. Age was taken as the differences in year levels as the computer use for school work was driven by the different curriculum for both years and generally consistent across the schools. Equating student age to year level did mean that age specific computer interests were not entirely captured but this was offset by the ability to compare the computer applications used at and away from school. The use of the Internet was consistent across both year levels as was databases, powerpoint and chat (Table 5.2, p. 93). Differences emerged in the use of word/spreadsheet and multimedia. Year 10 students indicated a higher use of these applications over year 8. The schools' technology strategy may be responsible for the higher use of these applications, with teachers focusing on the use of word/spreadsheet and to a lesser extent multimedia in some schools. The amount of application use would vary according the technology strategy of each individual school. The other factor affecting the difference in student use of applications is that year 10 marks the end of compulsory schooling with an associated demanding assessment schedule (NSW Board of Studies, 2001). These assessment demands would require year 10 students to use applications, such as word processing to complete assignments and is also supported by year 10 students' comments in their survey responses.

In comparison to the differences in the use of applications between the years, there was only one discernable difference between female and male students in the use of computer applications, that of games. The difference between the two genders was 19% (Table 5.2, p. 93), and shows that boys were more interested in games. Research by Fromme (2003), Salen & Zimmerman (2003) and Cummings & Vancewater (2007), for example, shows that teenage males are more interested in escapism, fantasy and the ability to explore in a cyber environment. There was one exception with the girls from the single sex school recording a 75% use of games which was higher than the total student response. This response may result from the lack of competition from boys at the school (Jacko & Sears, 2003) and in there are games that girls find interesting (Isbister, 2006). With the study showing that both genders were approximately equal in their use of applications for school purposes, it allows educational systems to consider expanding their curriculum delivery by using an online platform. Students' use of computer applications for school was differentiated by year not gender and may underpin students using a web interface to conduct more of their school-work.

For work purposes evidence suggests that female and male students are spending an equal amount of time on the computer. The study confirms the work of Paris (2004) in his study of year 10 students' use of the web in a South Australian School that showed both genders spent an equal amount of time on computers. The study found that both female and male students generally demonstrated favourable tendencies towards using the Web. Using a Chi-Square test of significance and Effect size analysis, Paris found that there was not a significant difference expressed in the female and male attitudes. Paris also notes a tendency by females to use the Web when it has a particular focus such as careers or work related activity. This would also explain boys spending more time on games because they are more interested in fantasy whereas girls tend to have a greater interest in realism (Subrahmanyan, Kraut, Greenfield & Gross, 2000). The social networking software has further demonstrated equal participation by females and males. Studies by Boyd (2008), Backstrom et al. (2006) and Acquisti & Gross (2006) all show that females were equally engaged and adept in using the software. The use of such software has demonstrated that the ability to extend social networks and create new ones has encouraged its use by both genders as well as providing a model for education institutions to utilise.

The research has shown there are contrasting factors, which affect student computer use when compared to teacher computer use. In the discussion above the factors of access, application proficiency and year use were shown to be important when considering student use. The amount of computer access available to students away from school has contributed to students' proficiency with applications. Student use of applications at school was influenced by teacher knowledge of applications and teacher assessment expectations and was discrepant from their preferred use. Acknowledgement of student application proficiency and allowing a range of applications to be used for assessment would affect school praxis. As well as engaging students with familiar computer practices, it would necessitate modifying teacher training policies and school computer hardware configurations.

9.3 eLearning Environment

Instructional material posted on school intranets and school internet web-pages should be able to inform students in a clear manner but also engage them in a two-way learning process. Research on the development of learning web pages (Humar et al., 2003 & Abbey, 2000) points to the need for concise direction and information clarity as an essential precursor for interactive learning as well as discussing the cognitive impact these pages have on the intended audience. The second research question concentrated on the efficacy of the learning tasks composed by teachers for an electronic learning environment. Involving the Internet as a learning exchange also required investigation into a wider use of computer technology and learning as well as student perceptions about learning over the Internet. The following discussion addresses this research question by utilising some of the qualitative and quantitative findings detailed in chapters five to eight.

9.3.1 Training teachers for a computer environment

Some principals raised the issue of how teachers were using computers in their classrooms. Two principals from the schools with the highest rating web pages were particularly critical of how some their school's teachers used the computing facilities inadequately for poorly directed, menial or low order tasks. Some of the other principals did mention that some computer activities employed in the classroom need not have been done on the computer or could have been accomplished by students in their own time. All principals mentioned training programs for teachers to maximize the use of computing facilities.

The deployment of training for teachers differentiated between those principals who were concerned about skills, mentioned earlier, and those who were concerned about integrating technology into the learning process. Most principals were concerned about raising the computer skill level of their teachers as a competency. They looked to the computer skills assessment for students operated by the NSW Board of Studies (2004) as a gauge for improvement in teacher use of technology in the classroom. These principals would evaluate the assessment results and use them as a guide for the following year's teacher technology development program. The two principals from the high eFactor group, (see Chapter 8, p. 224), and the principal of the school currently being refurbished were more concerned about how learning was to be affected by the training of their teachers. The three principals had commissioned working parties to investigate the best way for schools to move forward. This strategy seemed to have the dual purpose of involving the teachers in the development of a technology plan as well as informing the principal. The different viewpoints of the principals have in most cases affected how the computing resources at the school were utilised and developed. These developments in turn affected how the technology at the school was being used by the students and teachers as well as being reflected in the learning posted on the school web page.

The difference between student and teacher use of computer technology has been evident in much of the results presented in this study. Lee (2007) said that for the majority of teachers the way that technology was integrated into the curriculum and used did not depend on the teachers' skill level. There would always appear to be a barrier for the teachers in the effective use of technology within the curriculum. This was highlighted with teachers unable to use computers for student learning due to the unavailability of computer laboratories in the appointed time slot. Most of these schools had mobile laptops and some multi-purpose rooms with computers that could be specifically organised for the lesson. These types of solutions could be substituted for the computer laboratories but were not in most cases as it was outside most teachers' realm of experience. More optimal use of existing school resources as well as the students' resources is a matter that the school leadership should consider in their efforts to effect a maximum deployment and use of the technologies in the school. The desire by teachers to constrain the use of technology within four walls and timetabled laboratory use not only limits the flexibility of technology but also indicates barriers to the adoption of eLearning practice. Technology strategies developed for these teachers could be broadened to include flexibility of practice, as in the case of the two high eFactor schools. The teachers from these schools demonstrated some understanding about differentiated technology learning. The modification of school technology strategies to include the various modes of differentiated technology learning would enhance the capacity of schools to develop effective eLearning practice.

Another inhibitor for teachers, acknowledged by some of the principals, were inadequate training programs for teachers. The principals, themselves, were divided on the type of technology training opting for either a skills-based program or a learning technology fusion strategy. The schools in the high eFactor group had opted for the latter approach and there was evidence of a greater learning presence on those schools' web pages. It has been suggested that students, compared with teachers, were more motivated to use computer technology and look for solutions to poor technology access and slow Internet connections at school. Teachers were more likely to use poor school resourcing and infrastructure as reasons not to use technology or persevere using it (United States Department of Education Report, 2007). Teachers could utilise the greater student motivation and engagement with computer technologies and harness the student technology solutions to contribute to students achieving more with their learning tasks.

9.3.2 Computers raising achievement levels

The opinion of both students and teachers was that computers did raise achievement levels. For students (Appendix 1, Q8 (h)), there was a perception that they achieved more marks by using computers. The two most popular free-response answers from the students were teachers awarded more marks to work generated from the computer and that the spell and grammar check also earned more marks. The teachers were of the opinion that students submitted better quality assignments when they used the computer (Appendix 2, Q18(c)).

The research went beyond these perceptions and sought to establish any relationship between computers and online use. Six scales were developed to test whether a relationship existed between elements of computer use, elements of learning and an online environment (Chapter 4, pp.69-71). The regression analyses undertaken for both teachers and students failed to establish any significant direct paths between the scales of Computer Use and Computer Applications and either Positive Learning or Relevance. Computer use, as directed by teachers, in most of the schools was based on teacher technology competencies or presentation standards. The application use at schools, as indicated by students, was biased towards the applications chosen as part of the school's technology strategy. There was no significant student response in the questionnaire about computers and learning (Ch 5, p. 93). Lack of significant response may well indicate that school programs are not targeting the use of computers for challenging or engaging learning tasks. Of the responses received the most popular was that assessment generated through computers earned students more marks as it looked better than handwritten copies. Teachers required computer processed assignments, which were supplied by the students with a reward of extra marks. The demand and supply scenario seems more typical of a mutually beneficial trade agreement rather than engaging and motivating students to learn through the use of computers. However, with so few replies these responses may just be isolated to these few students.

The sophistication required for word processing is fairly low and different from the applications that students use at home. Hence the majority of students fail to perceive any connection between the ways computers are used at school, the types of applications used on the school computers and engaged learning. The manner of computer use in the school setting may be responsible for the failure to establish any relationship between computer use and elements of learning as well as the low reliability of the Computer Use and Computer Applications scales.

The regression analyses did establish significant paths from the independent variables Computer Use, Computer Applications, Relevance and Positive Learning to Online Readiness and Online Usefulness and the four other scales (Chapter 5, Figure 5.5, p. 98). A greater percentage of the variance in Online Usefulness (35%) was explained in the student model, with Relevance identified as the primary contributor. This result indicated students' preferred means of communication and interaction and was also greater than the variance explained for Online Readiness (1.8%). These paths indicate student preference and operational focus with the Internet. Current Internet trends show that children/young adults in this school stage are spending much of their time in social networking sites such as 'Facebook'. The responsiveness and multi-layered dimension to these sites motivate and perpetuate engagement (Kumar et al., 2006). These are signposts for school educators to use when planning school technology programs. The indicators suggest that schools consider how students interact with the technology as well as modifying the curriculum to include technology, strategise teacher technology utilisation and maximize the learning response.

By contrast the regression analyses for teachers, using the same constructs, places their practice in a different category to the students. As with the students, the regression analyses did indicate significant paths from the independent variables Computer Use, Computer Applications, Relevance and Positive Learning to Online Usefulness and Online Readiness (Chapter 5, Figure 5.8). The variance explained for Online Usefulness (14.4%) was less than Online Readiness (19%). The teachers who participated in this research had a broad cross-section of teacher experience and curriculum area representation. These teachers were fairly representative, on these dimensions, of the teachers employed in the schools administered by the Catholic Education Office Sydney.

The explanatory model for Online Readiness (Ch 4, p. 75) indicates that the variables of relevance and positive learning are significant for teachers in predicting Online Readiness. Positive learning was identified as the primary contributor, which indicated that teachers were stressing the attribute of this variable as an important benefit of computers in learning. The amount of variance explained for the stronger teachers' model is lower than the stronger students' model. The difference possibly indicates that teachers are uncertain how the technology will contribute towards positive learning compared with the engagement that students perceive they have with the online environment. This uncertainty could be attributable to the type of technology training that these teachers had received. Most of the school principals identified competency training for the teachers was pursued as a school strategy. As mentioned previously in this chapter, this type of training fails to give the learner a holistic understanding of the place of technology in the learning process. The competency-based training may also have the effect of a piecemeal approach with teachers just concentrating on the skill they are learning rather than linking all the skills together and understanding how the learning is enhanced (UNESCO, 2002). This narrow teacher focus may also be detrimental when planning and implementing a technology focus in the curriculum or posting a learning activity on the school web page. Teachers may be so engrossed in concentrating on a technology skill or set of skills that they fail to appreciate the ease with which their students can manipulate the applications and the web. Students may only need a fraction of the amount of time teachers need to plan and launch a technology-focused task to complete said task. Hence the goal of engaging the student to raise their achievement through technology is circumvented and this was a similar scenario across most of the case study schools.

9.3.3 School Computer Environments for Online Learning

Of the ten case study schools, there were five single sex schools and four were co-educational. The tenth school was single sex in the lower secondary and co-educational in the upper secondary and was classed as a single sex school for this project. One of the single sex schools was also the lone lower secondary school. The regression analyses used to determine the strength of the linear relationships for the overall model were repeated using the same constructs for each of the case study schools. The comparison of the linear relationships between the overall model and the case study schools enabled any similarities or differences occurring in the different categories of schools to emerge. These characteristics are discussed in light of the schools' ability to effect an online environment.

The pattern for linear relationships in the co-educational schools for the student model showed a similar relationship to the overall model with the independent variable relevance and the dependent variable online usefulness. The similarity of the student pattern for co-educational schools to the overall model consolidates student perceptions, application use and online use for this type of school. The pattern for teachers was difficult to establish due to the small number of teachers participating in two of the schools. For the two schools with low teacher numbers the correlation analysis failed to show any similarity of correlation between the two schools. Only in one of the two other schools did the regression analysis indicate a relationship. This relationship, between Positive Learning and Online Usefulness, was not consistent with relationships found in the overall model. Insufficient teacher numbers for two schools as well as different school technology policies contribute to the failure to establish either a similarity or dissimilarity to the overall model for teachers.

The relationships established for students in the single-sex schools show a similar pattern to the students in the co-educational schools. All five schools had a greater percentage of the variance explained for the dependent variable Online Usefulness. Three of the five schools had the primary contributing independent variable as Relevance. For the other two schools, with students of different gender, the primary contributing independent variable was Positive Learning. The differences in contributing independent variables relate in part to the influences of the school principals. The principals of those two schools had a particularly high profile in promoting the importance of authentic learning. Whilst this learning did not necessarily include the influence of technology, the encouragement of a wide sphere of learning groups and challenges may well have permeated the culture of the school. Gender does not appear to have been a contributing factor to the differences in the established relationships between the schools, despite some of the known characteristics of single sex schools (Datnow & Hubbard, 2002). In the majority of schools, the students' perception and use of computers and their applications appears to be governed by their home use that was shown not to have any appreciable gender bias. Rather interests and school related use were the primary influential factors in the equitable use of the computers by both genders.

The relationships established for the teachers in the single sex schools, displayed a result similar to those in the co-educational schools. Using the results calculated in Chapters six through eight, Table 9.1 displays the relationships that were established for the teachers in those schools. One school was omitted due to the teacher numbers being too few to conduct a regression analysis. The correlation analysis for this school, established a high correlation between Relevance and Positive Learning as well as Relevance and Online Readiness. This school had the second highest learning web postings of the ten schools which is confirmed by the correlation results. The principal for this school had set high expectations for the use of computers by teachers in the school and teachers were starting to reflect this expectation in their work practice.

Table 9.1: Relationships established between dependent and independent variables for teachers in single-sex schools		
Dependent Variable	**Contributing Variable**	**Number of Schools**
Online Readiness	Positive Learning	2
Online Readiness	Relevance	1
Online Usefulness	Computer Applications	1
Online Usefulness	Positive Learning	1

Only two of the schools exhibited the same relationship as that in the overall model. One of these schools did so with a much higher percentage of the variance explained than the overall model. The probable explanation for this high variance is due to the assistant principal who had that year commenced a teacher-training program in using technology, where previously that school had not had a program. The third school with the same dependent variable but with the independent variable Relevance was in the process of evaluating a wireless network for the school. The principal for this school had high expectations for the learning programs conducted in the school and had initiated computer competency training programs for the staff, albeit in an ad-hoc basis. The introspection about the way computers were being used explains the relationship established for this school. Programs instituted by the principals may also explain the other two schools' relationships but only in one school was an interview conducted with the principal to confirm this notion. The school whose data showed a relationship between Online Usefulness and Computer Applications had for the past two years undergone a complete re-emphasis regarding the use of computers. The change in school emphasis had concentrated mainly on applications for administration and the use of a basic suite of applications in the entire school. The variance explained (49%) suggests that this has influenced teacher opinion. Each school's internally developed technology strategies has had much influence on teacher use and understanding of technology. It is at this juncture that education systems may consider developing a strategic technology-learning framework for their schools so that a wide range of education strategies may be canvassed to implement a practice that includes a wide range of technology and learning strategies.

In all of the ten schools the main influence affecting the teacher perception was not the type of school but the decisions by the leadership of the respective schools. Whereas students were able computer practitioners and confidently operated in a virtual environment, teachers were more likely to be strongly influenced by school operating modes because they were not as confident in their use of computers. School leaderships do have a mandate and a responsibility to set educational agenda but in most schools there seemed to be few teachers with substantial expertise in this field either contributing to policy direction or classroom delivery.

These somewhat opposing practices contributed and influenced the way the Internet was used by schools for web-based learning.

9.3.4 Students and online learning

There seemed little evidence of substantive online learning programs operating in the case study schools. Only in two schools was there a specific mention of online courses, one for languages and the other for gifted student enrichment programs. There did not appear to be any evidence of school-authored online programs. Also in the evaluation of the 1158 school learning pages on the web, there was no evidence of any substantive online course.

The students themselves were asked about their ability to participate in online learning (Appendix 1). Students were more often confident of access to the Internet from home (72.3%) than they were from school (51.8%). These results may incorporate factors such as Internet connections and Internet speed as well as the computer students gain access to. Fewer students displayed confidence with their ability to plan work (57.%). This capacity to plan work for an online course may be the unknown factor for the students. Year 10 students would be able to draw some parallels with compulsory assessment work planning but the year 8 students this type of planning would not be as common. For the 27% of students who said they were unsure about their ability to plan work, proportionally there were more year 8 students. There was a greater response by the students (67%) about getting their assignments in on time. This is probably due to the fact that it is practice that they are already familiar with. The largely undeveloped use of the web as a learning exchange by the schools has in part contributed to the less confident response from the students. The current school use of the web by the ten schools is in part attributable to the teacher skills with computer technology and the technology focus adopted by the schools.

9.4 Online learning resources

The Internet as a learning exchange for school children has largely been developed for the distance education sector. Countries with large distance education sectors have invested much in the development of courses and infrastructure (Mioduser, 1999; Anderson & Jackson, 2000) but this development has not flowed easily to the traditional school sector. The final research question, 'How are schools currently employing Online Learning Resources?', concentrates on the use of online resources. To answer this question the learning presence on the web for the ten case study schools was evaluated. This process necessitated the development of an evaluative tool, subsequently termed the eFactor. The findings of the eFactor results are discussed in light of the ten participating schools with some of the major characteristics of the different eFactor schools identified. The wider implication of the eFactor is addressed at the conclusion of this chapter.

9.4.1 Learning presence online

Each school participating in this study had a school web page that was hosted by the education authority, the Sydney Catholic Education Office. The templates for the web pages were a commercial application that was introduced in 2005 with a package of intensive training for small groups of teachers. These teachers would then use the train-the-trainer model to in-service the rest of the teaching staff. The basic premise of deploying the package was that it reduced the need for teachers to have knowledge of web page construction and HTML coding. The process for each school was to populate the web page with content that was generated using basic computer applications such as Microsoft word and powerpoint.

The purpose of examining the school web pages was to evaluate the learning content contained on each page. In order to do this a rubric was developed and this is found in Chapter Five (pp. 109-112). The rubric enabled the researcher to assess how engaged the learner could be. Over 1100 pages were evaluated for the period 2005 and 2006, and by the completion of the evaluation three distinct groups of schools were formed; low, medium and high eFactor groups.

There were four schools identified in the low eFactor group. Of these schools two were co-educational and two were single sex. Of the four schools, only one was poorly resourced and was in the process of large-scale refurbishment. This fact may be responsible for this school's membership of the low eFactor group. Examination of the features and practices of these schools saw the emergence of common elements about computer and web practice. There was a small expansion of the number of web pages from 2005 to 2006. The main category of web posting was administrative or straightforward homework tasks. The majority of teacher skills in the use of computer applications were limited to a proficient use of word processing and internet, with some proficiency in powerpoint. Of the three principals able to be interviewed, two principals understood that the development of the curriculum and technology would occur though teacher training in computer competencies. These competencies were tracked through the year 10 cohort's proficiency with the computer skills examination undertaken towards the end of the year. The other principal did speak about the importance of engaging the use of technology with the wider learning practice but had delayed staff development due to the school refurbishment.

There were also four schools identified in the medium eFactor group. Three of the four schools were single sex, including the lower secondary school. More teachers were involved in the posting of web pages from 2005 to 2006. There was a greater use of the web pages for reference material and learning tasks that required a level of research/engaged learning. The majority of teachers indicated a level of proficiency in internet use and a small group in each school indicated a proficiency in applications such as multimedia. The student computer classroom data also indicated a greater use of multimedia and web page development than with schools in the low eFactor group. The four school principals all spoke about the importance of having a learning focus as central to the school identity but all were also convinced about the importance of developing computer skills. One of the key differences to the low group was identified with these principals not using the year 10 computer skill test as the sole discriminator but using student engagement and teacher comment as well. The difference between each school in this group was the consistency of the training and the methods of using the computer skills in the teaching programs. Schools that were closer to the high eFactor group were employing a range of computer skills in their technology strategy planning.

The high eFactor group consisted of two schools, one single sex and the other co-educational. There was a large increase in the number of web postings from 2005 to 2006 for both schools. The postings too, graduated from largely administrative to reference, information repository and sequenced engaged learning. The majority of teachers indicated a proficiency in four computer applications. However, teacher prowess across the school was also indicated in the numbers of teachers posting material on the school's webpages. Confirmation of high computer activity came from student indicators of average to high computer use in the school. The training paradigm was focused on learning with both principals asking the teachers what they wanted to achieve with the technology before any resources were acquired and deployed. Evaluation of technology use was sought through observation of student engagement and middle management evaluation of technology resources.

Each school's position in the eFactor groups was mainly dependent on two key elements, the method of incorporating technology into the curriculum and the understanding of school leadership about technology and learning. The success of each school's technology program and its ability to host an authentic online learning platform cannot be simply attributed to the latest technology release. The success of the school's program depends upon the vision of the school leadership, the prowess of the personnel and a benchmark to evaluate each item posted.

The criteria underlying the eFactor enabled the categorisation for each web posting. It has provided an opportunity for current e-learning frameworks to be rethought in light of a wider educational audience. The possibilities of different school designs, more flexible school curricula and the prospect of the changing nature of schools all mean that schooling will change in its current form. The electronic environment is an important dimension when considering the interaction between the children who currently and will populate our schools. Authentic web-based learning requires that the current and future group of educators have a level of expertise to guide the implementation of technology-infused learning and evaluate that learning when it is posted. Highlighting these critical factors for the development of web based learning forms the premise for further research.

9.5 Limitations of the Study

The results of this study were derived from ten secondary schools operated by the Catholic education system within the Sydney metropolitan area of Australia. Each state education department of Australia operates with its own particular set of curriculum requirements and educational standards and the schools involved in the study were subject to the educations requirements of the state of New South Wales. Certain features about school operating procedures and curricula are specific to this state and affect some of the nature of the information. However, it is the impact of school technology strategies and procedures on student learning that is central to this research focus thus containing the effect of state education requirements. The localised nature of information obtained from the study schools was supported and compared to data and research from a greater sphere of educational influence. Subsequent findings of this research have a footing not only in an Australian context but also for a wider education audience with the student and teacher models and the eFactor construct.

Two of the scales in the student model, Computer Use and Computer Applications, had reliabilities below 0.7 on the Cronbach scale. The necessity of retaining these scales in the overall model construct has been justified in the methodology chapter (Ch.5, p. 97). Whilst acknowledging this weakness in the student model, the model was successful in establishing significant paths between some of the independent and dependent variables that were reasonably consistent.

There was also the possibility that the teacher sample was not representative of teachers in the ten schools involved in the study due to the low response rate of teachers in five schools. As explained in Chapter Five (p.99), each identified curriculum area had teacher representatives and there were participants in each nominated level of teacher experience. Whilst there were consequent restrictions on the analyses that could be undertaken for these five schools, the correlational analyses was successful in establishing significant relationships between the constructs that were reasonably consistent. There was the case of one school where the student response rate was low. However, the significant relationships established between the constructs were consistent with the relationships established for the student model.

9.6 Implications of this study and direction for further research

Online world, environment or classroom, adopting a virtual presence or whatever terminology is used, the education sector should seek to strategise its operations to effectively incorporate the Internet into its practice and engage Prensky's (2005) 'Digital Natives'. Part of the challenge for educators has been, and remains, the process of changing incumbent operational modes in schools to adopt the Internet as an entity that is more than just an information-gathering tool. This research has furnished a snapshot of the perceptions and practices of students, teachers and principals about computing technologies to inform the guidelines that education strategists and school personnel could utilise in developing policy and practice.

9.6.1 Familiarity with and access to computer technology

The results of this study have enabled further insight into areas such as computer access and application proficiency for children, the professional development and understanding of teachers in regard to technology and using the Internet as an avenue for educational delivery. The computer access away from school for the students was greater than the principals of most of the ten schools realised. Several principals had equipped their schools on the assumption that schools would be the only place where a significant proportion of students be able to use computers. The greater access to computers than previously thought, in a metropolitan area, may well indicate the popularity of computer technology amongst school students as a factor to increase the acquisition of technology for the family home. With such access to the technology comes greater skill in the use of computer applications. Students claimed a greater proficiency, than teachers, in the use of applications and their familiarity with technology is in part responsible for their use of the online environment. The student model (Ch. 5, p.99) showed that a greater percentage of the variance was explained in Online Usefulness and school technology programs, of most of the study schools, did not allow for this student position. Student usage of computer applications also showed that gender use of computer applications was similar in frequency, further supporting the research findings (Kumar, 2003) that females use computers to achieve academic outcomes.

Student adeptness in using a range of computer applications was at odds with the technology strategies in most of the study schools. The school technology strategies were targeted at teacher competency without effectively considering the wider use of technology for learning. Teacher technology training also appeared to miss newly-appointed, experienced teachers perhaps on the premise that they were already familiar with such technology but in reality they are part of the group identified as anxious technology users.

9.6.2 Effective Technology Strategies

The school technology strategy, in all but two of the study schools, had no provision for learning posted on the schools' webpages. As most of the schools focused on a competency-based strategy, most of the webpage postings reflected this strategy and were limited in their capacity to stimulate learning. The consideration of online learning for schools did not feature prominently in the interviews with the school principals involved in the study. Given the strong enrolment, established curriculum and metropolitan setting it is probably difficult to consider the need for a strong online presence. However, as curriculum requirements change and to meet the challenge of educating students there is a need for schools to adopt the online environment as part of their overall learning technology strategy.

Just as teachers find technology daunting, one of the constant dilemmas raised by principals in their interviews was the struggle to keep pace with the rapid development of technology. The principals were earnest in their desire to implement appropriate technology but had received little guidance. Education systems have attempted to guide technology practice by setting benchmarks for schools to aim for and there are reports published (DfES, 2001) showing the success that schools achieve. However, as in the case of this research, little guidance is given to principals about how to achieve them.

9.6.3 Linking Technology and Learning to engage students

Technology planning and implementation is not something that schools alone should have to bear. There is a need for viable partnerships between education systems and their schools to assist each level of school to understand and implement technology. For it is how the learning is disseminated that is the key element. Technology is currently one of the major learning pathways (Kim et al, 2007) and just to use technology or place an activity online does not automatically render it worthwhile. One must consider the various types of learning and how students will be engaged in using a technology-infused learning activity. The schools identified in the high eLearning group had the highest instance of merging learning and technology and reflected the schools' strategies of matching the technology with appropriate learning.

An explanation of the various types of possible learning online is not new and several were given in chapter four. The difficulty with the explanations was the lack of detail about the different levels of learning and the grouping of learning with other school functions and infrastructure. This project has enabled the development a more detailed categorisation of the various types of learning posted. More importantly it has reconceptualised the way web-based learning is viewed in schools and can be used as a reference point to strategise professional development about online learning construction and delivery.

9.7 Further research themes

This study, whilst seeking to provide further information about technology and learning at the school level, has raised questions that promote further study. It is possibly one of the facets of inquiry that, as research provides some answers to questions, it opens the possibility for further investigation (Dewey, 1930). The findings of this study has raised possible research directions in the fields of school resourcing, professional development and greater utilisation of online environments.

The amount of student access to computers raises issues of school resourcing and use of technologies. In their interviews, principals did comment about the financial strain of having to continually update hardware. Many consumers may well empathise with this notion as the technology they purchase is dated almost as soon as it is invented. The development of smaller, lighter notebooks, mobile phones and audiovisual devices all illustrate this phenomenon. The cost for schools, in common with many other organisations, to update their technological hardware as often as they would like would be prohibitive for the majority of schools. This leads to the question of how essential is the most current technology to the education process. The 'Towards a Knowledge Based Economy' report, (United Nations, 2002), found that;

> "The digital readiness of a country implies not only the availability of affordable and reliable ICT infrastructure but also the availability of human capital that is capable of using, innovating and adapting new technologies." (p. 43)

Solutions or improvements for complex organizations are rarely easy or quick. Areas for further inquiry, stemming from this study, include allowing students to utilise their own resources in the school environment while carefully ensuring that students who do not have the resources are not penalised. Prioritising school resources could also involve maximising the school online environment to allow students the option of completing units away from school and not taxing school resources. Greater use of the online environment raises the notion of a curriculum pool in a cluster or group of schools to offer a wider range of courses and investigating the criteria for students' presence at school.

Changes to school structure and operation will involve professionally developing teachers, school leaderships and systems personnel. Different models of development need to be investigated for their greatest positive effect on education praxis and individual requirements. The final development model adopted for one school may not be suitable for other schools hence the abandonment of the one-size fits all approach and the consideration of a model that best suits the needs of a school.

9.8 Concluding Comments

The primary aim of this project was to add to the research about the use of computer technology and the online environment in schools. The different perceptions and practices of school students, teachers and principals underpinned the instruments used to study this field. The use of quantitative and qualitative methods within case study research added further clarity to the results obtained about the school practices.

This study showed that there are different outcomes achieved when technology is disseminated as a skill compared with technology being integrated across a school-learning platform. The range of outcomes were defined in three eFactor groups where the different characteristics of teacher perception and practice as well as school strategies were outlined. The crucial nature of school strategy, underpinned by the leadership vision, was evident as it drove teacher professional development and the use of technology in classroom practice. The underlying constant was the familiarity and use of computer technology by the students in those schools.

Much is to be achieved in the use of schools' web presence, professional development and systems understanding of the effective use of technology for learning. These areas are identified as the factors most responsible for each schools place in the subsequent eFactor groups. The desire to use technology in education practice was evident in the study, as it was in the research from people such as Hedberg (2002), Negroponte (1995) and Seimans (2005) as well as educational authorities DfES (2004). The incentive to change those areas of practice is propelled by an advocacy to provide a learning environment where students are suitably challenged, stimulated and engaged.

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Appendices

The following data have been organised as appendices and supply additional information to further inform the study. The appendices are numbered and arranged according to the order they appear in the study.

Appendix 1 Student Survey

Are school systems ready to go online?

A study that examines the current state of Information and Communication Technologies in secondary schools and explores the possibility of the introduction of a more flexible educational structure though online technology.

University of Newcastle

Faculty of Education

Chief Researcher: Professor S. Bourke, Faculty of Education, University of Newcastle

Researchers G. Preston, Faculty of Education, University of Newcastle

D. Smith, Catholic Education Office, Sydney

Student Survey

For this survey you mostly have to tick or circle the responses. There are only a few written answers.

Personal Information (please circle)

What year are you currently in? 8 / 10 51.5/48.5 male/female 48.8/51.2

1. Do you use that computer for (please tick questions 1 -3)

Playing games	69.5
Word processing/spreadsheets	74.2
Databases	14.1
Power Point	41.4
Multi-Media (Movies/Music/Photos)	66
Internet use	93.2
Other applications (please list)	7.1
Chat	7.3
Yes recorded n/a 0.5	

2. Are you allowed to use that computer

All the time	65.7
Most of the time	27.6
Some of the time	6
Never	0.1

3.How much of that computer use is for school?

All of it	8.5
Most of it	30
About half	40
Not much	20.4
None at all	1.1

Please turn the page

4.Are you allowed to use a computer at school? Yes/no (if no go to Q7)99.5 yes

5.Is that computer use (you can tick more than 1 box)

For a computing class	19.5
For library research	73.8
For other classes (not computing)	59.6
For occasional classwork	65.4
Other ………………………………………....	1.1

6.At school, what do you use the computer for? (you can tick more than 1 box)

Word Processing/Spreadsheets	75.6
Databases	20.1
Internet searches	93.7
Web page projects	26.8
Multimedia applications	13.3
Power Point	50
Designing web pages	11
Designing software	5.4
Email/chat	11
Other ………………………………………....	0.2

7. Do you have a laptop that you take with you to all classes? Yes/No

Please turn the page

For question 8 you will need to circle the response for each part.

SA = Strongly Agree

A = Agree

U = Unsure

D = Disagree

SD = Strongly Disagree

8. Please circle your answer;

(a) Generally I enjoy lessons that use computers	30.2	53.6	12.7	2.4	1.2
(b) I understand lessons better if computers are used	15.3	30.7	34.5	16.9	2.6
(c) I pay better attention in class if computers are used	15.6	29.9	25.7	23.5	5.3
(d) My teachers expect me to word process my assignments	32.2	39.5	19.1	7.4	1.7
(e) I am more likely to choose subjects that use computers	16.2	19.6	25.4	30.4	8.4
(f) Teachers are posting lessons and assignments on websites	5.7	15.8	33.4	24.2	20.9
(g) Teachers are supplying feedback via email/websites	4	11.4	28.5	30	26.1
(h) I tend to get more marks if I use computers in my subjects	26.5	34.1	22.9	12.7	3.8
(i) I chose subjects that use computers because I am good at computers	16.6	25.7	23.2	24.2	10.3
(j) My parents think that it is important for me to study subjects that use computers	10	19.7	30.6	27.3	12.4
(k) I will not choose subjects that use computers	3.5	0	24	36	35.9
(l) Generally most of my teachers use computers in my subjects	10.1	30.7	23.2	30.9	5
(m) My subjects are more interesting if computers are used in those subjects	20.6	40.1	20.4	15.1	3.9
(n) Subjects that are offered over the Internet offer	12.5	31.6	36	15.1	4.9

more subject choice					
(o) I would have trouble with subjects that are offered over the Internet	14.4	31.5	38.1	12.3	3.7
(p) I would have more time to do other things if I studied subjects over the Internet	14	31.9	27.2	21.5	5.3
(q) I would find studying subjects over the Internet hard because the teacher would not always be present to help me	11.5	24.2	24.4	28.9	11
(r) I would find studying subjects over the Internet difficult because I cannot always get to an Internet computer	6	17.7	16.9	36.7	22.7
(s) I would do well at studying subjects over the Internet because I am good at computers	19.1	35.6	25.3	15.7	4.4

9. Which computer are you more likely to use to do your work?(Please Circle)

The computer outside school/The computer at school 89.2/10.5

10.Are there any subjects that you would like to mention, where computers have made a big difference in your results, this could be either a positive or negative? You may also like to mention what particular computer application/s you have used with this subject.

English 12.5

Maths 5.04 & 0.1 neg

Science 9.6 and 0.1 neg ____

HSIE 12.8 and 0.1 neg PE 3.3____________________________________

TAS 22.8 and 0.1 neg LOTE 1____________________________________

CA 4.2 and 0.1 neg____

11. If you were studying a subject online, would you have any difficulty with;

	Yes	Unsure	No
Your current access to the internet at home	14.5	13	72.3
Your current access to the internet at school	15.9	32.1	51.8
Your ability to plan your work	15.3	27	57.5
Get your assignments in on time	15	17.5	67.1

Thank you for completing this survey

Appendix 2 Teacher Questionnaire

In this survey you will be mainly required to either circle or tick. There are some free response answers.

1. Please state your total years of teaching experience. -----------------
2. For how many years have you been employed at your current school?-------------
3. Gender: male/female. 31.6/68.4
4. In which Key Learning Areas are you predominantly involved?

Eng 15.4 Maths 15.4, Science 12.8, HSIE 23.1, TAS 10.3, CA 9, PE 7.7, LOTE 2.6, --
Support 3.8

5. Do you have a computer in your residence? Yes/No 95.7/4.3 if no go to Q10
6. How often do you use that computer?

Every Day	41
Most Days	31.6
Some of the time	21.4
Never	1.7

84.2/11.1/0.4

7. Is this computer connected to the Internet? Yes/No/Unsure if no or unsure go to Q10
8. How often would you use this computer to connect to the Internet for either personal or school use?

	PERSONAL	SCHOOL
Every Day	29.1	16.7
Most Days	27.4	28.2
Some of the time	26.1	32.5
Never	1.7	6.8

9. Do you have access to a computer at school? Yes/No 100 if no go to Q19
10. Generally, can you use the computer when you want to? Yes/No 93.2/6.8

11. For the computers that general teaching staff normally use, what is the ratio of computers to staff?

Computers	Staff	
1	1	
1	2	3.4
1	5	59.4
1	10	17.9
Other		.9
Don't know		18.4

12. How often would you use the school computers to correct, prepare documents, research material or attend to administrative tasks?

Every Day	40.2
Most Days	33.8
Some of the time	23.5
Never	2.6

13. Does the school have a common drive on a network(this could also be a website), where you can share work with your colleagues and/or students? Yes/No/Don't know. 85/1.3/13.7
14. If you answered yes in Q 13, is this facility available off campus? Yes/No/Don't Know 36.8/28.2/21.8

15. In transferring data between home and school, which of the following methods do you mostly use;

Dial into the school computer	5.6
Email the work	30.3
Burn it to CD-ROM/DVD	13.2
Save it to floppy disk/zip disk	59.4
Take a paper copy	21.8

16. In your school;

	Yes	Don't know	No
If there is a computer network, is there a person responsible for it?	93.6	4.7	1.7
Is there a person responsible for assisting/training staff with computer technology?	74.4	15.6	10.3
If there is a school website, is there a person responsible for it?	74.4	23.5	2.1
Is there a person responsible for integrating computer technology in your KLA?	40.2	25.2	34.6

17. Please indicate how good you are at using the following software;

	Very Good	Good	OK	Help Needed	Never Used
Word Processing	54.3	28.6	15	.9	1.3
Spreadsheets	20.5	17.9	26.5	26.9	8.1
Databases	11.1	13.2	26.5	32.1	17.1
HTML /Web creation software	8.1	6.8	9.4	32.5	43.2
Sound Editing	4.3	5.6	8.1	24.8	57.3
Movie/photo editing	6.8	6.8	12	29.5	44.9
Presentation Software egPower Point	22.2	18.4	27.4	18.8	13.2
Desktop publishing	12	16.7	21.8	20.9	28.6

18. Please comment on the following statements, using the following scale and circling your response.

SA=Strongly Agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree

(a) Students show more interest in class when computers are involved.	18.4 **SA**	56.8 **A**	17.5 **U**	6.8 **D**	.4 **SD**
(b) Students are more motivated towards their studies when computers are involved.	15.8	54.3	22.2	7.3	.4
(c) Students are submitting better quality assignments when they use computer technology.	23.1	31.6	21.8	21.4	2.1
(d) Students are gaining better exam results due to the integration of computer technology into the curriculum.	4.3	12	61.1	19.7	3
(e) Teachers want to integrate computer technology into their teaching.	12.4	65.8	17.9	3.4	.4
(f) Schools need more computers to facilitate better learning.	51.7	37.2	7.3	2.6	0.3
(g) Students benefit from the integration of computer technology into your KLA.	31.2	59.4	8.5	.9	0
(h) It is inevitable that teachers will be	26.9	47.0	14.5	9.4	2.1

facilitating some or all of their classes on-line.					
(i) On-line courses add a degree of flexibility to the school curriculum.	14.1	44.4	32.5	8.5	.4
(j) School networks need to be fast to facilitate computer related learning.	50.9	42.3	5.6	1.3	0
(k) Teachers need to have their own laptop to be effective with computer technology.	72.6	4	2.6	11.1	13.2
(l) Student learning would be enhanced if they were able to study some of their subjects on-line.	9.4	40.6	37.6	11.5	.9
(m) Teachers need more funded computer technology training to be effective with that technology.	60.7	36.8	3	.4	0
(n) There are advantages for schools offering courses on-line.	11.5	39.3	45.3	3	.9
(o) Schools need to have remote access to the computer network for the effective use of computer technology in education.	33.3	53.8	11.5	1.3	0
(p) Teachers are prepared to offer courses on-line.	2.6	16.2	61.1	16.2	3.8
(q) Teachers want to use computer technology in their teaching.	18.4	65	14.1	2.1	.4

19. If you have used the following facets of computer technology, how do you rate them in terms of stimulating student's interest?

	Very Good	Good	Ok	Small amount	None
CreatingWeb Pages	14.1	15.8	5.1	2.1	2.1
Multimedia	23.5	26.9	6.8	1.7	.9
Internet searches	34.2	34.2	18.4	2.1	0
Movie/Photo editing	12	17.1	5.6	3.8	3
HTML/Web creation software	7.7	14.1	6.4	3.8	3
Desktop Publishing	10.3	20.1	10.3	5.1	1.3
Email Projects	9.8	19.7	12.8	2.6	2.6
Spreadsheet	8.1	17.1	18.8	12	1.3
Presentation Software eg Power Point	36.3	27.8	8.1	3	.4
Database	4.7	15.4	16.2	11.1	1.7
Word Processing	29.9	34.2	20.1	3.4	0
Subject specific CD's	18.4	26.5	12	3	1.3
Email feedback	10.3	15.4	12.8	3	2.6

Thank you for completing this survey

Appendix 3 Interview questions for principals

1. Do you think there is a demand for the use of computers in education and is it in your school?
2. Where is this demand mainly coming from in your school?
3. Given the current state of the technology in your school, is this demand fulfilled?
4. How would you describe the level of computer competence, in terms of the types of software applications and use of the Internet, amongst (a) the staff and (b) the students
5. (a) Do you see computer technology having any effect on student learning and has the school established any means of measuring this effect? (b) If there is any effect, what strategies has the school adopted to address these effects?
6. In what direction would you like to see the school heading as far as learning and computer technology?
7. What do you need to do to the existing school structure to support this vision?
8. (a)(i)Are there any advantages in schools embracing an on-line delivery/platform and (ii) would it be an advantage in your school?
(b) What are the implications if your school does adopt such a delivery?

Appendix 4 Pilot Student Survey

A Pilot Student Survey

for

Are school systems ready to go online?

A study that examines the current state of Information and Communication Technologies in secondary schools and explores the possibility of the introduction of a more flexible educational structure though online technology.

University of Newcastle

Faculty of Education

Chief Researcher: Professor S. Bourke, Faculty of Education, University of Newcastle

Researchers G. Preston, Faculty of Education, University of Newcastle

D. Smith, Catholic Education Office, Sydney

Student Survey

For this survey you mostly have to tick or circle the responses. There are only a few written answers.

Personal Information (please circle)

What year are you currently in? 8 / 10 male/female

1. Do you use that computer for (please tick questions 1 -3)

Playing games	
Word processing/spreadsheets	
Databases	
Power Point	
Multi-Media (Movies/Music/Photos)	
Internet use	
Other applications (please list)	

2. Are you allowed to use that computer

All the time	
Most of the time	
Some of the time	
Never	

3.How much of that computer use is for school?

All of it	
Most of it	
About half	
Not much	
None at all	

Please turn the page

4.Are you allowed to use a computer at school? Yes/no (if no go to Q6)

5.Is that computer use (you can tick more than 1 box)

For a computing class	
For library research	
For other classes (not computing)	
For occasional classwork	
Other ………………………………………...	

6. Do you have a laptop that you take with you to all classes? Yes/No (If no go to Q8)

7.At school, what do you use the computer for? (you can tick more than 1 box)

Word Processing/Spreadsheets	
Databases	
Internet searches	
Web page projects	
Multimedia applications	
Power Point	
Designing web pages	
Designing software	
Email/chat	
Other ………………………………………...	

For question 8 you will need to circle the response for each part.

SA = Strongly Agree

A = Agree

U = Unsure

D = Disagree

SD = Strongly Disagree

Please turn the page

8. Please comment on the following statements;

(a) Generally I enjoy lessons that use computers	SA	A	U	D	SD
(b) I understand lessons better if computers are used	SA	A	U	D	SD
(c) I pay better attention in class if computers are used	SA	A	U	D	SD
(d) My teachers expect me to word process my assignments	SA	A	U	D	SD
(e) I am more likely to choose subjects that use computers	SA	A	U	D	SD
(f) Teachers are posting lessons and assignments on websites	SA	A	U	D	SD
(g) Teachers are supplying feedback via email/websites	SA	A	U	D	SD
(h) I tend to get more marks if I use computers in my subjects	SA	A	U	D	SD
(i) I choose subjects that use computers because I am good at computers	SA	A	U	D	SD
(j) My parents think that it is important for me to study subjects that use computers	SA	A	U	D	SD
(k) I will not choose subjects that use computers	SA	A	U	D	SD
(l) Generally most of my teachers use computers in my subjects	SA	A	U	D	SD
(m) My subjects are more interesting if computers are used in those subjects	SA	A	U	D	SD
(n) Subjects that are offered over the Internet offer more subject choice	SA	A	U	D	SD
(o) I would have trouble with subjects that are offered over the Internet	SA	A	U	D	SD
(p) I would have more time to do other things if I studied subjects over the Internet	SA	A	U	D	SD
(q) I would find studying subjects over the Internet hard because the teacher would not always be present to help me	SA	A	U	D	SD
(r) I would find studying subjects over the Internet difficult because I cannot always get to an Internet computer	SA	A	U	D	SD
(s) I would do well at studying subjects over the Internet because I am good at computers	SA	A	U	D	SD

Please turn the page

9. Which computer are you more likely to use to do your work?(Please Circle)

The computer outside school/The computer at school

10.Are there any subjects that you would like to mention, where computers have made a big difference in your results, this could be either a positive or negative? You may also like to mention what particular computer application/s you have used with this subject.

____

____

____

____

____

____

11. If you were studying a subject online, would you have any difficulty with;

	Yes	Unsure	No
Your current access to the internet at home			
Your current access to the internet at school			
Your ability to plan your work			
Get your assignments in on time			

Thank you for completing this survey

Appendix 5 Request to the Education authority

FACULTY OF EDUCATION & ARTS

Professor S.F. Bourke
Assistant Dean, Research & Research Training

Phone: 02 4921 5901
Fax: 02 4921 6895
Email: sid.bourke@newcastle.edu.au

David Smith
Inner West Catholic Education Office
Locked Bag 83
Lidcombe 1825
Ph. 9643 3600

Date

Br. Kelvin Canavan
Executive Director of Schools
Catholic Education Office
Sydney

Project: Are Schools Ready to go On-Line? An investigation of the current state of Information and Communication Technologies in Secondary Schools and the feasibility of introducing more flexible educational structures through On-Line Technology. **8th October 8, 2003**

Dear Br. Kelvin

Request

We request permission to undertake a research project, identified above, in the schools of the Sydney Archdiocese. This research will provide data for a thesis to be submitted by David Smith for a PhD under the supervision of Professor Sid Bourke and Greg Preston of the University of Newcastle. The research will examine the current technology skill level amongst students and teachers. It will also examine the current use of computer technology in the delivery of education programs in schools.

To facilitate the research, we would like to survey students, teachers and principals in ten of the schools in the Sydney Archdiocese, excluding the Inner West. We propose to distribute a questionnaire to year 8 and year 10 students in November of this year; about the time when students are thinking about the subjects they have chosen for next year. We also propose to distribute a questionnaire to the teachers of the same schools and interview the principals of those schools. The research proposal is also before the University of Newcastle's Ethics Committee and once their approval is gained, we will forward that to you.

David Smith is an employee of the Catholic Education Office and works out of the Inner West Office. Until last year he was a curriculum coordinator in a systemic high school in the Sydney Archdiocese. He is also a PhD student at Newcastle University. He is very interested in how computer technology can better facilitate the educational needs of students, and we hope that the data collected from his research will provide insights that will be of benefit to the schools of this archdiocese, indeed of education in general.

Purpose

The purpose of the student questionnaire will be to gauge current computer ownership and use of the students. It will also be to ascertain any impact that computers have on the education programs disseminated in the schools. Gender will also be a factor that is examined. The reason we have chosen years 8 and 10 is that these students will select subjects for the following stage of their schooling. It will be pertinent to note whether computer technology impacts on that choice.

The teacher questionnaire will also examine current computer use and ownership amongst teachers. More importantly though, the questionnaire will examine the current state of computer technology integration in the curriculum. The reasons for the current state of integration will hopefully be extracted from the data and used to recommend directions for future partnerships between computer technology and education.

The Principals will be asked for their opinion about the place of computer technology in schools. They will also be asked how they have facilitated the use of computer technology in their own schools.

Feedback

Once the data has been processed, then all participants will receive the following information;

- The number of computers that students have access to outside of school
- The popularity of certain software in the delivery of education programs
- The number of students who are willing to undertake courses on-line

This information will be given to schools to be distributed by them to all groups. As well, school principals will receive feedback on the number of key learning areas affected by computer technology.
The electronic data from the questionnaires and the interview transcripts will remain securely stored at the University of Newcastle for a period of 5 years.

Participation

It will be stressed that participation in the above research is voluntary for all participants and the identity of all participants will be confidential. The option of withdrawing at any time will also be explicitly stated for all participants.

If you give your permission, we will write to the secondary school principals and seek their permission. Participation will be voluntary and a letter will be sent to the parents of each participating child.

We look forward to your reply.

Yours sincerely,

Professor Sid Bourke David Smith

Project Supervisor **PhD Student**

FACULTY OF EDUCATION & ARTS

Professor S.F. Bourke
Assistant Dean, Research & Research Training

Phone: 02 4921 5901
Fax: 02 4921 6895
Email: sid.bourke@newcastle.edu.au

David Smith
Inner West Catholic Education Office
Locked Bag 83
Lidcombe 1825
Ph. 9643 3600

Date

Principal Name
School Address

Project: Are Schools Ready to go On-Line? An investigation of the current state of Information and Communication Technologies in Secondary Schools and the feasibility of introducing more flexible educational structures through On-Line Technology. 8th October 8, 2003

Dear Principal,

We request permission to undertake a research project, identified above, in your school. We hope to distribute a questionnaire to year 8, year 10 students and the teachers of your school. We would also like to invite you to participate in an interview at a time convenient to you later this year. That interview will be of approximately 30 minutes duration and will be recorded. You will be able to listen to that recording and make any alterations that you wish to. We have gained permission for the research from Br. Kelvin and the Ethics Committee of the University of Newcastle.

David Smith is an employee of the Catholic Education Office and works out of the Inner West Office. Until last year he was a curriculum coordinator in a systemic high school in the Sydney Archdiocese. He is also a PhD student at Newcastle University. The research being conducted will provide data for a thesis to be submitted by him for a PhD under the supervision of Professor Sid Bourke and Greg Preston of the University of Newcastle.

We are very interested in how computer technology can better facilitate the educational needs of students. We hope that the data collected from this study will provide insights that will be of benefit to the schools of this archdiocese, indeed of education in general.

Purpose

The purpose of the student questionnaire will be to gauge current computer ownership and computer use by the students. It will also be to ascertain any impact that computers have on the education programs disseminated in the schools. Gender will also be a factor that is examined. The reason why we have selected years 8 and 10 for the study is that these students will choose subjects for the following stage of their schooling. It will be pertinent to note whether computer technology impacts on that choice.

The teacher questionnaire will examine current computer use and ownership amongst teachers. It will also examine the current state of integration of computer technology in the curriculum. The reasons for the current state of integration will hopefully be extracted from the data and used to recommend directions for future partnerships between computer technology and education.

Participation

Participation in this study is entirely voluntary and participants are able to withdraw at any time by contacting the school. As the school will retain the consent forms, the identity of participants will not be known to the researchers. You can also withdraw the school at any time from the project.

Feedback and Storage

Once the data has been processed, then all participants will receive the following information;

- The number of computers that students have access to outside of school
- The popularity of certain software in the delivery of education programs
- The number of students who are willing to undertake courses on-line

This information will be given to schools to be distributed by them to all groups. As well, you will receive feedback on the number of key learning areas affected by computer technology.
The data will remain securely stored at the University of Newcastle for a period of 5 years.

We will of course be sensitive to the administrative structures of the school. The delivery of the survey for the students we anticipate will take just 30 minutes once permission has been obtained from the students' parents. Should you have any further questions, please contact David Smith on 9643 3637 or Professor Bourke on 02 49215901. David will contact you in about a week to ascertain whether you would agree to your school's participation as well as your participation in the interview.

We look forward to your reply.

Yours sincerely,

Professor Sid Bourke | David Smith

Project Supervisor | **PhD Student**

Appendix 6 Survey information and consent

FACULTY OF EDUCATION & ARTS

Professor S.F. Bourke
Assistant Dean, Research & Research Training

Phone: 02 4921 5901
Fax: 02 4921 6895
Email: sid.bourke@newcastle.edu.au

David Smith
Inner West Catholic Education Office
Locked Bag 83
Lidcombe 1825
Ph. 9643 3600

Project: Are Schools Ready to go On-Line? An investigation of the current state of Information and Communication Technologies in Secondary Schools and the feasibility of introducing more flexible educational structures through On-Line Technology. 8th October 8, 2003

Dear Year 8/10 Parent,

We would like to invite your child to participate in the above project by completing a questionnaire. This questionnaire forms part of the research for David Smith's PhD studies under the supervision of Professor Sid Bourke and Greg Preston of the University of Newcastle. Until last year Mr Smith was a curriculum coordinator in a systemic high school in the Sydney Archdiocese. This year he has moved to the Inner West Office. His research revolves around the use of online learning in secondary education, and he has gained permission for the study from Br. Kelvin Canavan, the Ethics Committee of the University of Newcastle and the Principal of your child's school.

Purpose and Who is Involved

The purpose of the student questionnaire will be to look at how computers are used at home and at school. The questionnaire will be given to year 8 and year 10 students in 10 schools of the Sydney Archdiocese. This data will be used to suggest methods of using computer technology in future years.

Place and Requirement

The questionnaire will be given to students during the school's administration time, and will take approximately 30 minutes to complete. Students will be asked to mainly tick boxes to complete the questionnaire. These questions will ask students about their computer use both at home and at school.

Participation

Participation in this research is entirely the choice of you and your child. Your child will not be identified in the research, as names are not required on the questionnaire forms. Only those students for whom parental/guardian consent is given will be able to participate, these consent forms will be retained by the school. Whatever your decision, your child will not be in any way disadvantaged. If you agree to your child's participation, your child can elect not to participate or to withdraw from the study at any time without giving a reason.

Feedback and Storage

Once the data has been processed, then all participants will receive the following information;

- The number of computers that students have access to outside of school
- The popularity of certain software in the delivery of education programs
- The number of students who are willing to undertake courses on-line

This information will be given to schools to be distributed by the schools to all groups. Once the data has been entered into the computer and checked, the questionnaires will be destroyed.
The electronic data will remain securely stored at the University of Newcastle for a period of 5 years.

Contact

If you have any questions please feel free to contact David Smith on 96433637 or Professor Sid Bourke on 0249215901. Should you agree to allow your child to take part in this research would you please fill out the attached permission form. The form may be given to <<arrangement with school>>.

Concerns

Should you have any concerns about the rights of your child as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, telephone 0249216333. Email Human-Ethics@newcastle.edu.au.

If you agree to your child's participation in this study, please complete the consent form overleaf and return it to the school. Thank you for taking the time to read this letter.

Yours sincerely,

Professor Sid Bourke	David Smith
Project Supervisor	PhD Student

FACULTY OF EDUCATION & ARTS

Professor S.F. Bourke
Assistant Dean, Research & Research Training

Phone: 02 4921 5901
Fax: 02 4921 6895
Email: sid.bourke@newcastle.edu.au

STUDENT CONSENT FORM

For a study entitled: **Are school systems ready to go online?** 8th October, 2003

Being conducted by:
Professor Sid Bourke; Faculty of Education, University of Newcastle
Greg Preston; Faculty of education, University of Newcastle
David Smith; Catholic Education Office, Sydney

I agree for my child to participate in the above research project and give my consent freely.
I understand that the project will be conducted as described in the information statement, a copy of which I have retained.
I understand that my child can withdraw from the project at any time and does not have to give any reason for withdrawing.
I consent to my child completing the questionnaire.
I understand that my child's personal information will remain confidential to the researcher.
I have had the opportunity to have questions answered to my satisfaction.

Print Name…………………………………………………….

Signed……………………………………………… (parent)

Print Name……………………………………………………

………………………………………………………………(student)

FACULTY OF EDUCATION & ARTS

Professor S.F. Bourke
Assistant Dean, Research & Research Training

Phone: 02 4921 5901
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Email: sid.bourke@newcastle.edu.au

David Smith
Inner West Catholic Education Office
Locked Bag 83
Lidcombe 1825
Ph. 9643 3600

Project: Are Schools Ready to go On-Line? An investigation of the current state of Information and Communication Technologies in Secondary Schools and the feasibility of introducing more flexible educational structures through On-Line Technology. 8th October 8, 2003

Dear Teacher,

We would like to invite you to participate in the above project by completing a questionnaire. This questionnaire forms part of David Smith's research for his PhD studies under the supervision of Professor Sid Bourke and Greg Preston of the University of Newcastle

Purpose

The questionnaire examines current computer use and practice. It will also track the current state of integration of computer technology in the curriculum. The data extracted will hopefully be used to recommend directions for future partnerships between computer technology and education.

Until last year David Smith was a curriculum coordinator in a systemic high school. This year he has moved to the Inner West Office. He is very interested in how computer technology impacts on the educational needs of students.

Place and Requirement

The questionnaire can be completed at your convenience. In the main you are asked to tick boxes, and the questionnaire takes about 30 minutes to complete.

Participation

Participation in this research is entirely your choice. Participants are not required to identify themselves when completing the questionnaire. Only those people who give their informed consent will be included. Whatever your decision, you will not be in any way disadvantaged. If you agree to participate, you can elect to withdraw from the study at any time without giving a reason.

Feedback and Storage

Once the data have been processed, then all participants will receive the following information;

- The number of computers that students have access to outside of school
- The popularity of certain software in the delivery of education programs
- The number of students who are willing to undertake courses on-line

This information will be given to schools to be distributed by the schools to all groups.
The data will remain securely stored at the University of Newcastle for a period of 5 years.

Contact

If you have any questions please feel free to contact David Smith on 96433637 or Professor Sid Bourke on 0249215901. Should you agree to take part in this research would you please complete the attached consent form. The form should be given to <<arrangement with school>>.

Concerns

Should you have any concerns about your rights as a participant in this research, or if you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, telephone 0249216333. Email Human-Ethics@newcastle.edu.au.

Thank you for considering this request,

Yours sincerely,

Professor Sid Bourke
Project Supervisor

David Smith
PhD Student

FACULTY OF EDUCATION & ARTS

Professor S.F. Bourke
Assistant Dean, Research & Research Training

Phone: 02 4921 5901
Fax: 02 4921 6895
Email: sid.bourke@newcastle.edu.au

CONSENT FORM

For a study entitled: **Are school systems ready to go online?**

Being conducted by:
Professor Sid Bourke; Faculty of Education, University of Newcastle
Greg Preston; Faculty of education, University of Newcastle
David Smith; Catholic Education Office, Sydney

I agree to participate in the above research project and give my consent freely.

I understand that the project will be conducted as described in the consent statement, a copy of which I have retained.

I understand I can withdraw from the project at any time and do not have to give any reason for withdrawing.
I understand that my personal information will remain confidential to the researchers.
I have had the opportunity to have questions answered to my satisfaction.

Print Name…………………………………………………….

Signed………………………………………………

Appendix 7 eFactor Scores

This table displays the individual components used to calculate the eFactor score for the ten secondary schools that participated in the study.

School	Teacher Numbers	Participating Teacher Proportion	Weighted Sum	Divided by School Size	Muliplied by teacher proportion (efactor)
School 3	49	55.10%	1712	34.94	19.22
School 1	46	45.65%	1827	39.72	18.27
School 9	61	24.59%	1385	22.7	5.68
School 5	55	20.00%	995	18.09	3.62
School 2	58	24.14%	577	9.95	2.39
School 10	39	28.21%	324	8.31	2.33
School 6	75	12.00%	505	6.73	0.81
School 4	61	13.11%	270	4.43	0.58
School 8	54	11.11%	140	2.59	0.29
School 7	47	8.51%	108	2.3	0.21

Appendix 8 Percentage totals for student and teacher questionnaires

Totals of student response for each item of the student questionnaire

Questionnaire Item	Response Categories	Number	Percentage
Access to a computer outside of school	yes	2011	99.4
	no	12	.6
using this computer for games	not applicable	11	.5
	no	607	30.0
	yes	1405	69.5
using this computer for word or spreadsheet	not applicable	11	.5
	no	511	25.3
	yes	1501	74.2
using this computer for databases	not applicable	11	.5
	no	1726	85.3
	yes	286	14.1
using this computer for power point	not applicable	11	.5
	no	1175	58.1
	yes	837	41.4
using this computer for multi media	not applicable	11	.5
	no	677	33.5
	yes	1335	66.0
using this computer for internet	not applicable	11	.5
	no	126	6.2
	yes	1886	93.2
using this computer for chat	not applicable	11	.5
	no	1866	92.2
	yes	146	7.2
other uses	not applicable	11	.5
	no	1827	90.3
	yes	185	9.1
permitted use of this computer	all	1330	65.7
	most	558	27.6
	some	122	6.0
	never	3	.1
	not applicable	10	.5
how much of this computer is for school use	all	81	4.0
	most	606	30.0
	half	890	44.0
	not much	413	20.4
	none	23	1.1

	not applicable	10	.5
use of a computer at school	no	11	.5
	yes	2012	99.5
use for a computing class	no	1628	80.5
	yes	395	19.5
use for library research	no	531	26.2
	yes	1492	73.8
use for programmed unit	no	818	40.4
	yes	1205	59.6
use for single classes	no	700	34.6
	yes	1323	65.4
other uses	no	2001	98.9
	yes	22	1.1
using school computer for word or spreadsheet	no	493	24.4
	yes	1530	75.6
using school computer for databases	no	1616	79.9
	yes	407	20.1
using school computer for internet searches	no	121	6.0
	yes	1902	94.0
using school computer for web projects	no	1481	73.2
	yes	542	26.8
using school computer for multimedia applications	no	1754	86.7
	yes	269	13.3
using school computer for powerpoint	no	1012	50.0
	yes	1011	50.0
using school computer for web page design	no	1801	89.0
	yes	222	11.0
using school computer for software design	no	1914	94.6
	yes	109	5.4
using school computer for email or chat	no	1800	89.0
	yes	223	11.0
using school computer for other uses	no	2018	99.8
	yes	5	.2
use of a laptop for all classes	no	2023	100.0
enjoy lessons that use the computer	strongly disagree	24	1.2
	disagree	48	2.4

	undecided	256	12.7
	agree	1085	53.6
	strongly agree	610	30.2
understand better if computers are used	strongly disagree	53	2.6
	disagree	341	16.9
	undecided	698	34.5
	agree	622	30.7
	strongly agree	309	15.3
pay better attention if computers are used	strongly disagree	108	5.3
	disagree	475	23.5
	undecided	520	25.7
	agree	605	29.9
	strongly agree	315	15.6
an expectation to word process assignments	strongly disagree	35	1.7
	disagree	150	7.4
	undecided	387	19.1
	agree	800	39.5
	strongly agree	651	32.2
likely to choose subjects that use computers	strongly disagree	170	8.4
	disagree	616	30.4
	undecided	513	25.4
	agree	397	19.6
	strongly agree	327	16.2
teachers are posting lessons/assignments on websites	strongly disagree	423	20.9
	disagree	489	24.2
	undecided	675	33.4
	agree	320	15.8
	strongly agree	116	5.7
teachers are supplying feedback via email/websites	strongly disagree	527	26.1
	disagree	609	30.1
	undecided	576	28.5
	agree	231	11.4
	strongly agree	80	4.0
more marks if computers are used	strongly disagree	77	3.8
	disagree	257	12.7
	undecided	464	22.9
	agree	689	34.1
	strongly agree	536	26.5
chose subjects with computers because of computer ability	strongly disagree	208	10.3
	disagree	490	24.2
	undecided	469	23.2

	agree	520	25.7
	strongly agree	336	16.6
Parents think that subjects using computers are important	strongly disagree	250	12.4
	disagree	553	27.3
	undecided	620	30.6
	agree	398	19.7
	strongly agree	202	10.0
Not choose subjects because of computers	strongly disagree	726	35.9
	disagree	728	36.0
	undecided	499	24.7
	strongly agree	70	3.5
Most teachers use computers	strongly disagree	102	5.0
	disagree	625	30.9
	undecided	469	23.2
	agree	622	30.7
	strongly agree	205	10.1
Subjects are more interesting if they use computers	strongly disagree	78	3.9
	disagree	305	15.1
	undecided	412	20.4
	agree	812	40.1
	strongly agree	416	20.6
Subjects offered over the internet offer more choice	strongly disagree	98	4.8
	disagree	305	15.1
	undecided	728	36.0
	agree	640	31.6
	strongly agree	252	12.5
There will be a difficulty if subjects are offered over the net	strongly disagree	74	3.7
	disagree	249	12.3
	undecided	771	38.1
	agree	637	31.5
	strongly agree	292	14.4
There would be more time if subjects are studied in the net	strongly disagree	108	5.3
	disagree	435	21.5
	undecided	551	27.2
	agree	646	31.9
	strongly agree	283	14.0
Net subjects would be difficult due to lack of teachers	strongly disagree	223	11.0
	disagree	584	28.9
	undecided	493	24.4
	agree	490	24.2
	strongly agree	233	11.5

Difficulty of accessing an internet computer	strongly disagree	460	22.7
	disagree	744	36.8
	undecided	339	16.8
	agree	358	17.7
	strongly agree	122	6.0
Do well at studying over the net because good at computers	strongly disagree	89	4.4
	disagree	317	15.7
	undecided	511	25.3
	agree	720	35.6
	strongly agree	386	19.1
Which computer is the most likely to be used	outside school	1806	89.3
	at school	212	10.5
english use of computers	no mention	1769	87.4
	positive	254	12.6
maths use of computers	no mention	1918	94.8
	negative	2	.1
	positive	103	5.1
science use of computers	no mention	1826	90.3
	negative	3	.1
	positive	194	9.6
hsie use of computers	no mention	1760	87.0
	negative	3	.1
	positive	260	12.9
tas use of computers	no mention	1556	76.9
	negative	2	.1
	positive	465	23.0
creative arts use of computers	no mention	1926	95.2
	negative	2	.1
	positive	4.7	4.7
pe use of computers	no mention	1956	96.7
	positive	67	3.3
lote use of computers	no mention	2001	98.9
	positive	22	1.1
problem access to the internet at home	no	1464	72.4
	unsure	263	13.0
	yes	294	14.5
problem access to the internet at school	no	1050	51.9
	unsure	650	32.1
	yes	321	15.9
ability to plan work	no	1166	57.6
	unsure	547	27.0

	yes	309	15.3
ability to get assignments in on time	no	1362	67.3
	unsure	355	17.5
	yes	304	15.0

Totals of teacher response for each item of the teacher questionnaire

Questionnaire Item	Response Categories	Number	Percentage
Total years of teaching experience	1 to 5	55	23.5
	6 to 10	37	15.8
	11 to 20	79	33.8
	21 to 30	50	21.4
	31 to 45	13	5.6
Number of years at the current school	1 to 5	142	60.7
	6 to 10	53	22.6
	11 to 20	33	14.1
	21 to 30	5	2.1
	greater than 30	1	.4
teacher gender	male	74	31.6
	female	160	68.4
the main KLA to which the teacher belongs	english	36	15.4
	mathematics	36	15.4
	science	30	12.8
	hsie	54	23.1
	tas	24	10.3
	creative arts	21	9.0
	pd/h/pe	18	7.7
	lote	6	2.6
	support	9	3.8
teachers who have a computer in their residence	yes	224	95.7
	no	10	4.3
frequency of home computer use	every day	96	41.0
	most days	74	31.6
	some days	50	21.4
	never	4	1.7
	n/a	10	4.3
connection of home computer to the internet	yes	197	84.2
	no	26	11.1
	unsure	1	.4
	n/a	10	4.3

use of home internet for personal use	every day	68	29.1
	most days	64	27.4
	some days	61	26.1
	never	4	1.7
	n/a	37	15.8
use of home internet for school use	every day	39	16.7
	most days	66	28.2
	some days	76	32.5
	never	16	6.8
	n/a	37	15.8
access to a computer at school	yes	234	100.0
are the computers available when needed	no	15	6.4
	yes	219	93.6
ratio of staff to computers	1:2	8	3.4
	1:5	139	59.4
	1:10	42	17.9
	other	2	.9
	don't know	43	18.4
frequency of use of school computers for school related work	every day	94	40.2
	most days	79	33.8
	some days	55	23.5
	never	6	2.6
common drive for the network	yes	3	1.3
	dont know	32	13.7
	no	199	85.0
remote availability of common drive	yes	94	40.2
	dont know	51	21.8
	no	89	38.0
dial into the network to transfer data	no	219	93.6
	yes	15	6.4
email to transfer data	no	162	69.2
	yes	72	30.8
burn to cd/dvd to transfer data	no	201	85.9
	yes	33	14.1
save to floppy/zip	no	89	38.0
	yes	145	62.0
network administrator in the school	no	4	1.7
	dont know	11	4.7
	yes	219	93.6
a person to train	no	24	10.3

staff to use the technology	don't know	36	15.4
	yes	174	74.4
a person to maintain the school website	no	5	2.1
	dont know	55	23.5
	yes	174	74.4
a person to integrate technology into the kla	no	81	34.6
	don't know	59	25.2
	yes	94	40.2
proficiency at word processing	never used	3	1.3
	help needed	2	.9
	ok	35	15.0
	good	67	28.6
	very good	127	54.3
proficiency at spreadsheets	never used	19	8.1
	help needed	63	26.9
	ok	62	26.5
	good	42	17.9
	very good	48	20.5
proficiency at database	never used	40	17.1
	help needed	75	32.1
	ok	62	26.5
	good	31	13.2
	very good	26	11.1
web creation	never used	101	43.2
	help needed	76	32.5
	ok	22	9.4
	good	16	6.8
	very good	19	8.1
proficiency at sound editing	never used	134	57.3
	help needed	58	24.8
	ok	19	8.1
	good	13	5.6
	very good	10	4.3
proficiency at movie/photo editing	never used	105	44.9
	help needed	69	29.5
	ok	28	12.0
	good	16	6.8
	very good	16	6.8
proficiency at desktop publishing	never used	67	28.6
	help needed	49	20.9
	ok	51	21.8

	good	39	16.7
	very good	28	12.0
students show more interest when computers are used	strongly disagree	1	.4
	disagree	16	6.8
	undecided	41	17.5
	agree	133	56.8
	strongly agree	43	18.4
students are more motivated when computers are used	strongly disagree	1	.4
	disagree	17	7.3
	undecided	42	17.9
	agree	134	57.3
	strongly agree	40	17.1
computer technology=better assignments	strongly disagree	5	2.1
	disagree	50	21.4
	undecided	41	17.5
	agree	83	35.5
	strongly agree	55	23.5
computer technology=better exam results	strongly disagree	7	3.0
	disagree	46	19.7
	undecided	77	32.9
	agree	75	32.1
	strongly agree	29	12.4
teachers want to integrate technology into their teaching	strongly disagree	1	.4
	disagree	8	3.4
	undecided	42	17.9
	agree	154	65.8
	strongly agree	29	12.4
schools need more computers to better facilitate learning	strongly disagree	3	1.3
	disagree	6	2.6
	undecided	17	7.3
	agree	87	37.2
	strongly agree	121	51.7
students benefit from the integration of computers	disagree	2	.9
	undecided	20	8.5
	agree	139	59.4
	strongly agree	73	31.2
teachers facilitating online courses	strongly disagree	5	2.1
	disagree	22	9.4
	undecided	34	14.5
	agree	110	47.0
	strongly agree	63	26.9

online courses add flexibility to curriculum	strongly disagree	1	.4
	disagree	20	8.5
	undecided	76	32.5
	agree	104	44.4
	strongly agree	33	14.1
school networks need to be fast to facilitate computer learn	disagree	3	1.3
	undecided	13	5.6
	agree	99	42.3
	strongly agree	119	50.9
teachers need to have their own laptops	strongly disagree	31	13.2
	disagree	26	11.1
	undecided	6	2.6
	agree	1	.4
	strongly agree	170	72.6
student learning would be enhanced with online	strongly disagree	2	.9
	disagree	27	11.5
	undecided	88	37.6
	agree	95	40.6
	strongly agree	22	9.4
teachers need more funded training with technology	disagree	1	.4
	undecided	5	2.1
	agree	86	36.8
	strongly agree	142	60.7
advantages for schools to offer online courses	strongly disagree	2	.9
	disagree	7	3.0
	undecided	106	45.3
	agree	92	39.3
	strongly agree	27	11.5
schools need to have remote access	disagree	3	1.3
	undecided	27	11.5
	agree	126	53.8
	strongly agree	78	33.3
teachers are willing to offer online courses	strongly disagree	9	3.8
	disagree	38	16.2
	undecided	143	61.1
	agree	38	16.2
	strongly agree	6	2.6
teachers want to use computer technology in teaching	strongly disagree	1	.4
	disagree	5	2.1
	undecided	33	14.1
	agree	152	65.0

	strongly agree	43	18.4
creating web pages to stimulate learning	none	127	54.3
	small amount	19	8.1
	ok	12	5.1
	good	37	15.8
	very good	33	14.1
using multimedia to stimulate learning	none	80	34.2
	small amount	11	4.7
	ok	20	8.5
	good	63	26.9
	very good	55	23.5
using web searches to stimulate learning	none	17	7.3
	small amount	8	3.4
	ok	42	17.9
	good	82	35.0
	very good	80	34.2
using movie/photo editing	none	125	53.4
	small amount	23	9.8
	ok	13	5.6
	good	40	17.1
	very good	28	12.0
using web creation software to stimulate learning	none	137	58.5
	small amount	26	11.1
	ok	15	6.4
	good	33	14.1
	very good	18	7.7
using desktop publishing to stimulate learning	none	106	45.3
	small amouint	27	11.5
	ok	24	10.3
	good	48	20.5
	very good	24	10.3
using email projects to stimulate	none	110	47.0
	small amount	20	8.5
	ok	30	12.8
	good	46	19.7
	very good	23	9.8
using spreadsheets to stimulate	none	88	37.6
	small amount	38	16.2
	ok	44	18.8
	good	40	17.1
	very good	19	8.1

using presentation software to stimulate	none	44	18.8
	small amount	10	4.3
	ok	25	10.7
	good	65	27.8
	very good	85	36.3
using databases to stimulate learning	none	106	45.3
	small amount	40	17.1
	ok	35	15.0
	good	37	15.8
	very good	11	4.7
using word processing to stimulate	none	17	7.3
	small amount	8	3.4
	ok	45	19.2
	good	88	37.6
	very good	71	30.3
using cds to stimulate	none	79	33.8
	small amount	8	3.4
	ok	36	15.4
	good	62	26.5
	very good	43	18.4
using email feedback to stimulate learning	none	117	50.0
	small amount	13	5.6
	ok	39	16.7
	good	36	15.4
	small amount	24	10.3

Appendix 9 Questions used to form the scales for Students and Teachers

Student Scales
Computer applications
Q6 At School, what do you use that computer for? Word processing/Spreadsheets Databases Internet searches Web page projects Multimedia Powerpoint Designing Web pages Designing software Email/chat Other
Computer Use
8(d) My teachers expect me to word process my assignments 8(l) Generally most of my teachers use computers in my subjects Q5 Is that Computer use for – a computing class - library research - other classes - Occasional classwork
Relevance
Scale 8(e) I am more likely to choose subjects that use computers 8(h) I get more marks when computers are used 8(i) I chose subjects with computers because I am good with computers 8(j) My Parents think that it is important for me to study subjects that use computers
Positive Learning
Scale 8(a)Generally I enjoy lessons that use computers 8(b) I understand lessons better if computers are used 8(c) I pay better attention in class if computers are used 8(m) My subjects are more interesting if computers are used
Online Readiness
11. If you were studying a subject online would you have any difficulty with - Your current access to the Internet at home - Your current access to the Internet at School - Your ability to plan your work - Get your assignments in on time
Online Usefulness
8(f) Teachers are posting assignment and lessons on websites 8(g) Teachers are supplying feedback via email/websites 8(n) Subjects that are offered over the Internet offer more choice 8(p) I would have more time to do other things if I studied subjects over the Internet 8(s) I will do well at studying subjects over the Internet because I am good at computers

Teacher Scales
Computer applications
Q17 Please indicate how good you are at using the following software:- Word Processing Spreadsheets Databases HTML/ Web creation software Sound editing Movie/photo editing Presentation software Desktop Publishing
Computer Use
18(e) Teachers want to integrate computer technology into their teaching 18(q) Teachers want to use computer technology in their teaching Cronbach Alpha = 0.8 Supporting questions Q10 Generally can you use that computer when you want? Q15 In transferring data between home and school which of the following do you use: - Dial into - email - Burn - Zip/disk - Paper Q16 In you school is there a person responsible for- network..? - training - school website - KLA integration
Relevance
Q19 How do you rate the following facets of computer technology in terms of stimulating student interest? Creating Web Pages Multimedia Internet Searches Movie/Photo editing HTML/web creation software Desktop publishing Email projects Spreadsheet Presentation software Database Word Processing Subject Specific CD's Email Feedback

Positive Learning
18(b) Students are more motivated toward their studies when computers are involved 18(c) Students are submitting better quality assignments when they use computer technology. 18(d) Students are gaining better exam results due to the integration of computer technology into the curriculum 18(g) Students benefit from the integration of computer technology into your KLA.
Online Readiness
Q13 Does the school have a common drive…? Q14 Is this available off campus 18(f) Schools need more computers to facilitate better learning 18(h) It is inevitable that teachers will be facilitating some or all of their classes online 18(j) School networks need to be fast to facilitate computer related learning 18(m) Teachers need more funded computer technology training to be more effective with that technology 18(o) Schools need to have remote access to the computer network
Online Usefulness
Scale 18(i) Online courses add a degree of flexibility to the curriculum 18(l) Student learning would be enhanced if they were able to study some of their subjects online. 18(n) There are advantages for schools offering courses online 18(p) Teachers are prepared to offer courses online

Appendix 10 Number of Learning Postings on each School's web site

Table A9.1: Sum of learning postings in each construct							
2005	administration	auxiliary	reference	preparatory	directed	dependent	interactive
School 1	0	0	16	1	0	1	0
School 2	0	0	0	0	0	1	1
School 3	0	1	18	2	7	16	0
School 4	0	0	3	1	3	10	0
School 5	1	0	13	5	5	38	1
School 6	0	1	8	0	3	6	0
School 7	0	0	0	1	3	0	0
School 8	0	1	0	0	1	0	0
School 9	0	10	1	1	3	4	0
School 10	2	2	4	0	12	13	0
2006	administration	auxiliary	reference	preparatory	directed	dependent	interactive
School 1	1	73	33	6	120	59	5
School 2	1	12	7	1	22	31	0
School 3	0	6	24	3	25	121	3
School 4	1	0	2	0	10	6	11
School 5	1	1	15	0	22	63	0
School 6	0	1	6	1	5	12	1
School 7	0	0	4	1	9	3	0
School 8	0	2	3	0	4	6	0
School 9	1	16	38	2	18	96	1
School 10	0	2	6	0	12	15	0

Appendix 11 Regression Analyses for the eFactor Medium Group

Teachers

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.374(a)	.140	.100	5.98889
2	.373(b)	.139	.106	5.96838
3	.371(c)	.138	.112	5.95017
4	.357(d)	.127	.108	5.96477

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta	Std. Error		
1	(Constant)	25.102	4.451			5.640	.000
	computer use	-.560	.267	-.189	.090	-2.097	.038
	computer applications	-.038	.084	-.045	.101	-.448	.655
	relevance	-.050	.054	-.093	.102	-.917	.361
	positive learning	.448	.239	.188	.101	1.872	.063
	readiness for online	-.579	.224	-.262	.101	-2.584	.011
	online usefulness	.082	.253	.030	.092	.323	.747
4	(Constant)	26.280	4.287			6.130	.000
	computer use	-.602	.261	-.204	.088	-2.305	.023
	positive learning	.376	.219	.158	.092	1.718	.088
	readiness for online	-.610	.212	-.276	.096	-2.880	.005

Medium Group-Students

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.269(a)	.073	.065	5.30756
2	.269(b)	.072	.067	5.30442
3	.269(c)	.072	.068	5.30133

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta	Std. Error		
1	(Constant)	13.499	.937			14.400	.000
	Computer Use	-.196	.107	-.069	.037	-1.843	.066
	Computer Applications	.039	.134	.011	.036	.293	.770
	Relevance	-.170	.072	-.112	.047	-2.363	.018
	Positive Learning	-.164	.078	-.097	.046	-2.113	.035
	Online Readiness	.024	.088	.010	.035	.273	.785
	Online Usefulness	-.120	.067	-.080	.045	-1.792	.074
3	(Constant)	13.670	.814			16.791	.000
	Computer Use	-.184	.102	-.065	.036	-1.812	.070
	Relevance	-.170	.072	-.112	.047	-2.366	.018
	Positive Learning	-.162	.077	-.095	.045	-2.089	.037
	Online Usefulness	-.122	.067	-.082	.045	-1.825	.068

Appendix 12 Regression Analyses-Case Study Schools-Students

Dependent Variable-Online Usefulness

class	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
School 1	1	.818(a)	.668	.536	2.183
	2	.817(b)	.668	.578	2.083
	3	.805(c)	.648	.590	2.052
School 2	1	.681(d)	.463	.454	2.741
	2	.680(e)	.463	.456	2.736
	3	.680(f)	.462	.458	2.732
School 3	1	.498(d)	.248	.236	2.918
	2	.496(g)	.246	.238	2.915
	3	.492(f)	.243	.237	2.916
School 4	1	.578(d)	.335	.324	2.943
	2	.578(e)	.335	.327	2.937
	3	.577(f)	.333	.328	2.933
School 5	1	.559(d)	.312	.300	2.909
	2	.558(g)	.312	.303	2.904
	3	.554(f)	.307	.301	2.906
School 6	1	.504(d)	.254	.244	2.754
	2	.504(e)	.254	.247	2.750
School 7	1	.630(d)	.398	.385	2.585
	2	.629(g)	.395	.386	2.583
	3	.622(f)	.387	.381	2.593
School 8	1	.671(d)	.450	.439	2.880
	2	.670(g)	.449	.440	2.875
School 9	1	.527(a)	.278	.262	2.670
	2	.527(e)	.278	.266	2.663
School 10	1	.555(d)	.309	.288	2.649
	2	.552(g)	.304	.289	2.647
	3	.546(f)	.298	.288	2.649

class	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
School 1	1	(Constant)			-.955	.362
		computer use	.382	.202	1.886	.089
		computer applications	.151	.207	.732	.481
		relevance	.894	.236	3.796	.004
		positive learning	.024	.240	.099	.923
	3	(Constant)			-.837	.419
		computer use	.364	.188	1.930	.078
		relevance	.886	.188	4.703	.001
School 2	1	(Constant)			3.363	.001
		computer use	-.019	.052	-.374	.709
		computer applications	.025	.050	.500	.617
		relevance	.421	.062	6.760	.000
		positive learning	.333	.062	5.336	.000
	3	(Constant)			4.283	.000
		relevance	.420	.062	6.818	.000
		positive learning	.332	.062	5.391	.000
School 3	1	(Constant)			5.403	.000
		computer use	.048	.060	.790	.430
		computer applications	.040	.060	.669	.504
		relevance	.382	.064	6.005	.000
		positive learning	.150	.063	2.375	.018
	3	(Constant)			6.903	.000
		relevance	.393	.063	6.236	.000
		positive learning	.158	.063	2.515	.013
School 4	1	(Constant)			5.032	.000
		computer use	.002	.056	.035	.972
		computer applications	.035	.055	.635	.526
		relevance	.492	.067	7.372	.000
		positive learning	.117	.065	1.790	.075
	3	(Constant)			6.144	.000
		relevance	.499	.065	7.669	.000
		positive learning	.117	.065	1.791	.074
School 5	1	(Constant)			5.531	.000
		computer use	.076	.060	1.267	.206
		computer applications	-.027	.057	-.468	.640
		relevance	.362	.067	5.416	.000
		positive learning	.241	.066	3.658	.000
	3	(Constant)			6.791	.000
		relevance	.380	.065	5.831	.000
		positive learning	.247	.065	3.791	.000
School 6	1	(Constant)			7.968	.000
		computer use	-.005	.056	-.080	.936
		computer applications	-.094	.055	-1.695	.091
		relevance	.368	.065	5.694	.000
		positive learning	.199	.065	3.077	.002
	2	(Constant)			9.324	.000
		computer applications	-.095	.051	-1.868	.063

class	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
		relevance	.368	.064	5.709	.000
		positive learning	.199	.064	3.107	.002
School 7	1	(Constant)			2.587	.010
		computer use	.071	.063	1.122	.263
		computer applications	.051	.062	.819	.414
		relevance	.437	.066	6.569	.000
		positive learning	.241	.066	3.629	.000
	3	(Constant)			4.234	.000
		relevance	.451	.066	6.823	.000
		positive learning	.254	.066	3.847	.000
School 8	1	(Constant)			1.091	.276
		computer use	.140	.056	2.507	.013
		computer applications	-.034	.057	-.598	.551
		relevance	.328	.073	4.486	.000
		positive learning	.378	.072	5.255	.000
	2	(Constant)			1.040	.300
		computer use	.130	.053	2.445	.015
		relevance	.318	.071	4.476	.000
		positive learning	.384	.071	5.390	.000
School 9	1	(Constant)			3.979	.000
		computer use	.004	.069	.058	.954
		computer applications	-.139	.066	-2.107	.037
		relevance	.365	.080	4.574	.000
		positive learning	.235	.076	3.088	.002
	2	(Constant)			5.034	.000
		computer applications	-.138	.065	-2.137	.064
		relevance	.366	.076	4.823	.000
		positive learning	.235	.075	3.112	.002
School 10	1	(Constant)			2.144	.034
		computer use	.100	.078	1.283	.202
		computer applications	-.068	.077	-.889	.376
		relevance	.303	.082	3.691	.000
		positive learning	.320	.084	3.830	.000
	3	(Constant)			3.329	.001
		relevance	.300	.081	3.692	.000
		positive learning	.337	.081	4.138	.000

Dependent Variable-Online Readiness

class	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
School 1	1	.334(a)	.112	-.244	1.472
	2	.329(b)	.108	-.135	1.406
	3	.322(c)	.104	-.046	1.350
	4	.262(d)	.069	-.003	1.322
	5	.000(e)	.000	.000	1.320
School 2	1	.112(f)	.013	-.005	2.111
	2	.110(g)	.012	-.001	2.107
	3	.104(h)	.011	.002	2.104
	4	.091(d)	.008	.004	2.102
	5	.000(e)	.000	.000	2.106
School 3	1	.217(f)	.047	.032	2.413
	2	.214(i)	.046	.035	2.410
	3	.209(j)	.044	.036	2.408
School 4	1	.153(f)	.024	.008	1.997
	2	.153(k)	.023	.012	1.993
	3	.149(l)	.022	.014	1.991
	4	.112(m)	.012	.009	1.997
School 5	1	.180(f)	.033	.016	2.361
	2	.179(n)	.032	.020	2.356
	3	.169(h)	.029	.020	2.355
	4	.146(d)	.021	.017	2.359
School 6	1	.162(f)	.026	.013	2.045
	2	.159(g)	.025	.016	2.042
	3	.151(o)	.023	.016	2.041
	4	.135(m)	.018	.015	2.043
School 7	1	.164(f)	.027	.007	1.904
	2	.164(k)	.027	.011	1.899
	3	.157(p)	.025	.014	1.896
	4	.139(q)	.019	.014	1.896
School 8	1	.286(f)	.082	.063	2.052
	2	.286(k)	.082	.068	2.047
	3	.277(p)	.077	.068	2.048
	4	.254(q)	.065	.060	2.056
School 9	1	.245(a)	.060	.039	1.985
	2	.243(i)	.059	.043	1.980
	3	.240(c)	.057	.047	1.976
School 10	1	.155(f)	.024	-.005	2.032
	2	.151(n)	.023	.001	2.025
	3	.143(l)	.020	.006	2.020
	4	.132(q)	.017	.010	2.016
	5	.000(e)	.000	.000	2.026

class	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
School 1	1	(Constant)			2.500	.031
		computer use	-.322	.331	-.970	.355
		computer applications	-.069	.339	-.204	.842
		relevance	-.074	.385	-.192	.851
		positive learning	-.185	.393	-.471	.648
	5	(Constant)			17.015	.000
School 2	1	(Constant)			9.982	.000
		computer use	.100	.071	1.408	.160
		computer applications	-.054	.069	-.781	.435
		relevance	.054	.085	.641	.522
		positive learning	-.027	.085	-.315	.753
	5	(Constant)			45.612	.000
School 3	1	(Constant)			6.799	.000
		computer use	.172	.068	2.538	.012
		computer applications	.038	.068	.564	.573
		relevance	-.150	.072	-2.093	.037
		positive learning	.051	.071	.719	.473
	3	(Constant)			9.597	.000
		computer use	.192	.062	3.102	.002
		relevance	-.120	.062	-1.944	.053
School 4	1	(Constant)			8.347	.000
		computer use	-.012	.068	-.170	.865
		computer applications	.099	.067	1.482	.140
		relevance	.047	.081	.586	.558
		positive learning	.072	.079	.915	.361
	4	(Constant)			20.788	.000
		computer applications	.112	.063	1.776	.077
School 5	1	(Constant)			5.202	.000
		computer use	.105	.071	1.490	.138
		computer applications	.085	.067	1.263	.208
		relevance	.022	.079	.276	.783
		positive learning	.052	.078	.663	.508
	4	(Constant)			9.052	.000
		computer use	.146	.065	2.252	.025
School 6	1	(Constant)			11.099	.000
		computer use	-.062	.065	-.955	.340
		computer applications	.143	.063	2.264	.024
		relevance	.056	.074	.757	.449
		positive learning	.037	.074	.499	.618
	4	(Constant)			22.863	.000
		computer applications	.135	.057	2.379	.018
School 7	1	(Constant)			7.966	.000
		computer use	-.017	.080	-.218	.827
		computer applications	.054	.079	.679	.498
		relevance	.084	.085	.988	.324
		positive learning	.091	.084	1.082	.281
	4	(Constant)			10.312	.000
		positive learning	.139	.071	1.953	.052
School 8	1	(Constant)			6.011	.000

class	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
		computer use	.005	.072	.064	.949
		computer applications	.072	.074	.978	.329
		relevance	.128	.094	1.357	.176
		positive learning	.162	.093	1.747	.082
	4	(Constant)			8.646	.000
		positive learning	.254	.068	3.723	.000
School 9	1	(Constant)			4.923	.000
		computer use	.189	.079	2.406	.017
		computer applications	-.032	.075	-.421	.674
		relevance	-.049	.091	-.533	.595
		positive learning	.185	.087	2.133	.034
	3	(Constant)			5.078	.000
		computer use	.170	.073	2.320	.021
		positive learning	.158	.073	2.163	.032
School 10	1	(Constant)			5.382	.000
		computer use	.052	.093	.564	.573
		computer applications	-.074	.091	-.808	.421
		relevance	.039	.097	.404	.687
		positive learning	.113	.099	1.139	.257
	5	(Constant)			33.570	.000

Appendix 13 Regression Analyses-Case Study Schools-Teachers

Dependent Variable-Online Usefulness

Participating school	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
School 1	1	.655(a)	.429	.103	2.07254
	2	.655(b)	.429	.215	1.93891
	3	.611(c)	.373	.234	1.91475
	4	.567(d)	.322	.254	1.89031
School 2	1	.466(e)	.217	.154	2.20313
	2	.466(b)	.217	.171	2.18147
	3	.464(f)	.215	.185	2.16332
School 3	1	.391(g)	.153	-.271	2.79383
	2	.388(b)	.150	-.133	2.63758
	3	.370(h)	.137	-.036	2.52232
	4	.305(i)	.093	.010	2.46532
	5	.000(j)	.000	.000	2.47811
School 4	1	.679(e)	.461	.245	1.26587
	2	.607(k)	.368	.196	1.30695
	3	.557(l)	.310	.196	1.30708
	4	.529(i)	.280	.224	1.28354
School 5	1	.580(a)	.336	.189	1.74641
	2	.580(m)	.336	.232	1.69984
	3	.580(f)	.336	.270	1.65697
	4	.569(d)	.324	.291	1.63250
School 6	1	.857(a)	.734	.521	1.93130
	2	.857(b)	.734	.601	1.76319
	3	.851(f)	.725	.646	1.66091
	4	.776(d)	.602	.553	1.86632
School 7	1	.484(a)	.235	.055	2.93473
	2	.474(n)	.225	.096	2.87049
	3	.464(l)	.215	.133	2.81080
	4	.351(o)	.123	.079	2.89603
	5	.000(j)	.000	.000	3.01834
School 8	1	.567(a)	.321	.127	2.88039
	2	.567(b)	.321	.185	2.78273
	3	.562(f)	.315	.230	2.70546
School 9	1	.369(p)	.136	.054	2.25957
	2	.366(m)	.134	.074	2.23510
	3	.361(f)	.130	.091	2.21449
	4	.307(i)	.094	.074	2.23512
School 10	1	.794(q)	.630	.419	1.85220
	2	.771(r)	.595	.443	1.81370
	3	.700(s)	.490	.376	1.91877

Participating school	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
School 1	1	(Constant)			1.422	.198
		computer use	.018	.451	.040	.969
		computer applications	.279	.313	.890	.403
		relevance	.688	.624	1.102	.307
		positive learning	-.332	.476	-.698	.508
	4	(Constant)			7.271	.000
		relevance	.567	.260	2.177	.055
School 2	1	(Constant)			2.288	.026
		computer use	-.007	.136	-.048	.962
		computer applications	.054	.146	.369	.714
		relevance	-.279	.150	-1.869	.068
		positive learning	.504	.143	3.537	.001
	3	(Constant)			3.937	.000
		relevance	-.258	.135	-1.905	.062
		positive learning	.508	.135	3.755	.000
School 3	1	(Constant)			.786	.454
		computer use	-.074	.507	-.146	.887
		computer applications	.224	.431	.520	.617
		relevance	.082	.433	.189	.855
		positive learning	.325	.414	.785	.455
	5	(Constant)			14.773	.000
School 4	1	(Constant)			5.606	.000
		computer use	-.454	.294	-1.546	.153
		computer applications	-.520	.320	-1.627	.135
		relevance	.417	.317	1.314	.218
		positive learning	-.571	.258	-2.212	.051
	4	(Constant)			9.632	.000
		positive learning	-.529	.235	-2.247	.043
School 5	1	(Constant)			1.671	.112
		computer use	.011	.204	.056	.956
		computer applications	-.002	.251	-.009	.993
		relevance	.482	.291	1.655	.115
		positive learning	.144	.243	.591	.562
	4	(Constant)			13.745	.000
		relevance	.569	.179	3.170	.005
School 6	1	(Constant)			.380	.720
		computer use	.009	.274	.031	.976
		computer applications	.205	.489	.420	.692
		relevance	.423	.510	.828	.445
		positive learning	.374	.268	1.396	.222
	4	(Constant)			5.650	.000
		relevance	.776	.223	3.482	.008
School 7	1	(Constant)			2.770	.013
		computer use	-.364	.213	-1.711	.105

Participating school	Model		Standardized Coefficients Beta	Std. Error	t	Sig.
		computer applications	.166	.272	.610	.550
		relevance	-.129	.275	-.470	.645
		positive learning	.286	.263	1.088	.292
	5	(Constant)			14.621	.000
School 8	1	(Constant)			.315	.758
		computer use	-.003	.265	-.010	.993
		computer applications	-.090	.297	-.304	.765
		relevance	-.511	.299	-1.708	.110
		positive learning	.709	.292	2.430	.029
	3	(Constant)			.590	.564
		relevance	-.543	.259	-2.100	.052
		positive learning	.682	.259	2.636	.018
School 9	1	(Constant)			2.301	.026
		computer use	.077	.158	.488	.628
		computer applications	-.052	.191	-.272	.787
		relevance	.229	.176	1.303	.200
		positive learning	.220	.171	1.286	.206
	4	(Constant)			5.062	.000
		positive learning	.307	.142	2.161	.036
School 10	1	(Constant)			2.085	.075
		computer use	-.254	.310	-.819	.440
		computer applications	.835	.430	1.941	.093
		relevance	-.797	.363	-2.193	.064
		positive learning	.441	.279	1.582	.158
	3	(Constant)			8.114	.000
		computer applications	.982	.355	2.766	.022
		relevance	-.964	.355	-2.716	.024

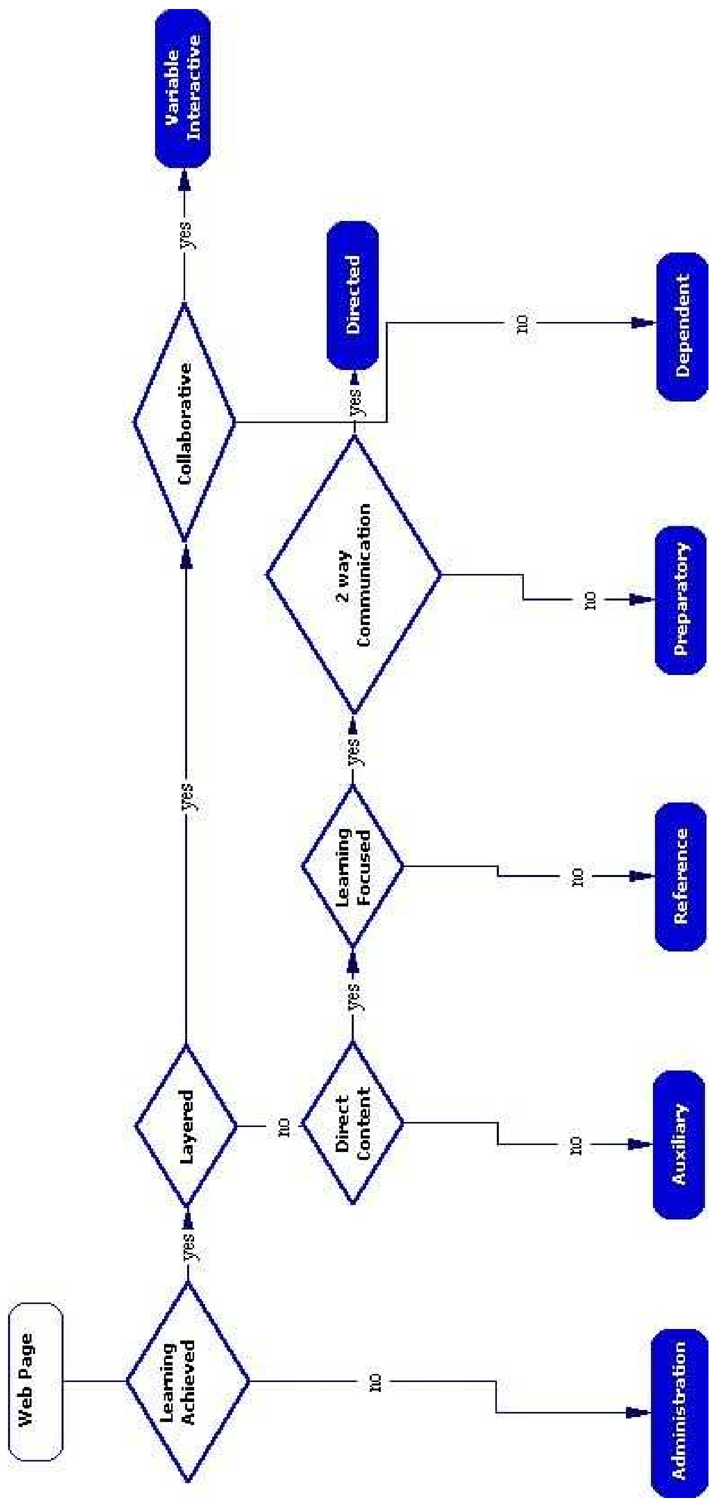
Dependent Variable-Online Readiness

Participitating school	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
School 1	1	.832(a)	.693	.517	1.83484
	2	.831(b)	.690	.574	1.72235
	3	.829(c)	.687	.618	1.63249
	4	.777(d)	.604	.564	1.74311
School 2	1	.466(e)	.217	.154	2.27576
	2	.466(f)	.217	.171	2.25334
	3	.465(g)	.216	.186	2.23260
	4	.440(h)	.194	.179	2.24264
School 3	1	.499(i)	.249	-.127	3.32408
	2	.493(j)	.243	-.010	3.14686
	3	.488(g)	.238	.086	2.99430
	4	.443(h)	.196	.123	2.93270
	5	.000(k)	.000	.000	3.13172
School 4	1	.397(e)	.158	-.179	1.84482
	2	.392(l)	.154	-.077	1.76318
	3	.382(m)	.146	.003	1.69593
	4	.340(n)	.116	.048	1.65771
	5	.000(k)	.000	.000	1.69874
School 5	1	.697(a)	.486	.372	2.66879
	2	.694(f)	.481	.399	2.61078
	3	.692(g)	.478	.426	2.55158
	4	.674(h)	.454	.428	2.54717
School 6	1	.763(a)	.583	.249	2.97507
	2	.761(b)	.579	.368	2.72988
	3	.725(o)	.526	.391	2.67998
	4	.704(h)	.496	.433	2.58564
School 7	1	.549(a)	.301	.137	2.02554
	2	.534(f)	.285	.166	1.99091
	3	.504(p)	.254	.176	1.97928
	4	.404(d)	.163	.121	2.04372
School 8	1	.651(a)	.424	.260	2.21343
	2	.644(f)	.415	.298	2.15532
	3	.544(q)	.296	.208	2.28911
	4	.415(h)	.172	.123	2.40898
School 9	1	.578(r)	.335	.271	2.21190
	2	.577(f)	.333	.287	2.18819
	3	.557(p)	.311	.279	2.19968
School 10	1	.900(s)	.810	.702	1.43165
	2	.900(t)	.810	.739	1.33981

Participating school	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
School 1	1	(Constant)			2.157	.068
		computer use	.073	.331	.222	.831
		computer applications	.298	.230	1.296	.236
		relevance	.527	.458	1.150	.288
		positive learning	.122	.349	.348	.738
	4	(Constant)			15.558	.000
		relevance	.777	.199	3.903	.003
School 2	1	(Constant)			5.332	.000
		computer use	.159	.136	1.170	.248
		computer applications	-.002	.146	-.015	.988
		relevance	-.029	.150	-.193	.848
		positive learning	.405	.143	2.843	.006
	4	(Constant)			10.829	.000
		positive learning	.440	.123	3.572	.001
School 3	1	(Constant)			2.077	.071
		computer use	-.335	.478	-.702	.503
		computer applications	.104	.406	.257	.804
		relevance	-.131	.408	-.322	.756
		positive learning	.596	.390	1.529	.165
	5	(Constant)			23.203	.000
School 4	1	(Constant)			4.211	.002
		computer use	.253	.367	.689	.506
		computer applications	-.217	.399	-.544	.598
		relevance	-.087	.397	-.219	.831
		positive learning	-.073	.323	-.225	.827
	5	(Constant)			45.142	.000
School 5	1	(Constant)			.275	.787
		computer use	.188	.180	1.045	.310
		computer applications	.095	.221	.428	.674
		relevance	-.127	.256	-.496	.626
		positive learning	.722	.214	3.373	.003
	4	(Constant)			3.298	.003
		positive learning	.674	.161	4.180	.000
School 6	1	(Constant)			.938	.392
		computer use	.078	.343	.228	.829
		computer applications	-.583	.612	-.952	.385
		relevance	.430	.639	.673	.531
		positive learning	.749	.335	2.235	.076
	4	(Constant)			3.013	.017
		positive learning	.704	.251	2.805	.023
School 7	1	(Constant)			7.614	.000
		computer use	-.290	.203	-1.426	.172
		computer applications	-.163	.260	-.624	.541

Participating school	Model		Standardized Coefficients		t	Sig.
			Beta	Std. Error		
		relevance	.571	.263	2.169	.045
		positive learning	-.160	.251	-.635	.534
	4	(Constant)			18.278	.000
		relevance	.404	.205	1.974	.062
School 8	1	(Constant)			1.525	.149
		computer use	.328	.244	1.343	.201
		computer applications	.129	.273	.472	.644
		relevance	-.628	.276	-2.277	.039
		positive learning	.660	.269	2.456	.028
	4	(Constant)			4.513	.000
		positive learning	.415	.221	1.878	.078
School 9	1	(Constant)			3.845	.000
		computer use	.337	.139	2.427	.020
		computer applications	-.048	.168	-.288	.775
		relevance	.327	.154	2.122	.040
		positive learning	.184	.150	1.229	.226
	3	(Constant)			4.407	.000
		computer use	.380	.126	3.013	.004
		relevance	.364	.126	2.883	.006
School 10	1	(Constant)			2.837	.025
		computer use	.018	.222	.081	.938
		computer applications	.798	.308	2.589	.036
		relevance	-.476	.260	-1.829	.110
		positive learning	.474	.200	2.376	.049
	2	(Constant)			7.211	.000
		computer applications	.807	.266	3.036	.016
		relevance	-.476	.243	-1.956	.086
		positive learning	.479	.179	2.669	.028

Appendix 14 eFactor learning categories flowchart



Appendix 15 Overall Regression Model for Teachers

With the Dependent Variable Online Usefulness

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.380(a)	.145	.129	2.27556
2	.380(b)	.144	.133	2.27068

Regression Path Summary

Model		Standardized Coefficients		t	Sig.
		Beta	Std. Error		
1	(Constant)			7.368	.000
	frequency of use of school computers for school related work	.134	.066	2.041	.042
	computer applications	.106	.075	1.404	.162
	relevance	.015	.076	.203	.839
	positive learning	.340	.069	4.917	.000
2	(Constant)			7.384	.000
	Computer use	.134	.065	2.041	.042
	computer applications	.112	.067	1.664	.098
	positive learning	.344	.066	5.211	.000

With the Dependent Variable Online Readiness

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.447(a)	.200	.186	2.51267
2	.447(b)	.200	.189	2.50719
3	.446(c)	.199	.192	2.50293

Regression Path Summary

Model		Standardized Coefficients		t	Sig.
		Beta	Std. Error		
1	(Constant)			17.819	.000
	frequency of use of school computers for school related work	.009	.063	.149	.881
	computer applications	.037	.073	.505	.614
	relevance	.158	.074	2.140	.033
	positive learning	.343	.067	5.122	.000
3	(Constant)			20.520	.000
	relevance	.173	.065	2.652	.009
	positive learning	.346	.065	5.293	.000

Appendix 16 Overall Regression Model for Students

With the Dependent Variable Online Usefulness

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.600(a)	.360	.359	2.846
2	.600(b)	.360	.359	2.845
3	.600(c)	.360	.359	2.846

Regression Path Summary

Model		Standardized Coefficients		t	Sig.
		Beta	Std. Error		
1	(Constant)			11.979	.000
	computer use	.028	.019	1.465	.143
	computer applications	-.009	.019	-.498	.619
	relevance	.402	.022	17.918	.000
	positive learning	.259	.022	11.601	.000
3	(Constant)			15.866	.000
	relevance	.405	.022	18.182	.000
	positive learning	.262	.022	11.748	.000

With the Dependent Variable Online Readiness

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.134(a)	.018	.016	2.137
2	.134(b)	.018	.016	2.136

Regression Path Summary

Model		Standardized Coefficients		t	Sig.
		Beta	Std. Error		
1	(Constant)			22.718	.000
	computer use	.078	.024	3.272	.001
	computer applications	.048	.024	2.030	.042
	relevance	-.001	.028	-.039	.969
	positive learning	.067	.028	2.410	.016
2	(Constant)			22.763	.000
	computer use	.078	.024	3.282	.001
	computer applications	.048	.023	2.032	.042
	positive learning	.066	.023	2.938	.003

Appendix 17 Teacher Rating of Computer Applications by School

School1 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 1	0.0	0.0	8.3	16.7	75.0
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 1	16.7	33.3	41.7	0.0	8.3
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 1	0.0	33.3	16.7	25.0	25.0
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 1	50.0	33.3	8.3	8.3	0.0
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 1	75.0	25.0	0.0	0.0	0.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 1	66.7	25.0	8.3	0.0	0.0
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 1	0.0	8.3	33.3	25.0	33.3
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 1	16.7	33.3	16.7	25.0	8.3
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 2 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 2	1.8	1.8	12.5	30.4	53.6
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 2	14.3	34.0	28.6	16.1	7.1
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 2	5.4	25.0	26.8	25.0	17.9
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 2	30.4	29.3	14.3	7.1	8.9
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 2	41.1	35.7	10.7	7.1	5.4
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 2	26.8	42.8	14.3	7.1	8.9
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 2	8.9	17.8	25.0	17.8	30.4
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 2	26.8	14.3	23.2	23.2	12.5
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 3 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 3	0.0	0.0	7.7	38.5	53.8
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 3	0.0	23.1	38.5	15.4	23.1
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 3	0.0	30.8	23.1	23.1	23.1
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 3	30.8	38.5	7.7	7.7	15.4
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 3	53.8	23.1	0.0	15.4	7.7
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 3	53.8	7.7	23.1	0.0	15.4
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 3	0.0	23.1	23.1	38.5	15.4
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 3	7.7	7.7	38.5	30.8	15.4
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 4 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 4	0.0	0.0	6.7	40.0	53.3
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 4	6.7	46.7	26.7	20.0	0.0
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 4	6.7	26.7	40.0	13.3	13.3
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 4	53.3	40.0	0.0	6.7	0.0
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 4	66.7	26.7	6.7	0.0	0.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 4	46.7	40.0	13.3	0.0	0.0
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 4	6.7	26.7	13.3	20.0	33.3
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 4	13.3	46.7	26.7	13.3	0.0
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 5 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 5	0.0	0.0	16.7	41.7	41.7
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 5	16.7	20.8	33.3	8.3	20.8
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 5	16.7	16.7	25.0	8.3	33.3
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 5	45.8	25.0	8.3	4.2	16.7
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 5	58.3	12.5	8.3	8.3	12.5
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 5	45.8	20.8	8.3	12.5	12.5
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 5	4.2	37.5	25.0	16.7	16.7
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 5	50.0	12.5	16.7	4.2	16.7
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 6 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 6	0.0	0.0	0.0	30.0	70.0
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 6	20.0	20.0	10.0	20.0	30.0
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 6	10.0	10.0	20.0	20.0	40.0
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 6	50.0	10.0	10.0	10.0	20.0
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 6	50.0	20.0	0.0	10.0	20.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 6	60.0	10.0	10.0	10.0	10.0
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 6	20.0	10.0	30.0	10.0	30.0
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 6	50.0	10.0	10.0	10.0	20.0
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 7 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 7	0.0	0.0	13.6	31.8	54.5
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 7	22.7	36.4	18.2	13.6	9.1
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 7	4.5	36.4	27.3	9.1	22.7
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 7	36.4	40.9	9.1	9.1	4.5
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 7	63.6	22.7	13.6	0.0	0.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 7	27.3	36.4	18.2	4.5	13.6
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 7	9.1	22.7	40.9	18.2	9.1
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 7	22.7	27.3	27.3	22.7	0.0
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 8 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 8	0.0	0.0	15.0	15.0	70.0
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 8	25.0	25.0	20.0	20.0	10.0
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 8	20.0	15.0	15.0	25.0	25.0
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 8	60.0	15.0	15.0	5.0	5.0
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 8	80.0	10.0	10.0	0.0	0.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 8	65.0	20.0	10.0	5.0	0.0
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 8	25.0	15.0	25.0	20.0	15.0
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 8	30.0	25.0	20.0	10.0	15.0
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 9 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 9	4.0	2.0	28.0	22.0	44.0
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 9	20.0	38.0	24.0	8.0	10.0
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 9	8.0	36.0	30.0	12.0	14.0
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 9	46.0	36.0	4.0	8.0	6.0
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 9	60.0	30.0	4.0	4.0	2.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 9	52.0	26.0	8.0	10.0	4.0
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 9	28.0	12.0	28.0	12.0	20.0
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 9	28.0	28.0	18.0	10.0	16.0
Total number of teachers	28.6	20.9	21.8	16.7	12.0

School 10 Teacher proficiency rating of computer applications					
	never used	**help needed**	**ok**	**good**	**very good**
Word-School 10	0.0	0.0	8.3	25.0	66.7
Total number of teachers	1.3	0.9	15.0	28.6	54.3
Databases-School 10	25.0	25.0	25.0	16.7	8.3
Total number of teachers	17.1	32.1	26.5	13.2	11.1
Spreadsheet-School 10	8.3	25.0	33.3	25.0	8.3
Total number of teachers	43.2	32.5	9.4	6.8	8.1
Web Creation-School 10	58.3	16.7	16.7	0.0	8.3
Total number of teachers	43.0	32.0	9.4	6.8	8.1
Sound Editing-School 10	50.0	8.3	25.0	16.7	0.0
Total number of teachers	57.3	24.8	8.1	5.6	4.3
Movie Editing-School 10	50.0	33.3	8.3	8.3	0.0
Total number of teachers	44.9	29.5	12.0	6.8	6.8
Presentation-School 10	8.3	16.7	33.3	25.0	16.7
Total number of teachers	13.2	18.8	27.4	18.4	22.2
Desktop-School 10	41.7	0.0	25.0	25.0	8.3
Total number of teachers	28.6	20.9	21.8	16.7	12.0