Girls' perceptions of secondary school specialist computer courses: A case study

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A thesis submitted in partial fulfillment of the requirements for the

Degree of Master of Teaching and Learning

University of Canterbury

May, 2008

Acknowledgements

I wish to acknowledge and thank my two supervisors, Dr Jane Abbiss, Senior Lecturer, School of Maori, Social and Cultural Studies in Education, and Julie Mackey, Head of School, School of Literacies and Arts in Education at the College of Education, University of Canterbury.

Without their continued support, guidance, constructive feedback and encouragement to 'finish the race', I would not have been able to complete this task.

This work also acknowledges the contribution and time given by teachers and students involved in this study.

Last, and most of all, I wish to acknowledge and give thanks to my husband, my family and my Lord who have supported and sustained me in this long journey.

Abstract

This research project investigated girls' perceptions of specialist computer courses in secondary schools. Literature both international and in New Zealand indicate a dwindling number of females pursuing study and careers in ICT. This project identified some of the factors influencing girls' choices to take computer courses; their perceptions on computer careers and the implications for teachers and schools.

The research was based on a collective case study with embedded cases. Data was collected from a survey using a mind map and questionnaire, as well as semi-structured face-to-face interviews. A descriptive narrative derived from the interviews with five of the participants is presented as well as cross case analysis for more than five participants.

Overall the students' accounts revealed complex, inter-related and disparate data regarding their perceptions of computing. The data revealed confusion with language and terminology; a perception of variance in levels of knowledge and abilities in specific courses; stereotypical perceptions of computing; and differences in experience, relevance and choices within the computing context.

The study highlights issues related to the association of computing with science and mathematics; girls' perceptions of the relevance and content of computer courses; gender-related issues with computing; apparent lack of knowledge of computer careers and how schools label and describe their computer courses.

It also puts forward some implications for schools and suggests some actions that schools could take as a starting point to try and break down some of the stereotypes and myths that seem to be discouraging girls into specialist computer courses.

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Abbreviations

AAUW American Association of University Women

ACM: Association for Computing Machinery

CCE: Christchurch College of Education

CPS: Computer Studies

CSTA: Computer Science Teachers' Association

CT: Communication Technology

DTF: Digital Technology Framework

FIT: Fluency in Information Technology

ICT: Information and Communication(s) Technology.

IM: Information Management

IS: Information Science (an umbrella term adopted in New Zealand for all computing-related subjects in secondary education including Computer Studies, Computer Science, Text and Information Management, Computer Graphics)

IT: Information Technology

IT and T: Information Technology and Telecommunications

MOE: Ministry of Education

NZIST : New Zealand Information Science Teachers

PC: Personal Computer

STEM : Science, Technology, Engineering and Mathematics

TIM: Text and Information Management

UNESCO: United Nations Educational, Scientific and Cultural Organization

Chapter 1: Introduction

> As long as women have less access to computers and do not have a significant voice in the development of new technology, then systems will not be developed to the extent that they could be for the good of all people (Selby, 1995).

From observation and reflection to research

The issue of the lack of women involved at the levels of technology development and system design appears to 'begin' at school. In my personal experience of 20 years of teaching computer science in secondary schools, I have always had a gender imbalance in my classes. In the past 12 years I have taught both Computer Studies and Computer Science to Year 12 and Year 13 students in New Zealand, and have observed an approximate ratio of one girl to five boys in my classes. This gender imbalance in specialist computing subjects is not confined to New Zealand, as confirmed by current international literature (American Association of University Women [AAUW], 2000; Crombie, Abarbanel & Trinneer, 2002; Margolis & Fisher, 2002). The persistence of gender imbalance in specialist computer courses in secondary schools invites an investigation to look into the factors contributing to this gender imbalance.

In contemporary culture the computer is no longer an isolated machine. It has permeated and become essential in science, arts, music, media, medicine, industry, commerce, communications and civic life. Computing has become a raw construction material for building products and services in the world around us. In recent years, there has been growing concern internationally at the shrinking number of student graduates in the computing/technology field in general, and women in particular. Diversity in the technology workforce is seen as being essential to the diverse population that will use the products and services developed. From an official perspective, the Ministry of Education (MOE) commissioned a review to explain gender differences in compulsory education during the period 1989-1999 (Alton-Lee & Praat, 2000). Of particular importance in this review was the key curriculum area of technology for its potential role in growing the knowledge economy. Selby (1995) as articulated in the opening quote argued that the

attrition of New Zealand girls in Information Technology (IT) as they progress up the school and into higher education is a profound concern for them personally and for the national good.

As a female teacher of computer science classes in secondary schools, I am interested in how girls perceive specialist computer courses and their participation choices. What are the encouraging or inhibiting factors that influence their choices of subject selection and possible career paths in the Information and Communications Technology (ICT) field? Gender equity is a term commonly used about issues of fairness and perceived advantages and disadvantages related to gender, and represents a set of concerns that extends beyond classrooms and schools (Maher & Ward, 2002). In relation to ICT gender equity is an ongoing issue and platform for much debate and concern. An example is that some people take the low number of women in ICT to mean that women do not want to be in this field or are not able to work in it. Another view is that IT is for men only and women have to prove themselves as IT professionals to a much larger extent than men (Eckle, 2007).

A commitment to lifelong technology learning implies an ability to adapt to rapid changes, to interpret critically the wealth of electronic information, to experiment without fear, and to assume a variety of roles beyond that of end user or consumer (AAUW, 2000). What are the girls' views in terms of this commitment? Technology and computing can have different and often multiple meanings for different people (Abbiss, 2005b; Beynon & Mackay, 1993). By listening to the 'voices' of the participants in this study, there may be a greater understanding of what computing and technology means for girls in secondary schools in New Zealand.

My background

I am a female teacher who has taught in secondary schools for nearly 40 years as a mathematics teacher and for the last 20 odd years in the computer field as well. My teaching experience has been gained in private schools, state schools, co-educational schools, single-sex schools and adult training institutions. In the last 12 years I have taught

in New Zealand and before that in South Africa. I first became interested in the role of computers in schools in the early 1980s and have seen many changes in content, attitudes and initiatives over the years. Mathematics was my favourite subject at school and it was a natural progression for me to learn programming languages to be able to teach them.

In the mid 1960s and 1970s there were not a lot of careers open to women and there may be some envy and puzzlement on my behalf in observing that there are so many more opportunities for young women today in this field, yet they don't appear to be taking up these opportunities. Why not, I wonder? I can also remember the reactions of people when they found out that I was a Mathematics teacher, of getting the impression of being an oddity as there were not a lot of women in this field. I wonder though if young women today receive the same reaction if they admit to taking Computer Programming as a subject. I have also been involved in movements in South Africa and here in New Zealand in promoting the credibility and value of Computer Science as a subject in its own right at school. I know I am passionate about my subject, but would like to think that I am also able to listen and reflect on the viewpoints of others. I accept that others, particularly young women, may not share my passion and enthusiasm for computing, but wonder if that is from choice or ignorance.

In my experience, both content and attitudes in the computing/technological field have changed in the last 20 years. As a teacher I have been forced to think about and reflect on what should be taught in this field that will maintain the basic principles, but also keep up with the changing technologies. I am therefore constantly in a learning process which led me initially to this research. During the course of this research I have had to put aside my role as an educator and wanting to inform the students of what they should learn, and try to be 'outside' of myself; to actively listen and constantly focus on what they are saying. I therefore come to this research as an experienced teacher, but novice researcher, who loves computing and has had to keep learning new skills and technologies but genuinely wants to discover what are the current perceptions of young women about computing

and careers in ICT. I use the word perceptions in a broad sense of encompassing ideas, conceptualisations and understandings.

Relevance of research

Is it important for girls to become designers and creators of computer technology, rather than just users? What underpins the gender equity debate? Should girls learn the 'know-how' of computers, computer systems and software? Three main arguments have emerged in literature that address these questions, emphasizing personal, economic and discipline interests.

a) Personal benefit

Firstly, there is a personal benefit to females in financial and occupational terms. According to a CNN money magazine report the best job in America in 2006 was software engineering (Kalwarski, Mosher, Paskin, & Rosato, 2006). The US Department of Labor predicts that computer related employment will grow by 38% in the 10 years from 2006. In New Zealand, the number of IT vacancies increased by an average of 33% each year from 2003 to 2007 and this growth is expected to continue. A female IT consultant in Australia confirmed that there has been a decline in the number of women coming into the industry and that the position of women in the industry is not as good as it could be (Hembry, 2006). Girls and women who have the ability and talent but are not engaging in the technology are perhaps unaware of available economic and educational opportunities (Margolis & Fisher, 2002). O'Neill (2003) writes that the demography of the New Zealand IT industry is both gender and racially biased as indicated by an analytical report released by Statistics New Zealand in 2003. Based on the report he comments further that there are far more males than females in the industry; that males dominate the management positions and females dominate data entry occupations (O'Neill, 2003). Literature suggests that it is perhaps the lack of 'under the hood' knowledge that prevents girls from commanding the high computing salaries that would be available if they were involved in different IT fields (Dalziel, Saunders, & Taylor, 2005; Margolis & Fisher, 2002).

Creating computing solutions is a highly creative activity that drives innovation in the fields of science, engineering, business, education and entertainment. Because technology is used in so many contexts, there are a myriad of careers and opportunities available that require specialist computer knowledge. Some examples are: the film industry, architecture, and advertising which need an in-depth knowledge of computer animation and modelling programs; designing computer programs for use in medical technology; being able to determine digital forensic evidence in a criminal law case; building the next generation of mobile phones, or robots, or designing prosthetics or devising new ways of fighting forest fires, to mention a few (Dean, 2007). This raises a question about whether girls know about these careers, or is it they aren't interested in such careers? Or is it something else?

b) Economic benefit

Secondly, there are implications for the NZ national economy with an imbalance in gender participation, especially the lack of women as ICT professionals. The economic imperative in education is illustrated by the Statement of Intent 2006–2011 released by the MOE, stating one of the four education goals is "making sure every New Zealander can be involved in learning throughout their lives so they can make the most of their social and economic potential" (MOE, 2006a, p. 2). Of concern in NZ are the very low numbers of women studying technology and science subjects. Statistics relating to participation in tertiary education in New Zealand released by the MOE (www.educationcounts.govt.nz retrieved May 30, 2008) show that in 2007 females in the 18-19 age group made up 36% of those enrolled for Information Technology. Although overall, women made up 52% of those enrolled in Information Technology, 44% were in the 40+ age bracket. Overall, however, women only made up 11.4% of students enrolled for Engineering and related technologies degrees. In 2006, women made up 21% of students enrolled for Information Technology degrees, and only 16% of those enrolled for Engineering and related technologies degrees. Women represent half the population and any society that disenfranchises half of its working population puts itself at a distinct disadvantage in the competition for brain power in a knowledge economy (Eckle, 2007).

Dalziel et al. (2005) reports that there will be a 73% increase in research and development staff in the software industry in the Canterbury High-Tech sector over the next five years. Figures for Canterbury indicate that in 2004 there was an 80% increase in advertised jobs in the ICT sector, and a 20% drop in the number of students graduating with ICT degrees. Insufficient high-skilled workers in the software and electronics industry could see companies moving off shore. National newspaper reports reflect this concern by the IT industry sector throughout NZ (Bathgate, 2005; Pullar-Strecker, 2005). Current reports from overseas indicate a growing concern about the overall number of students expressing an interest in the field decreasing, while the number of computer science jobs is increasing (Perelman, 2007). Of interest to me and my research are the factors that influence talented girls and women who could perhaps fill these positions, but may or may not choose to pursue ICT careers.

c) Benefit to technology and computer science

Thirdly, the greatest impact of girls not having technology and computer science know-how may be on computer science as a discipline, and its influence on society (AAUW, 2000; Mackenzie & Wajcman, 1996; Margolis & Fisher, 2002; Selby, 1995). Although women have been moving closer to enrolment parity in American universities in mathematics, biology and other related fields, their presence relative to men is shrinking in the field of computer science (Camp, 1997; Dean, 2007). Turkle (1998) discusses how the computer as a machine has no inherent bias, but that the computer culture is not equally neutral. A legacy of computer culture traditionally dominated by images of competition, sports and violence has contributed to the perception of computers as a 'boy-thing' (Klawe, 2002; Turkle, 1998). The overwhelming dominance of boy-themed products in computer and video games has contributed to boys being likely to spend more time on computers and thus develop more skills and confidence. Turkle writes that girls are computer reticent rather than fearful as the computer appears to represent a cultural symbol of what they are not. It may be that it is not as much about fitting girls into the current computer science courses and implying that girls are the 'problem', as it is in perhaps changing the perception of computer science and/or changing the courses

themselves, so that the "valuable contributions and perspectives of women are respected within the discipline" (Margolis & Fisher, 2002, p. 6). Are girls exercising a choice of not studying ICT, even though they are able to, because they have a different view of the technology (AAUW, 2000; Beynon & Mackay, 1993; Mackenzie & Wajcman, 1996)?

Computers in the modern world are ubiquitous and there are many niches for people who understand the technology and what it can do for medicine, ecology, law, chemistry etc. Making the computer culture more reflective of the interests and values of women and girls depends on their ability to influence the popular discourse about cyberculture and education (AAUW, 2000; Dean, 2007). Along with technology's power come responsibilities to determine what it should be used for and how it is used. Women need to be part of the design teams that are reshaping the world through technology, to ensure the reshaped world fits women as well as men. "If boys invent things, and girls use the things that boys invent, a cyberspace culture will inevitably reflect the desires and sensibilities of males to the exclusion and often denigration of females" (Margolis & Fisher, 2002, p. 12). Selby (1995) presents the ideas of Dale Spender that there is no doubt that women will be able to clerk and consume via the information super highway. Spender is reported to ask the question though as to how effectively will women be able to author, build, explore and motivate; information is power, but will it again be a situation of women on the outside looking in? For women's voices to be heard, women therefore need to know more than just how to use the technology – they need to know how to design and create it. Frances Allen, a leading female computer scientist, regards the low number of women in the computer science/technology field as a tragedy in the sense that there is a need for diversity of opinion and knowledge and information and points of view to solve scientific problems (Walker, 2007).

New Zealand secondary school scene

Internationally, there are growing concerns that for various reasons students in high school, especially female students, get a distorted or inaccurate perception of computer specialist subjects, and therefore do not continue with computer science and related

subjects after school (Camp, 2006; Dean, 2007; Gerson, 2006; Klawe, 2002). In the New Zealand context, a number of current ICT initiatives by the MOE relates to access and facilities and the integration of ICT across the curriculum. The e-learning action plan launched in 2006 by the MOE (2006b), Enabling the 21st century learner, builds on previous ICT strategies for schools; Interactive Education produced in 1998 and Digital Horizons (MOE, 2003). One aspect of the Digital Horizons initiative is to create a "learning culture that recognises … the importance of specialist ICT skills to economic development" (MOE, 2003, p. 12). Ballantyne (2004) writes ICT may be learnt through specialist ICT classes, through integration, or through an osmosis-like process. Fluency in Information Technology in New Zealand (FIT NZ) is part of the Government's 'digital strategy' to establish a framework for the development of specialist ICT programmes in schools for Years 11-13. In reviewing the New Zealand literature, I have found very little current New Zealand literature that considers or explores the lack of girls in specialist ICT courses in schools and issues of gender equity. In their article on tech-savvy girls, the American Association of University Women (AAUW, 2000) claim that the new benchmark for gender equity should emphasise computer fluency which includes girls' mastery of analytical skills, computer concepts and their ability to imagine innovative uses for technology across a range of problems and subjects. This is something that does not appear to have been considered in New Zealand policy and discussion documents to date. Increasingly, today's students are living their lives online. As new technologies and media expand rapidly in students' lives outside the classroom and schools adopt new technologies and services, educators also need to stay abreast of the evidence on how to maximise these opportunities for learning in the classroom (MOE, 2006b).

One of the few NZ studies looking at gender issues and ICT in the NZ schooling context, Abbiss (2005b), explores the gender identities students associate with three specialist Year 12 IT classes; two Text and Information Management (TIM) classes and one Computer Studies class. She suggests that the 'problem' of under representation of girls in computer science classes may be more complex than initially appears, and is related to identity

formation. In an earlier study, Selby (1995) also identified as a key barrier in the New Zealand context "the male-dominated computer culture with its 'macho' connotations" (p. 26). With a historical heritage of male focus in technology and engineering, with the confusing messages given by education in terms of Computing/Technology, ICT/TIM/Computer Studies/Computer Science, with the huge impact of TV and multimedia on our culture, with the informal use of computers in communications (Internet/emails) and mobile phones, what are the perceptions of girls about specialist computer courses? This leads me to my research questions.

Main question

How do girls perceive computing as a school subject and career path?

Sub questions

1. What are the inhibiting or encouraging factors that influence girls in their choice to take specialist computer courses in secondary school?

2. How do girls perceive the relevance/attractiveness of a career in ICT?

3. What are the implications for teachers and schools?

International research shows that female students who have positive experiences with computer-related activities tend to keep positive computer attitudes and are more likely to continue with further studies in ICT (AAUW, 2000; Crombie, Abarbanel, & Trinneer, 2002; Klawe, 2002; Margolis & Fisher, 2002; Siann, Macleod, Glissov, & Durndell, 1990). Although there are no equivalent NZ studies to confirm this in the NZ context, recent speakers at a Women in Technology[1] function gave the impression that girls move into IT later on in their careers. Given the paucity of work in the field of girls and specialist ICT courses in NZ, there is scope for my research to offer a new perspective and information on girls' involvement, or lack of involvement, in specialist ICT courses. By engaging in research that listens to the 'voices' of girls and endeavours to uncover their perceptions of

[1] www.womenintechnology.co.nz
Started in July 2002, with the purpose to support and enable women in technology to reach their career and personal goals.

computers and careers, I hope to raise issues that may be of relevance and can inform teaching practice and specialist computer course development.

Chapter 2: ICT, gender and education: Reviewing the literature

Introduction

A difficulty I experienced early in my research is the multi-faceted meanings and interpretations given to words and phrases in the computer/technology field. In this chapter I will explain my definitions in the computer/technology context and give some background to New Zealand education to describe the context of my research participants' voices. Finally literature pertaining to the topic of girls and computer education in schools is reviewed. Some of the ideas have been alluded to in the previous chapter and are expanded here.

Terminology

As the field of computing and ICT has developed, so has the language used to describe different computing practices and technology. In the early 1900s, a computer was a person who performed arithmetical calculations. The Concise Oxford Dictionary (Pearsall, 1999) defines *computer* as: "An electronic device which is capable of receiving information (data) and performing a sequence of logical operations in accordance with a predetermined but variable set of procedural instructions (programs) to produce a result in the form of information or signals" (p. 294). The term now refers to an artefact and a process of computing, and less commonly the human operator.

The Concise Oxford Dictionary (Pearsall, 1999) defines *technology* as: "the application of scientific knowledge for practical purposes; machinery and equipment based on such knowledge; the branch of knowledge concerned with applied sciences" (p. 1471). Even in the early 1980s, technology had a layered meaning (Mackenzie & Wajcman, 1996). Firstly, it referred to a set of artefacts such as machines, computers, vacuum cleaners; in other words, the visible, tangible 'hardware' meaning. Secondly it was a set of human activities – for example "a computer without programs and programmers is simply a useless collection of bits and pieces of metal, plastic and silicon" (Mackenzie & Wajcman, 1996, p. 3). Note the reference to programmers in the human activities; this was written in 1985

when Personal Computers (PCs) were only just coming into their own. Thirdly, technology was what people know as well as what they do. Technology is knowledge, is visual, even tactile and can be taught as in various disciplines of engineering.

As computers became more accessible to the 'man (or woman!) on the street', the word *computer* became synonymous with *technology* and vice versa. Computers were used more and more for extensive databases in commerce and *information systems* became synonymous with computers. The layered meanings of technology were encapsulated into the word *computing* in that it refers to computers (hardware), to software (programs) and also to knowledge. Historically, computers and *communications* developed along different paths, but they have converged to the extent that computers are now synonymous with communication. Communication devices are now called *technologies*.

The Concise Oxford Dictionary (Pearsall, 1999) defines *computer science* as "the study of the principles and use of computers" (p. 294). Princeton University (as cited in Dictionary.com, 2008) gives the same meaning to both computing and computer science, namely: "the branch of engineering science that studies (with the aid of computers) computable processes and structures". In society as a whole, there are widely differing views of meaning for computer practices. This is problematic, and has led to inconsistencies and confusion in the educational context, as there are a range of terms to describe computer practices and learning (Clear & Bidois, 2005; Harris, 2005).

In the New Zealand Digital Horizon document (MOE, 2003), Information Technology (IT) is the term used to describe the items of equipment (hardware) and computer programs (software) that allow us to access, retrieve, store, organise, manipulate, and present information by electronic means. Personal computers, scanners and digital cameras fit into the hardware category; database programs and multimedia programs fit into the software category. Communication Technology (CT) is the term used to describe telecommunications equipment through which information can be sought, sent and accessed, for example, phones, faxes, modems, and computers. As computers and communications converged, the term Information and Communication(s) Technology

(ICT) evolved. In this thesis, the terms ICT, IT and computing are used as umbrella terms, loosely and somewhat interchangeably.

A review of literature, both national and international reveals many different interpretations of ICT. The Webopedia states: "it is the study or business of developing and using technology to process information and aid communications" (http://www.webopedia.com/TERM/I/ICT.html, retrieved 29 April, 2007). Dalziel et al. (2005) confirms there are multiple contested definitions of ICT, which has become an umbrella term covering a wide range of technologies and their enabling effect across many sectors and industries. ICT includes products and services that underpin electronics, software and telecommunications. An OECD (2007) document discussing occupations and skills in the information economy states: "There is currently no commonly adopted definition of ICT skills and there is no internationally agreed list of ICT-related occupations." Potgieter (2005) talks about the spectrum of ICT which ranges from the non-technical user perspective to the hard technology of software algorithms. These multiple definitions have impacted on the meaning of ICT education in the New Zealand context which is further compounded by the variety of specialist computer subjects offered, and the qualifications students may gain in this field.

In my initial research ideas, my definition of a specialist computer course for secondary school students was one which encapsulates the study of the principles and use of computers as well as the related social and ethical learning and knowledge. This included learning about the computer as artefact – how it works from both a hardware and software perspective; learning about software engineering (programming); using the computer to critically analyse and solve problems using higher-order thinking skills; and exploring the social and ethical issues to be addressed. During my research I have refined my above definition to include what it is not, based on research by Clear and Bidois (2005) and a UNESCO (2002) schools curriculum report. It is not ICT literacy, it is not the application of ICT in subject areas, it is not the integration of ICT across the curriculum, but it is ICT specialisation which is designed for students who may become designers and

producers of new technology. This is my interpretation and explains how I will use the terms, but these constructions could be quite different from the participants in this research study. Care will be taken to reflect students' interpretations where they are determined to differ.

Computer education in New Zealand

In the 1990s, Year 12 students could typically take a computer applications course focused on office application skills or a computer studies course which was based on the then Sixth Form Certificate requirements. The latter included three themes based on the applications and implications of computing, technology of computing and techniques of problem-solving using a computer. Year 13 students (then Seventh Form) could take a computer studies course, which offered unit standards from the national framework in computing which could lead to a National Certificate in Computing qualification. Computing as such did not contribute to the normatively assessed national qualifications for University Entrance, University Bursary and Scholarship examinations (Clear & Bidois, 2005). The introduction in 1993 of the National Curriculum Framework (MOE, 2007) specified Technology as one of the seven essential learning areas. Of these areas, Technology is the only curriculum area to specifically address ICT, but includes it as one of several candidate technologies for study in what is quite a broad, integrated and flexibly designed curriculum model, based upon a socio-cultural learning perspective (Clear & Bidois, 2005). However, the placing of ICT under the Technology curriculum evoked a fierce debate among teachers of computing as to the place of specialist computer courses and the need for knowledge about computing, computers and the skills needed by different sections of our society (P. Curry, personal communication on NZIST listserv, April 22, 2002; A. Rowney, personal communication on NZIST listserv, April 22, 2002; December 5, 2005). Ballantyne (2004) conducted research into how ICT could be taught through osmosis, integration or as a standalone subject. With the advent of the NCEA qualification in 2002, Computing became an approved subject for university entrance with the first cohort of students taking Level 3 Computing in 2004. As yet, there is no

'curriculum' in Computing which allows schools to develop their own courses. Students can attain Unit Standards in Computing, and Achievement Standards (which allow for acknowledgment of excellence) in Technology.

In New Zealand, interested stakeholders in industry and tertiary institutions have expressed concern at the lack of ICT graduates (Dalziel et al., 2005). The wider debate of specialist computer courses and declining numbers of ICT graduates has become a world-wide issue (Brislen, 2006; Taft, 2005). The confused perceptions of ICT and the fragmented and uneven state of computing education at the secondary level in NZ have contributed to the disparity between tertiary education and industry needs (Clear & Bidois, 2005).The low number of ICT graduates and the perceived differences between school, tertiary and industry sector needs and practices has prompted various government and industry initiatives in New Zealand over the past few years. In the revised edition of the Digital Horizons document (MOE, 2003), one of the strategies is to "work with secondary and tertiary sectors to investigate and extend options for senior students to access specialist studies in ICT" (p. 12). The absence of a Year 11-13 ICT curriculum and the lack of understanding and communication around ICT as an educational or career option prompted the Fluency in IT New Zealand (FIT NZ) project in 2004. This project was jointly funded by the ICT industry and government to address the poor alignment between secondary education, tertiary education and the IT needs of the industry sector. A recent development by the MOE is the Digital Technology Framework (DTF). This Framework will include the subjects ICT, IM, IT and Computer Science. "The choice of the term Digital Technologies rather than ICT to describe the Framework, was done to include the diverse, and progressively changing, range of technologies, knowledge, concepts and skills that comprise the software, electronics, information, communication and creative technologies"(D. Harre, personal communication on NZIST listserv, March 28, 2007)[2].

My research is looking at a very small part of this larger, ongoing debate and continuum of learning and reflects a snapshot of what Year 13 girls' perspectives on specialist

[2] From March 2008 this initiative is to be known as the Digital Technology Guidelines.

computing courses and careers are at the time of this research. I am limited by time and resources and can only present a thesis which I hope will contribute in a small way to this larger debate. At the time of data collection (2006), I looked at students from three different schools and noted that courses being offered varied in names and content. This will be discussed further in Chapter 3 (methodology).

International debates

International literature pertaining to ICT education and gender outlines the social and economic forces driving educational needs and vice versa. Critical and feminist literature stress the development and potency of a gendered IT culture broadly in society, and specifically in fields such as education, gaming and advertising. The slant given to the "gender problem" of girls and ICT depends on views of gender and gender theory.

Social and economic forces driving educational needs

Technology is not neutral in terms of society, economics or gender (AAUW, 2000; Mackenzie & Wajcman, 1996). Use of technology is influenced by a range of social structures and norms and our environment and culture are affected by the world of cyberspace. Very little is unaffected by the onslaught of technology. Students are aware of this as reflected by their answers to the Stocktake Report (MOE, 2002) where technology featured significantly in students' views of the future. The products of computer science affect the way that we look at business, how we work, what we expect from entertainment and how we communicate (Brownlie, Fair, & Ingram, 1981; Mackenzie & Wajcman, 1996; Margolis & Fisher, 2002; O'Neill, 2003). A feature of technological determinism is the view that technology develops independently of society. However, Mackenzie and Wajcman counter this argument by stating that society both shapes technology and is shaped by it. The education sector operates in a dynamic and complex environment. It is characterized by many interdependencies with other social and economic systems (MOE, 2006a). The political and economic imperative positions IT as an essential for the economy and for personal success and consequently can be assumed to have an impact on and be shaped by education. "The rapid growth of, and importance placed upon, the use of information

and communication technology (ICT) in educational institutions around the world has inevitably led some to question their value, and the extent to which they really do improve teaching and learning" (Parrot, 2003, p. 12). As Brown and Murray (2003) point out, there is no acknowledgement in the Digital Horizons document (MOE, 2003) of the growing body of literature that seriously questions the rapid growth of ICT use in schools. Brown and Stratford (2002) suggest that New Zealand's current policy and practices around new technologies lacks an appropriate focus. Instead of the MOE's ideologically driven and business influenced ICT strategies, education would be better served with strategies focused on learning and teaching. They question the technocentric heralding of ICT in relation to educational change, while also acknowledging that new technologies have a social impact. New technologies alter a social situation by allowing and limiting certain activities; they create new social and power relationships. For example, introducing a computer into the classroom may raise issues of who ends up using, and not using, the technology. There is a concern about technology driving education, instead of sound pedagogy that uses technologies. This conflict of interest between the concern of social educationists and the economic needs of the IT industry with the lack of ICT graduates is reflected in the gender equity debate pertaining to IT (Beynon & Mackay, 1993; Brown & Murray, 2003; Futureintech, 2005; O'Neill, 2003).

Gendered IT culture

Critical and feminist literature stresses the development and potency of a gendered IT culture. The claiming of success and interest by boys in ICT is largely the work of culture and society. Technology has a history of being male focused because of the activities of production, politics and military defence that have driven research. The social perception of 'computer geek' has been promoted through that group of boys and men who "burn with a passion for computers and computing" (Margolis & Fisher, 2002, p. 4). Through their intense interest, they have tended to enshrine the technology as a male preserve. Studies have shown that women are more interested in the context of computing and in attaining a sense of 'interconnectedness'. Their interest is captured by learning how something is relevant to society and to their own lives while men are more likely to be

satisfied with studying the computer as an artefact in isolation (Margolis & Fisher, 2002; Treu & Skinner, 2002). An example of someone whose interest was sparked by social motivation is Wendy Hall, senior vice-president of the Royal Academy of Engineering. In an interview with Biever (2006) Wendy explains that she taught herself to program because she was captivated by the promise of how computing could change people's lives. As a young computer science lecturer, her ideas were rubbished by her male peers. Today, as a world renowned scientist, she is working with an international team on the first ever web science research initiative to understand how the web evolves from the social networks it creates. Mackenzie and Wajcman (1996) acknowledge social context and influence when they write: "... we should not deny our social values. We should work our way into technology along paths that make sense for us" (p. 62).

Bell, (as cited in Selby & Ryba, 1993), argues that the alienation and disadvantaging of girls in the 'hard' computing areas of programming systems analysis and design is explained by the ignoring of the ideas and experiences that many girls bring to science and technology as well as an image of computer science being detached from people and thus foreign to many of the ideas of girls. Research at Norwegian Institute of Technology (NIT) indicated that male domination in computer science is created because lecturers and male students share values of machine fascination, work addiction and total absorption in computers together with a playful attitude towards computers. These values are opposed to the values and interests of female students (Rasmussen & Hapnes, 1998). The stereotype of a computer scientist as someone myopically obsessed with computing is largely due to a computer culture that promulgates a typically male orientation towards computing, expectations of male success, and continual questioning of women's abilities (Margolis & Fisher, 2002).

In a report by Selby (1995) on research commissioned by the MOE to explore issues of female participation in tertiary information technology education, she found the absence of women lecturers as role models led to problems in attitudes and behaviours in both students and staff who were predominantly male. "Not enough role models" was the top

response given by girls to a survey in American households to the question of why girls are less likely to pursue computer science careers (Jepson & Perl, 2002, p. 36). Annalee Newitz, co-editor of "She's such a Geek" comments in an interview that women in sci-tech fields might feel discouraged because there are so few women to support them (cited in Silverberg, 2007). In a discussion on the under-representation of women in the IT workforce with Eckle (2007), Eileen Trauth, an Associate Dean for Diversity, Outreach and International Engagement for Penn State's College of Information Sciences and Technology, reports on a growing concern to improve the "critical mass conundrum" (p. 2): the fewer women in IT, the more it is a men-only club; the more it is a male club, the more women might be feel uncomfortable in it. Critical mass is thought to be about 30% of women in the field.

One of the major spurs for girls to succeed in male worlds has been the presence of a compulsory curriculum (Arnot, 2002). Girls who have made their way into mathematics and science have shown that they can excel. The social perception of males dominating in the scientific and engineering environment, is slowly changing, with men appearing to increasingly accept that "It doesn't matter if you are male or female, as long as you can get the job done" (Ripley, 2005, p. 53). When Frances Allen was awarded the A.M. Turing Award in 2007 as a top computer scientist, she was the first woman in 40 years to receive her profession's highest honour (Pham, 2007). She comments that women are moving into a new era in this field. The CEO of the New York based Association for Computing Machinery (ACM) comments that it is a shame there is an image about the profession that does not appeal to women, as they are great researchers and leaders but there are not enough of them, which has been an issue for years. There is still, however, a persistent dilemma of inequity tension in the ICT field in that only limited inroads have been made in dismantling sexual divisions of labour.

Silverberg (2007) comments that at press conferences reporting on the world of inventing and new technology it is still very much a male-dominated affair. But beneath the surface, gender equality in this area is quietly gaining ground. Female geeks are finding a home in

their various interests from blogging to engineering to tech journalism. Although in a minority, there are some women who are making an impact in bringing technology to the masses by being on high profile TV shows. “Sometimes people think that a woman doesn’t know her tech stuff. But as soon you show them that you do, you should just hold your head high and support other women who do the same” says Amber MacArthur of Toronto’s CityTV (Silverberg, 2007, p. 1). Silverberg strikes a cautionary note in claiming that a subtle kind of sexism still exists in the sci-tech fields. Although the number of female bloggers is growing, and software companies are hiring more women, there is still gender inequity in terms of pay and respect in the sci-tech industries (Eckle, 2007; Silverberg, 2007).

Klawe (2002) found from numerous research studies that there were significant gender differences in computer related interactions and perceptions at every age from kindergarten through secondary school. Differences were found in terms of how much time was spent at the computer, what activities were liked, students’ perception of their level of skill in using computers, to mention a few. Secondary school students think of the specialist subjects TIM and CPS as feminine and masculine domains (Abbiss, 2005a). Something about the subject culture leads them to these conclusions. Her research appears to indicate that girls tend to reject the subject they most closely associate with male computer practice, and favour that which they think is more consistent with female computer interests and identities. Research by Rasmussen and Hapnes (1998) locates the low number of women in Computer Science courses in the gendered culture of computer science. Cultural definitions of femininity place IT outside the boundaries of ‘feminine’ (Eckle, 2007). Female students reject an intimate knowledge of the machine, which hackers (usually male) appear to embrace. In her research, Turkle (1998) suggests that women are reticent about becoming emotionally and socially involved with the computer. There is a tension in maintaining their femininity, and working with a machine (computer) which becomes a personal and cultural symbol of what a woman is not.

Another thread in literature relates to the role of advertising and the media in defining a gendered IT culture. Negative media such as too many magazine covers showing male dominance in the industry; too many stories emphasizing the long hours and dead-lines; TV programmes that promote the 'nerdy' image of computer scientists, were regarded as non-trivial factors in turning women off possibly selecting a computing career. TV programs that promote a positive image of women in a career, such as LA Law, may have had an influence on career decisions (Jepson & Perl, 2002; Klawe, 2002; Taft, 2005). A current Crime Scene Investigation program on TV has a female computer geek, which may not be the positive image needed. Many women dislike the way some marketers target them, because their approach comes off as condescending or re-enforcing outdated views of women. An example is having an essentially male game product distributed in a box with flowers or painted pink. Another case in point is having women as 'booth babes' at the E3 Expo, hired to attract the attention of the mainly 20 to 30 year old male (Wells, 2005).

On the other hand, some companies are looking at what aspects of technology will appeal to women in their advertising campaigns. "Digital story telling (DST) makes it possible to produce a new creative approach to marketing" (Dooley & Adams, 2005, p. 48). Coca-Cola for example, is shifting from passive TV marketing to interactive game and story-telling on the Internet and on mobile devices. Voice, music, video and text are the core ingredients of DST, suggesting it can be used as a tool in education to enhance the learning experience. At the turn of the century, women are surfing the web in equal proportion to men and women make up a majority of Internet consumers (Margolis & Fisher, 2002). The Internet program 'Second Life' has attracted a number of companies to have virtual offices to promote their products, and there is growing evidence that women account for half the total time spent on Second Life, an immersive virtual world (Silverberg, 2007). Naomi Klein (as cited in Mendick, 2005) explains the phenomenon of culture jamming which is based on how marketing affects communities not only by stereo-typing them, but also by hyping and chasing after them. Sophisticated culture

jammers not only create parodies on advertisements, but also hack into a corporation's own methods of communication, to send a message starkly at odds with the one that was intended. Many female culture jammers indicate they first became interested in the machinations of marketing via a feminism seminar on the critique of the beauty industry.

Computer gaming is an instance of some ICT fields that have been clearly dominated and claimed as a male domain. Video games and arcades provide many children with an introduction to the current computer culture. Computer games that developed in parallel to the computer technology has favoured boys who tend to value individual performance and the element of competition, rather than the more collaborative and shared problem solving approach of girls (Selby & Ryba, 1993). The social computing environment is an important factor in the perceived limiting of opportunities for girls to have access to computers. The observation that the digital divide between males and females starts early is largely contributed to boy-based video games and boys having more time on the computer than their sisters because of the boys' absorption with video-games (Jepson & Perl, 2002).

A distinction should be made between players of computer games and developers of computer games. Gaming is attributed greater value than some other types of computing knowledge such as office applications and is associated with real computing. Essentially a game is an end-user application just like word processing. However what counts as experience with a technology is socially framed in a gender discourse (Abbiss, 2005b). End uses associated with a masculine activity tend to be granted greater status than others. A focus on the social contexts of computer game development reveals that few women are involved with design, not only of games, but of software in general. People concerned with diversity at the point of design argue that not only is it important to design games for girls, but it is also important to have more women in the software department (Martinson, 2006). Although women's interest in gaming has been growing gradually over the years, there is still something in the game design industry's culture that does not appeal to women. Wells (2005) in an article from the business media claims that relatively few

women choose to become programmers and even fewer spend their programming careers designing games. A perceived gender divide within the games industry was illustrated when a recently instituted games degree course developed at University of Derby, UK received no female applicants (Wells, 2005). However, this trend may be changing. In her article on the computer games industry, Jamieson (2005) reports that one in five gamers is a girl. They're seeking something a little bit different and developing the games they want to play. Although still a minority, there may be a growing number of girls who are crossing the gender divide into the gaming culture which reveals that some are looking to change the culture of gaming as a male domain as they are not put off by masculine culture and male dominance of gaming. Koutsos (as cited in Jamieson, 2005) who is a texture artist says she knows that many women are not aware that game development could be a career option for them, and thinks this could be improved. Developing computer games involve drama, story-telling and animation as well as programming. An all-female team at Cornell University won first prize in a student computer-game design contest, working from the basic concept that girls are more social and need to fit into a more social environment than boys (Clairborne, 2006). The team members shared knowledge from their diverse academic backgrounds and personal pursuits in music, art, programming and sports to create a game that requires players to play in tandem to win. "Could the next big thing in games be designed by girls for girls – but that boys also love to play?" (Jamieson, 2005, p. 43).

Martinson (2006) comments on the lack of research in the use of computing technology in the leisure pursuits of women. The use of the telephone changed from a device for (male) business entrepreneurs to a social device when women began to use it for maintaining social relationships (Martin, 1998). The Internet capability and offerings such as email, newsgroups, blogging and chat programs are transforming the nature of leisure. This suggests that technology use patterns change, as does the gender discourse around different technologies. New types of leisure software are being developed, such as health and wellness, nutrition, yoga and personal websites like Face-Book. More research is

needed into the specific contexts of leisure practices. The study of computer game design may make it easier to integrate knowledge of the social issues, including gender issues, with the knowledge of design skills. Martinson (2006) comments that the cultural associations of masculinity and femininity with specific roles (e.g. programmer) and objects (e.g. telephone) do change over time. However an understanding of the cultural importance of gender is necessary to explain the gender gap in information technology. And conversely, understanding gender and information technology may provide insights into the broader patterns of gender in society.

Views of gender

There are competing views on gender, characterized in broad terms of biological determinism and social constructionism. An example of the former is given by Larry Summers, President of Harvard University, when speaking on gender disparities called for rigorous and careful thinking to explain the gender gap among top-tier tenured science professors (Ripley, 2005**)**. The most likely explanations, he said, are that 1) women are just not so interested as men in making the sacrifices required by high-powered jobs, 2) men may have more 'intrinsic aptitude' for high-level science and 3) women may be victims of old-fashioned discrimination. The intrinsic aptitude of men implies a natural or biological difference. This biological determinism supports current theories that there are gender differences in brain development, and that male/female differences in interest and aptitude can be attributed to biological differences. A further view is that the brain is open to suggestion, and that girls who have been encouraged and motivated have excelled in the sciences. A counter theory is one that sees gender as primarily a social construction. Feminist scholars have argued along with social constructivists that all knowledge is the result of social processes of negotiation and interpretation, and therefore necessarily bears the imprint of the social context within which it is constructed. They argue that biomedical sciences have developed and promoted theories that justify rather than explain social inequality between men and women (Lupton, Short, & Whip, 1992). Research into contributions by women scientists serves to dispel the myth that women cannot do science. Leonard Sax, a physician and psychologist who has written books on

gender matters, believes the reason women are under-represented in computer science and engineering is not because they can't do it, it's because of the way they're taught (Ripley, 2005). A growing body of literature supports this view, particularly with regard to high school education (Countryman, Feldman, Kekelis, & Spertus, 2002; Denning, 2007; Jepson & Perl, 2002; Scholefield, 2007; Stephenson, 2007; Treu & Skinner, 2002). Research has shown parallels between the development of the sociology of science and of technology and sociologists are turning their attention to the way in which technology is shaped by the social context in which it is developed and used. Women's educational success in Western economies is attributed to feminism as a social movement in the broadest sense.

Despite evidence that men and women are equally capable of careers in Science, Technology, Engineering and Mathematics (STEM) fields, percentages of women, particularly in the computer science and technology fields remain small. Theories based on the 'women as deficient' model are increasingly being shown to be inappropriate (Bystydzienski & Bird, 2006). Eileen Trauth, Associate Dean for Diversity, Outreach and International Engagement at Penn State's College of Information and Sciences maintains the gender imbalance is not a 'woman's problem'; it is a societal problem. She advocates that gender inequality in the workplace is not the problem of a lone woman experiencing inequality, it is the responsibility of every person in the institution to ensure that inequality is eliminated (Eckle, 2007). Recognition is now being given to what many social science researchers and gender studies scholars have been advocating for some time, that the barriers to women's progress in these fields is systemic. "Rather than trying to change women to fit the sciences and engineering, these fields need to be changed in order to fully embrace women" (Bystydzienski & Bird, 2006, p. 5). Computer science and the computer industry needs to change with more interest in the users, the complex realities of computers and their applications, and work organizations. This could have implications for how Computing is taught in schools. How could we as teachers ensure that they (girls) have positive experiences? What factors and role models influence the

choices that girls make? What changes are needed in the computer culture in the educational context to improve its image and make it more appealing to girls and women? In this respect, female students may be an important resource in initiating such a change (Rasmussen & Hapnes, 1998).

Listening to the voices

Ballantyne (2004) draws on literature that indicates that exploration into how young people are currently using ICT and what should be taught is critical to their current occupation as learners, their future occupations in employment and for their general use in society. "I think maybe kids could bring, well, they could open up new frontiers for computers, because they have such wild ideas that they could do great things if people just let them" (Lisa as cited in Turkle, 1998, p. 379). The secondary school sector faces the most significant changes with the introduction of ICT. Within the social constructivist discourse it is suggested that the experience of 'growing up' in the future may well be one of 'growing out' of traditional gender identities. Schools will need to listen to male and female pupils to learn how far and in what ways boys and girls have different ways of knowing and learning and the diversity and changing nature of gender identities. The most likely scenario for substantial changes in education is that "the voices of young people themselves, rather than the campaigns of teachers, parents and educational policy makers, will be the driving force for educational change" (Arnot, 2002, p.258). This reflects the focus of this research, as it is my intention to listen to the voices of girls in secondary schools, and underpins the methodology as outlined in the next chapter.

Chapter 3: Method and sources of data

Introduction

This study is located within the paradigm of qualitative research with phenomenological perspectives providing the theoretical underpinning. A case study research strategy is adopted, incorporating multiple data collection methods and thematic data analysis. In this chapter I outline the research methodology, examine the issues of ethical considerations and conclude with a reflective discussion.

Qualitative paradigm

The context of this research is specialist computer classes in New Zealand secondary schools and is concerned with how girls view specialist computer classes in secondary school and the factors that have influenced their choices of taking or not taking these classes. This leads me to adopt a phenomenological perspective and qualitative paradigm for my research.

Phenomenology as an ideology focuses on lived experience and as a methodology is the study of people's experience of social phenomena (Abbiss, 2005b).

> Building on an epistemology that sees knowledge as a social construction (and not a correspondence with 'truth') and a theory that views learners as active constructors, 'phenomenology' presents itself as appropriate – investigating participants, viewing them as people who interpret the world and their experiences and who construct personal understandings of them (Pring, as cited in Hopwood, 2004, p.348).

Social research techniques that are sensitive to the context and that use various methods to determine how others see the world, follow an interpretive social science approach (Neuman, 2006).

A qualitative paradigm is characteristically concerned with participant perspectives, process and how people negotiate meaning, and descriptive data being collected in the form of words and pictures (Bogdan & Biklen, 1998). Words are the way that most people come to understand their situations, and the qualitative researcher looks to understanding

a situation as it is constructed by the participants (Maykut & Morehouse, 1994; Merriam, 1998). Qualitative research assumes there are multiple realities and that the world is a function of personal interaction and perception. This places me as a qualitative researcher in a phenomenological framework, "attempting to understand the meaning of events and interactions to ordinary people in particular situations" (Bogdan & Biklen, 1998). My project is social research and fits within a qualitative-interpretive paradigm.

Social constructionism as a theory underpinning qualitative research is compatible with the phenomenological perspective. As a qualitative researcher, I am also influenced by my own life experiences, and have constructed my own meanings and perspectives. As Glesne (1999) notes, the researcher is a translator of culture, trying to understand the world of the interviewee, and make a meaningful interpretation. I am also the primary instrument for data collection and analysis. Data is mediated through my perceptions, knowledge and my own indwelling posture to present an understanding of the other's world (Glesne, 1999; Maykut & Morehouse, 1994). It is important therefore to acknowledge that my research will be filtered through my own past experiences (see Chapter 1), disciplines, traditions and events that have shaped my thoughts, beliefs and values. However, "By being aware of forces that help shape your interpretations, you can challenge some, while simply acknowledging others" (Glesne, 1999, p. 158). The benefit of researcher as instrument means that I can be responsive to context, flexible, and able to change direction and focus (Bogdan & Biklen, 1998; Janesick 2003; Merriam, 1998). This happened in my plan for research design and data collection which is explained later in this chapter.

Research design

Given the focus of this study on how girls perceive computing as a school subject and career path, my research has a case study design structure.

A case study should be used when a 'how' , 'who', 'why' or 'what' question is being asked, or when the focus is on a real-life phenomenon within a real-life context, or about a contemporary set of events over which the investigator has little or no control (Burns,

1997; Yin, 1994). Merriam(1998) describes four characteristics that are essential properties of a qualitative case study:

a) Particularistic – the case study focuses on a particular event, situation or phenomenon. It can examine a particular instance but illuminate a general problem.

b) Descriptive – the end product of the case study is a rich "thick" description of the phenomenon under study.

c) Heuristic – the case study illuminates the reader's understanding and brings about discovery of new meaning of the phenomenon under study.

d) Inductive – data is grounded in the context itself, and inductive reasoning leads to discovery of new relationships and understanding rather than a verification of pre-determined hypotheses.

My study falls within this general description in that it is a particular contemporary issue (perceptions of girls on specialist computer courses in schools) in a real-life situation (the secondary school). I am also guided by the fact that case study methods have been widely used in educational research relating to perceptions and experience. A study that had an influence on my choice of research strategy was Hopwood's (2004) study on exploring students' conceptions of geography within a qualitative framework.

A case study may be intrinsic (the researcher wants better understanding of a particular case), instrumental (the case is supportive and facilitates our understanding of something else) or collective (an instrumental study extended to several cases). The 'several cases' in my study were three classes of female students taken from two different secondary schools. The students were from a Year 12 ICT class and a Year 12 Computer Science class in a co-ed school, and Year 12 and Year 13 students combined in a Computer Programming class in an all girls' school. In this respect my case study is a collective case study. From these classes, female students were selected from volunteers for a face-to-face interview to add depth to the questions being researched and to keep the context

consistent. These selected participants comprise the embedded cases. The following sections discuss the context of the classes and how the embedded cases were selected.

Context of cases.

Class Case A comprises Year 13 students in a Computer Programming class, which also includes some accelerated Year 12 students, in an all girls' school. The girls' only school was selected to determine if there are any discernible differences in perspectives from an all girls computer class relative to a co-ed school. The girls in this class may have quite different prior experience of ICT classes. Computer and Information Management (CIM) classes are offered from Year 10 through to Year 13. CIM classes involve learning office application programs of word processing, spreadsheet, desk top publishing and electronic presentations. The Technology department offers a Year 9 and 10 half year course in Technology. In the senior school there is also a Year 12 Computer Systems Technology – Web Site Design course and a Year 13 Computing Information Technology – Programming course. The Web Site Design course covers topics such as PC use, data management, graphics and images. The Programming course includes robotics, database for business, macros and programming languages. The English department offers a multimedia course for Media Studies involving film making and animations. Girls in the Class Case A may or may not have experienced any of these courses.

Class Case B is a Year 12 ICT class and **Class Case C** is a Year 12 Computer Science class in a large co-educational school. Girls from these classes may have different prior ICT experience, and choices for further computing classes. In 2005, computing in Years 9, 10 and 11 were taught within the department of Commerce and focused on keyboarding skills and office application programs of word processing, spreadsheet, desk top publishing and electronic presentations. In Year 12, as well as ICT classes under Commerce there were Computer Studies and Computer Science courses under the department of Mathematics. Topics included programming, web design, hardware, social and ethical issues and office applications. From 2004, Year 13 Computing was an accepted option for a University Entrance requirement under NCEA level 3, and there were two

subject choices of Programming and Hardware and/or Applications. In 2006, a new department called Computer and Information Science (CIS) was created, which combined all the classes originally under the Commerce and Mathematics department as well as creating new class options. There are now three possible choices of computer class at Year 12: Programming and Hardware, Applications and Multimedia. There are four possible choices of computer classes at Year 13 under CIS: Multimedia, Applications, Hardware/Networking and Programming. Students have the option to take from one to four of them. In addition, there is Media Studies which involves film making and extensive use of computers under the English department, as well as Visual Art: Design under the Art department and Graphics.

Embedded cases selection

In November 2005, a questionnaire was handed out to Class Cases B and C. Questionnaires were handled by colleagues at the school and returned to me. The questionnaire was given to all the students in the class, but only those from the girls were analysed. In reply to a question on the questionnaire, six girls indicated they were willing to be interviewed. In March 2006, all six girls, who were now in Year 13, were contacted. One girl did not have the time for the interview. Of the five available for interview, one was not taking a computer course in 2006. In February 2006, a questionnaire was also sent to a colleague for the Class Case A. Two Year 12 girls from the Year 13 computer class indicated they were willing to be interviewed. I decided to accept all seven girls as the embedded cases. As the research evolved, I also decided to interview three other girls. From feedback received at a forum, and using recognized practices of qualitative research to be flexible as the study progresses, I decided to include interviews with girls who had not taken computer subjects at senior secondary level. This would hopefully extend the range of experience in the social phenomenon being studied. Two girls volunteered for interviews as a result from a request one morning by the Senior Dean in the senior common room at the co-ed school. These additional students are outside of the class cases and constitute individual cases.

The extension of the case studies to include additional participants is consistent with a qualitative approach. Qualitative researchers build a sample with the goal of "gaining deep understanding of some phenomenon experienced by a carefully selected group of people" (Maykut and Morehouse, 1994). The goal of the qualitative researcher is not generalizability. In contrast to random sampling, purposive sampling selects on the basis of some criterion and increases the likelihood that a range of experience in the social phenomenon being studied will be represented. Therefore it is the working knowledge of the contexts of the individuals and settings that leads the researcher to select them for inclusion in her study (Maykut & Morehouse, 1994; Merriam, 1998).

In October 2005 I conducted an interview with a student from Year 13 as a pilot study and to refine interview techniques. The volunteer student came from a specialist Computer School where I was teaching. (The school closed at the end of 2005 and merged into the co-ed school). There were only two girls at the Computer school and I needed to get pilot data before the students left for their final exams. This was a unique school specifically for Year 13 students with a strong emphasis on computing. Subjects offered were Applications, Programming, Hardware and Networks, Multimedia, Mathematics Statistics, Mathematics Calculus, Economics and Business English. Although this student is part of the pilot study, and not part of any of the class case studies, I have decided to include her interview in my data as she provides richness as a specific individual case with some information different to the others, and the nature of the data collected did not change drastically after the pilot study.

Methods of data collection

Qualitative research techniques have been used in this study to set up strategies and procedures to enable me to consider experiences from the informants' perspective, to give voice to the students, and to attempt to understand behaviour from the subject's own frame of reference (Bogdan & Biklen, 1998; Hopwood, 2004). The research methods of data collection were i) a concept map (also known as brainstorming mind maps) from each of the students in each of the class cases; ii) a questionnaire from each of the students in each

of the class cases; iii) a face-to-face semi-structured interview from students comprising the embedded cases and the three additional individual cases. Hopwood (2004) notes that a weakness in the variety of data formats can lead to some difficulties in data analysis and triangulation. However, a strength in variety is that there is a range of preferred styles for participants to express themselves and it gives value to the participant's perspectives. It also provides for checks and balances between different data sources pertaining to the same person.

Although my research follows a dominant qualitative paradigm, the methods incorporate both qualitative and quantitative collection and analysis modes. Patton (2001) writes that qualitative and quantitative data, with their varying strengths and weaknesses, can be fruitfully combined to elucidate complementary aspects of the same phenomenon. In summary therefore, my research strategy is a collective case study with embedded cases using multiple methods.

Concept map

"The nature of conceptions: concepts, thoughts, feelings and understanding are 'hidden' phenomena that cannot be directly observed, but evidence of them can be obtained" (Hopwood, 2004, p. 349). Students were given several opportunities with different response formats to demonstrate their perceptions of computing. Concept mapping presents itself as a technique that might be employed alongside others such as interviews (Kunowski, 2005), although problems with triangulation across different response formats may arise. The loosely structured concept map had very little guidance in order to minimize researcher interference and elicit grounded responses (Hopwood, 2004). The concept map (or 'brainstorming mind map') included with the questionnaire indicated some lines to follow and be further investigated with the interview. Participants were asked: "What ideas or thoughts or feelings come to mind when you hear the phrase: 'Technology/Computers'? Write down your thoughts and/or ideas and/or feelings in the bubble/clouds on the map. You can add more bubbles if you wish" (see Appendix A, section one).

Questionnaire

The questionnaire was structured with multiple choice questions that were adapted from a study by Crombie, Abarbanel and Trinneer (2002). The focus of the questionnaire was to look at computer related attitudes and future intentions. Questions were both positively and negatively worded and were structured under the topics of perceived support from parents/caregivers and teachers; computer related attitudes of confidence, intrinsic value, usefulness and gender stereo-typing; future intentions in occupations and further academic study (see Appendix A, section two). Students responded to these items using a Likert response format (1 = strongly disagree; 5 = strongly agree); negatively worded items were reverse coded. The questions from each topic were randomly ordered to determine consistency of responses (see Appendix C).

Face-to-face semi-structured interviews

Interviews of one kind or another are indispensable in case study research because of the richness and depth of the communication that is possible to gain insight and understanding of individuals (Gilham, 2000b). Face-to-face semi-structured interviews are open to a multiplicity of ideas and responses that are not limited to the choices and options presented and pre-determined by the researcher. Such interviews form the core of the research as I am interested in the girls' perceptions and ideas which are best expressed in oral communication.

Interviewees were 10 female students selected as discussed above. The interviews ranged from 45 minutes to one hour in duration, and were transcribed in entirety. A copy of the transcription was sent to the participant for comment and any necessary corrections. Eight of the 10 interviewees returned their signed transcripts. Two did not return them, though I sent them a second copy. Field notes were written up by me before, during and immediately following the interviews. The interview was guided in nature and was completed in an environment acceptable to the participant. See Appendix E for a list of the proposed questions. These have been adapted from Margolis and Fisher (2002) and were reviewed in light of the pilot study.

I was not working at a school during the period of interview data collection, and found it quite difficult to make contact with the students. I was also aware of the time involved for them, when they were quite busy with assessments. The advantage was that they did not know me as a teacher, except for the one student in the pilot study, and were perhaps more willing to speak their mind. I felt that I learnt more about the interview technique with each student. It was quite hard at times to get the girls to talk as some were quite happy to chat on, while others had short answers. So I did not always get them to 'tell their story' in the same depth and detail. However, as a matter of ethics and respect for the participants' comfort and safety, it would be inappropriate to probe them too pointedly or aggressively. Interviewing is definitely a learned skill. In hindsight, a question it would have been helpful to have included in my interview schedule is one relating to role models in the ICT field, although several participants voluntarily alluded to role models in their interviews.

Data was collected from 49 female students surveyed for the mind map and questionnaire, and 10 students who were interviewed, as shown in Table 1. In my research, I did not have any students from the Media Studies or Graphics or Visual Art: Design courses. All embedded cases and some of the additional cases had experienced a specialist IT course as explained above. The questionnaire and mind maps provided an overview of potential issues and themes that could be further investigated. Particular ideas were explored in the interviews in greater depth.

Table 1: Case study structure

Instrumental cases	Schools	Number of female students surveyed	Embedded cases
Class Case A – Year 13 Computing class	All Girls'	26	Helen Esther
Class Case B – Year 12 ICT class	Co-ed	13	Sandra Gillian Erica Susan
Class Case C – Year 12 Computer Science class	Co-ed	10	Monica
Additional interviewees	Co-ed Pilot Study		Andrea Norma Sheryl

Table 2: Diary of data collection

Date	Item
21 October 2005	Pilot Study: Student Interview - Sheryl
November 2005	Survey using mind map and questionnaire – Class Case B and C
February 2006	Survey using mind map and questionnaire – Class Case A
29 March 2006	Student Interview - Gillian
31 March 2006	Student Interview - Erica
4 April 2006	Student Interview - Monica
4 April 2006	Student Interview - Susan
6 April 2006	Student Interview - Andrea
6 April 2006	Student Interview - Sandra
11 April 2006	Student Interview - Norma
12 April 2006	Student Interview - Esther
12 April 2006	Student Interview - Helen

Ethical considerations

Qualitative, social research needs to take into account the main ethical issues of informed consent, coercion, intrusiveness, confidentiality and consequences at every stage of the research (Darlington & Scott, 2002; Kvale, 1996). The researcher needs to have high standards of personal and professional integrity, especially as s/he is the research instrument. The research was conducted according to the ethical standards of the Ethical Clearance Committee at the Christchurch College of Education (CCE). Once permission for the study was obtained from the Ethic Clearance Committee at CCE, a letter was sent to the principals of the three schools involved, outlining the purpose of the study and requesting permission to collect data from the students (see Appendix F). Permission was

granted and contact was made with classes and individual students through the designated class teacher. The purpose of the study was outlined to them and it was explained that all names would be held in confidence and material would not be attributable to any particular student.

Questionnaires were distributed by teachers of the classes that participated in the study. An opening statement on the questionnaire made it clear to students that completion of the questionnaire was voluntary and that completion implied consent. The questionnaire was anonymous, but included a question at the end asking if they would be prepared to be interviewed, and if so, to give a name. This provided a list of volunteers who could be approached for interviews.

Written permission of all participants as well as from parents or caregivers was acquired before any interviews took place. A formal letter of invitation was sent to each participant with an attached consent form to complete and return to the researcher (see Appendix F). Their right to privacy was protected in the gathering of interview notes and transcriptions and participants have been given a pseudonym in the reporting of data in this thesis.

All interviews were tape recorded with students' verbal permission at the beginning of each interview session. Interviews were held at school in a safe, non-threatening environment. A seminar room in the library was booked so that interviews would be private and uninterrupted. Confidentiality of raw data was maintained between the researcher and her supervisors. The person who completed the task of transcribing the interviews was obliged to respect confidentiality and was asked to delete all relevant files once her work was completed.

The data and findings are stored on a computer that has a password known only to the researcher. Data will be kept by the researcher for a period of five years and will be used only for this thesis, any conference papers, journal articles or subsequent reports drawn from the data.

Data analysis and representation

Qualitative data analysis can be viewed as having two simultaneous activities: a) the mechanical reduction of data and b) analytic categorisation of data into themes (Abbiss, 2005b; Kunowski, 2005; Maykut & Morehouse, 1994; Neuman, 2006; Taylor & Bogdan, 1998). As Merriam (1998) notes, data analysis is the process of making sense out of one's data. Coding is a means of organising one's data, but it is also a part of the process of analysis. Codes can be thought of as a heuristic device in that as we attach codes or tags to units of data, as a means of identifying and re-ordering data, we are allowing data to be thought of in new and different ways (Coffey & Atkinson, 1996). Developing codes and categories and looking for new patterns and themes, is an iterative process of continually interacting with the data. The researcher then moves from coding to interpretation to transform the data into meaningful information. Data analysis and data collection occur in parallel. Initial data is collected, preliminary analysis takes place, which informs further data collection. The first interview with its transcription and field notes in October and the initial analysis of the mind maps helped to refine the interview schedule for the later interviews.

I found the constant comparative method to conduct an inductive analysis of the qualitative data – mind maps and interviews - most helpful (Flick, 2006; Maykut & Morehouse, 1994; Merriam, 1998). The researcher begins with a particular incident from an interview, say, and compares it with another incident in the same set of data or in another data set. These comparisons lead to tentative categories that are then compared to each other and to other instances. Categories may arise from answers to the research questions as the data is interrogated. "Categories are abstractions derived from the data, not the data themselves" (Merriam, 1998, p. 181). The naming of the categories comes from the researcher as well as the participants.

The first step in the data analysis of the mind maps was to read through all the responses to get a holistic appreciation of what was said. I then started with the first student's response and wrote her words from each bubble (see Appendix B) on separate pages of an

exercise book. From the second student's response, I added words to the same page if I thought they 'fitted', or started on a new page. Some words fitted into more than one page. After this first breakdown of the data, I read and re-read the responses and my initial coding to see if there were other ways to represent the data. I then entered this summarized data onto a spreadsheet table. Further analysis gave me four broad categories and several sub-categories. On revisiting this data, I found that there were other possible categories in which to organize the data. The substantive content of data in the mind maps varied considerably and made simple coding a bit difficult. However, this variation is in itself a feature of interest.

In analysing the interview data, transcripts were made of each interview. In fact the volume of data was daunting in terms of the qualitative focus and nature of analysis. All the transcripts were read through to get a holistic understanding for the data and voices of the participants. Taking the first student interview, I read through and made notes and comments in the margin next to data that appeared potentially relevant or important to my study. These were read again and coded with highlighter and coloured stick-it notes, marking central concepts and statements and making notes. My coding scheme was a personalized filing system which was intended to help me develop insights and generate theoretical understandings, not to prove hypotheses with frequency counts. Grouping the notes and comments that seemed to go together gave me an initial list of themes to consider. I then processed the next interview in the same way, keeping in mind the original list. This second list was then compared to the first one, and merged into a master list of concepts derived from both sets of data. This master list was a primitive outline of the recurring regularities or patterns in my study, which became the categories or themes into which subsequent items were sorted. I also summarised data on a spreadsheet under specific headings, trying always to keep in mind that the codes fit the data, and not vice versa. These categories evolved and changed as I read and re-read through each transcript and related field notes.

Flick (2006) describes how global analysis, as a form of editing texts before their actual interpretation, is helpful in deciding whether it is worth choosing one interview over another for detailed interpretation, if resources such as time are limited. After performing a global analysis of all the interviews, I decided to focus on five of the girls interviewed for the presentation of personal narratives that highlight students' potentially different experiences and perceptions. The participants, Andrea, Helen, Sandra, Sheryl and Monica were selected for their variations in response and reasons why they chose different things. These students were selected not just because they came from different schools, but because of themselves, the nature of what they were talking about and what their voices reveal (Chapter 5). Merriam (1998) writes that in a multiple case study, there are two stages of analysis; the within-case analysis and the cross-case analysis. Each of the ten selected embedded or additional cases were analysed as a within-case unit before the cross-case analysis was undertaken (Chapter 6). They were analysed for recurring themes and concepts. Interview transcripts from the five girls who aren't the focus of the narratives were coded and analysed, to determine if any new concepts were revealed, and to add value to themes and concepts that emerged in the detailed analysis of the transcripts for the five girls selected as the narrative focus.

The questionnaires were analysed in a more quantitative manner, in that numbers of responses to the multi-choice questions were recorded and summarized on a spreadsheet. Responses from the three different classes were recorded separately and then totalled. The responses were grouped into the categories as explained in Appendix C, and results of the positively and negatively worded questions in each section were investigated and discussed.

Hopwood (2004) notes that it should be recognized that data from any one method is unlikely to be exhaustive, but that concepts or themes arising in one case but not another does not necessarily imply inconsistency on the part of the participants. The data was interpreted with reference to the research questions and presented in the form of a rich, thick narrative.

Trustworthiness and credibility

The trustworthiness and credibility of qualitative inquiry depends on rigorous methods, the credibility of the researcher and a philosophical belief in the value of qualitative inquiry (Patton, 2001). Credibility through rigour entails having strategies for enhancing the quality of data collected and of analysis. Triangulation is a methodological strategy for enhancing the quality of data collected. In my study I used both the triangulation of methods as well as the triangulation of data sources (Patton, 2001). Triangulation of methods involved comparing and integrating data collected through the multiple qualitative methods of mind maps and interviews and the quantitative method of the questionnaire. Triangulation of data sources involves multiple sources (participants) and checking the consistency of different data sources (the selected participants) within the same method (for example, the semi-structured interview). Triangulation does not mean however, that different data sources are expected to yield essentially the same results, but rather to test for the consistency of results. Dependability of the results is achieved by maintaining an audit trail of all data documentation (transcripts of interviews, questionnaire and mind map returns), coding schemes, decisions made in the analysis. The credibility of the researcher involves reporting any personal and professional information that may have affected the data collection, analysis and interpretation. I have given some of my background (in Chapter 1) and give some reflections on methodological decisions in the next section.

Reflection

In the course of the research, I have had to amend my initial definition of a computer specialist course to include any subject that has computers and computer software as the main resource for instruction. This therefore includes courses teaching applications as well as graphics, multimedia, programming and hardware. Over the three years of data gathering and analysis, there have been developments and changes in the use of some of the technologies. Cell phones, for example, have increased in capabilities, and have become commonplace amongst students. In the survey I refer to high technology/computer courses and in the interviews to computer specialist courses. This

may have created confusion for the students who may have interpreted the high technology/computer courses as the programming or hardware ones, and the computer specialist courses as the applications or multimedia ones. However there was sufficient time lag between the survey and interviews for this terminology not to cause too much bias or confusion.

Initially, I intended having focus group discussions with the selected female students, as well as individual interviews, so that perhaps ideas not originally thought of would be 'discovered' by social interaction and peer discussion. I made the decision not to include group discussions, as there was triangulation from different methods, and variety across different schools without having group interviews. There were also logistical and time issues which prevented me from having this method of data collection.

I also hoped to have interviews and group discussions with Year 9 female students from the same schools, to give supporting background data. I decided against interviewing Year 9 students as a) there was not enough time, b) they are a different age group and c) they are at a different technological stage from the Year 13 students. Technology is changing so rapidly that the current Year 9 students are in a different technology space from where the Year 13 students were five years ago. However, I think there is scope for a longitudinal research project to follow a cohort of girls from Year 9 and interview them at two year intervals to discover if and how their perceptions and ideas of computing may or may not change as they move up through the secondary school system, and are subjected to a fast changing technological scene as well.

I am aware that the students I have interviewed are self selected, and that most have already shown an interest by making the choice of taking a computer course at senior secondary level. The class cases comprise specialist IT classes. However, I have included participants that are not especially enthusiastic about IT as embedded cases, even though they haven't taken a specialist IT course, to provide balance in case selection. My research is focused not so much on what girls have learnt about computers, as to what has

influenced specific groups in their choices about specialist computer classes and who may or may not pursue this interest in the future.

For various reasons, I have taken three years doing this research part-time. This is a mixed blessing. An advantage is that I have had time to learn and process various concepts, and can see in my own thinking how I have built up meanings and learnt research skills, consolidating my philosophical stance of social constructivism. In the next two chapters I present the data and the analysis of the data.

Chapter 4: Survey results, analysis/synthesis

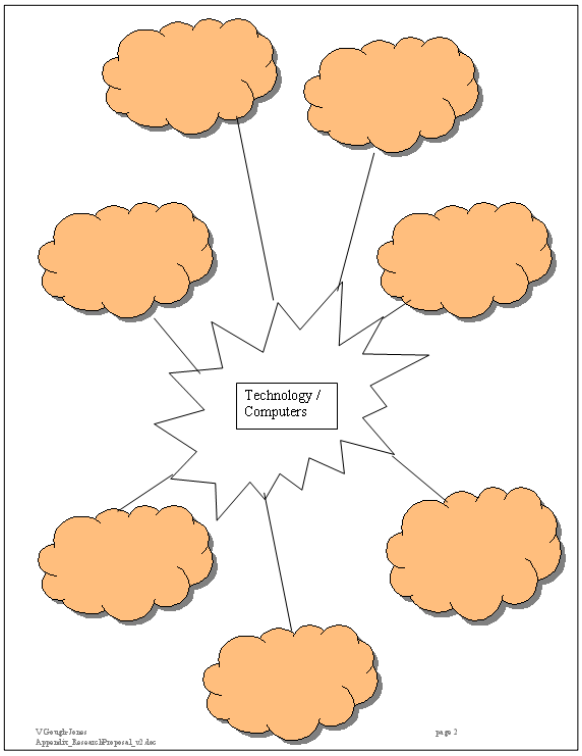
Introduction

Each of the students in the collective case study was surveyed using a 'brainstorming mind map' and a questionnaire eliciting information on their ideas and concepts relating to computers, as explained in the previous chapter. The cross case analysis of the data from these two methods provided an overview and highlighted issues and questions that could be explored in more detail in the interviews. The brevity of the responses in the data presented in the following sections limits the ability to interpret student responses for depth and complexity of meaning, but is useful in providing a context to the students interviewed.

Concept map

Maykut and Morehouse (1994) write that out of a process of inductive reasoning, what is important to analyse emerges from the data itself. The first part of the survey was a 'brainstorming mind map' (see Appendix A). Figure 1 is the blank map given to students with the instructions: "What ideas or thoughts or feelings come to mind when you hear the phrase: 'Technology/Computers'? Write down your thoughts and/or ideas and/or feelings in the bubble/clouds on the map. You can add more bubbles if you wish."

Figure 1: Blank mind map issued to students



The process of category construction, as explained in literature (Flick, 2006; Maykut & Morehouse, 1994; Merriam, 1998), was followed to analyse the data. In the first step of my analysis, I read through all the responses to get a holistic appreciation for what was being said. Examples of responses from four students (Appendix B) give some idea of the variety and range of responses. Neuman (2006) explains that qualitative data are in the form of words, which "are relatively imprecise, diffuse and context-based, and can have more than one meaning" (page 459). What I found interesting in the responses from the students was the variety of words, thoughts and ideas written down. It made me realise how complex an apparently simple topic and task can be, and made the analysing into categories quite challenging.

Each bubble containing a word or phrase was regarded as a unit of data. These units were then categorised based on look/feel-alike criteria. This data was then summarised into a table (Table 3). The word in the first column is an actual word that occurred, or an encompassing word – by my interpretation. ICT (x4) means that the word ICT appeared four times in the group surveyed. A few comments appear in more than one category – as they seemed to fit in both.

Table 3: Summary of data from mind maps

Encompassing Word	*Student Responses*
Environment	Sitting on a chair; office, desk top
Positive	Fun (x5); excitement (x2); videos; neat; great; fill with wonder; marvellous; enjoyable; software – useful and fun kinda; curious; million dollar home page
Negative	Fear; people with no lives; nerds; we rely on them; nerdy; boring
Effort	Hard work (x2); complicated (x2); difficult (x2)
Equipment	Computer screens; iPods (x3); hard drive; floppy disk; RAM; technical names; cell phone (x5); laptop (x3); models of computers; cd's; CD/DVD burner (x2); hardware (x3); smaller, faster, better; DVD player; machines; gadgets; newest models; software for products eg digital camera; MP3's
Developments	Future (x7); research (x3); discovering new things; improvements in technology; economic growth; business management; artificial intelligence; developments; new updates; modern technology (x2); new technology invented every day; newest models; help businesses; advanced; the latest
Typing (x6)	
ICT (x4)	
Subjects	Technical; maths (x2); science
Creative (x2)	Creating things; fresh new ideas; animation (x2); advertising; web design – fun, useful, helpful
Documents	
Internet (x12)	Google (x2); MySpace; TradeMe; Google - very useful and user friendly; Internet - great range of information
School	Projects (x2)
Files (x2)	
Programs (x2)	Software (x3); software that actually works; software – useful and fun kinda; Publisher, Word, spreadsheet, Access (x3); Microsoft; design; graphics; Microsoft word; software for products eg digital camera
Time (x3)	
Learning (x2)	
Information	Information management; Internet is great range of information
Investigations	Technology practice – the unit we did on cars
Design (x3)	Design skills; advertising; graphic designs; poster designs; web design – fun, useful, helpful; presentation
Use	Used everywhere – in every job – required skill; useful; a convenient tool for everyday life; useful (x22); helpful; important; everything we do; global; computer careers; used for everyday use; we rely on them; email is useful for correspondence;
Communications	MySpace; email (x4); allow quick communication; cell phones (see equipment); media; online friends around the globe; hotmail – useful for correspondence; MSN;
Entertainment	Videos; CDs; 3D or 2D games; games (x2); MP3 players (x2); music; matrix movies; PlayStation/Xbox,
Miscellaneous	Fast-paced; updating; short-sighted; interesting (x5); professional; smart (x2); convenience; excelling your standards; smaller, faster, better; nano; Microsoft vs Macintosh; virus (x2); intelligence; hackers; slow/fast; advanced; challenging; sometimes unreliable
Programming	Program writing
Problem-solving	
Mental exercise	
Robots	A I ; system control; media

I then read through these preliminary categories to try and combine them into bigger encompassing groups, by determining common properties or characteristics. My first effort was to group the data under the headings of Computers (including hardware and software), Use in Home and School, Social Use and Perceptions, and Beyond Home and School. However, on subsequent readings, I used the categories of Computer Technology, Computer Use, Computer Perceptions and Computers in Society. It was helpful to develop a *rule of inclusion* for each category (Maykut & Morehouse, 1994).

Computer Technology: Students identify ICT equipment and devices, as well as programs/software available in ICT.

Computer Use: Students are associating computer/technology with the use of ICT in home, school, workplace and entertainment.

Computer Perceptions: Words and phrases indicate a perception of, attitudes towards, and experience of using ICT (I like/don't like ICT).

Computers in Society: Students associate technology/computers with their perceptions of its impact on the wider society.

These categories also fit well with the definition of technology as discussed in Chapter 2. The data from the mind maps is summarised under these categories in Figures 2, 3, 4 and 5. Each word or phrase appeared in a bubble in the response from the students. Some of the responses appear in more than one category – as they seemed to fit in both. These items are indicated with an asterisk. Note that the grouping in the bubbles in the categories is my interpretation, and I realise that there may be some overlap.

The responses in the **Computer Technology** grouping indicate students could identify basic items of computer equipment, as well as the more popular general use software programs. These could be what they use the most and may therefore be an immediate association with the computer/technology phrase. Although there was no mention of more technical hardware, or more sophisticated software such as a programming

Figure 2: Computer Technology

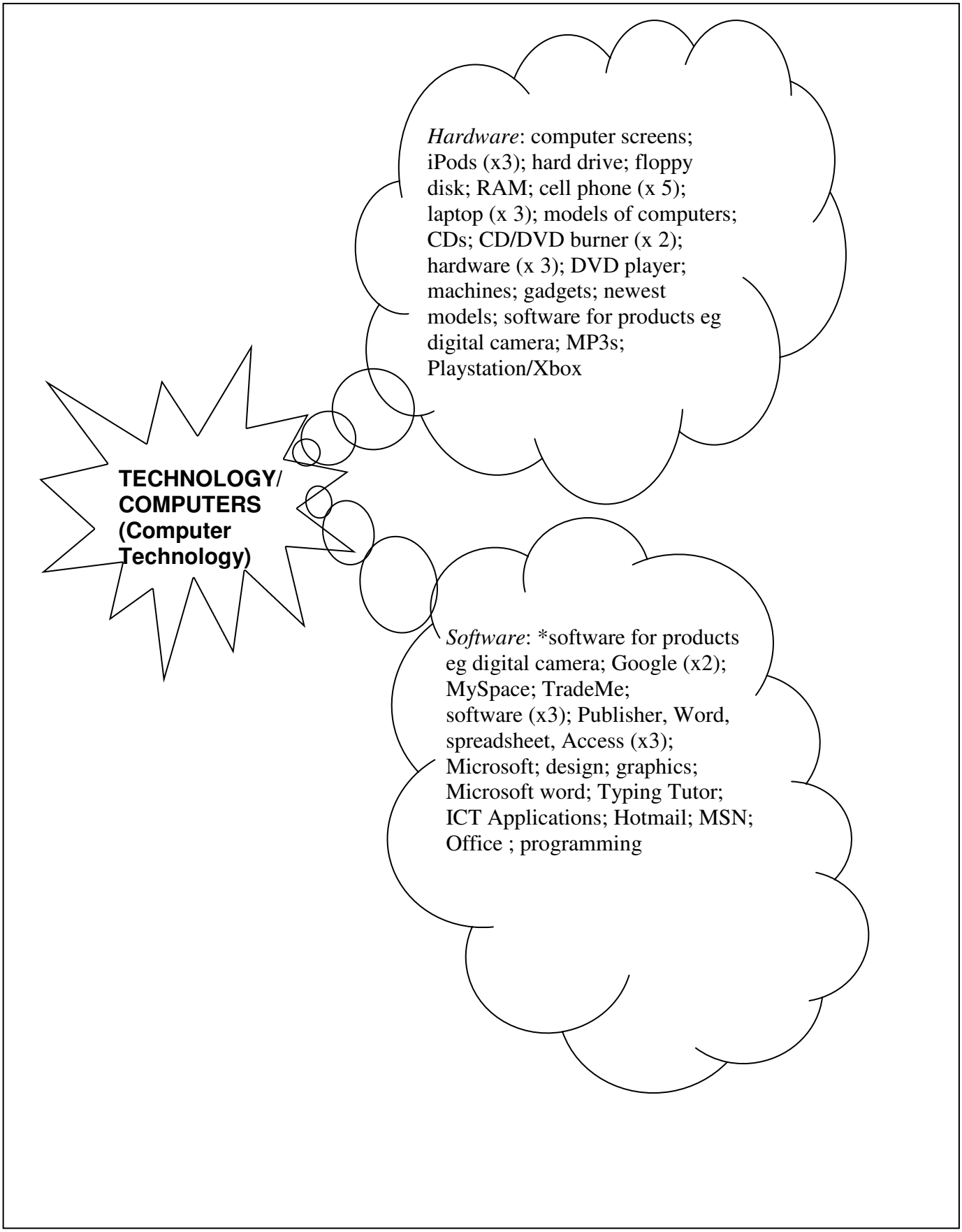


Figure 3: Computer Use

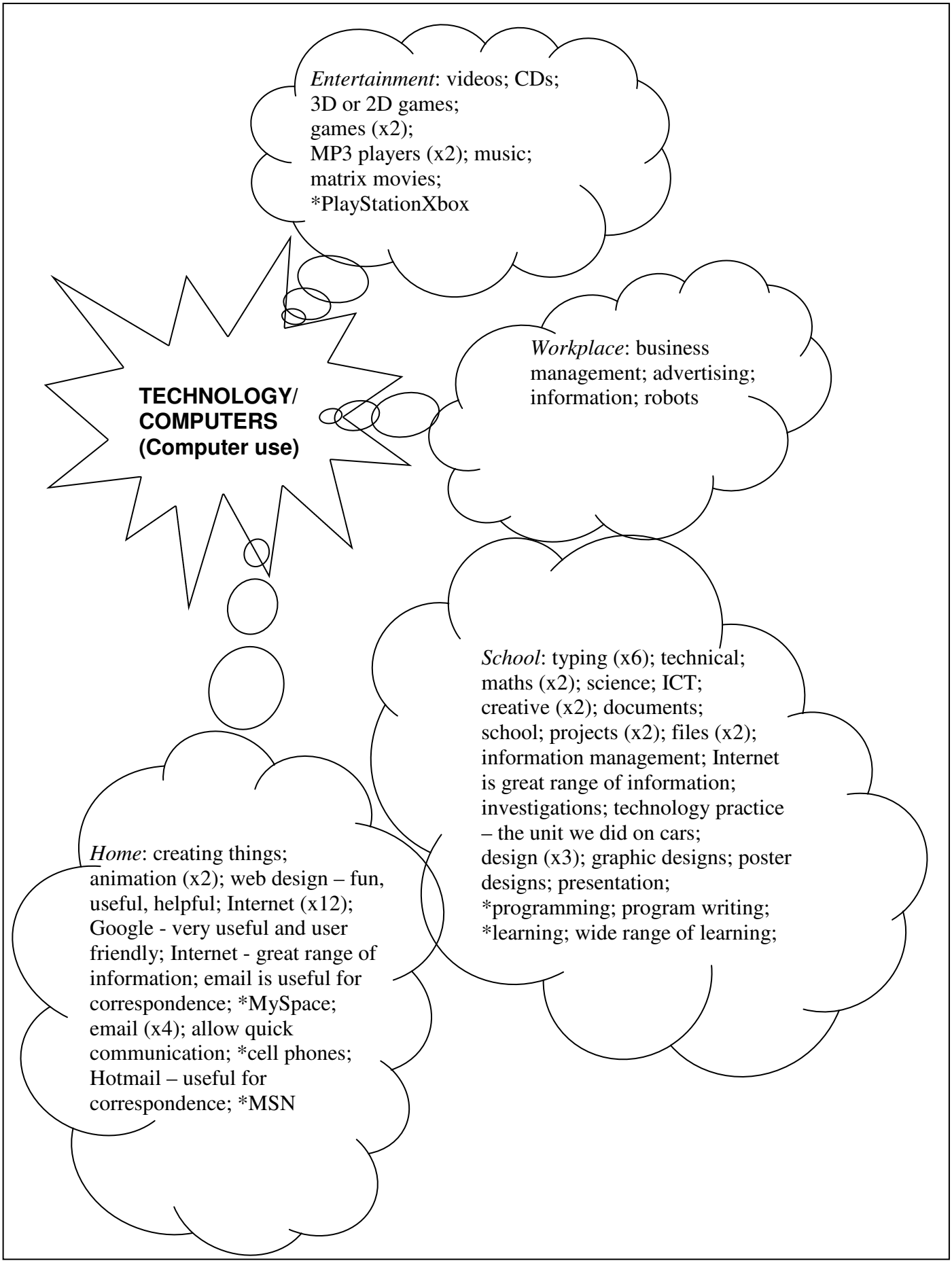


Figure 4: Computer Perceptions

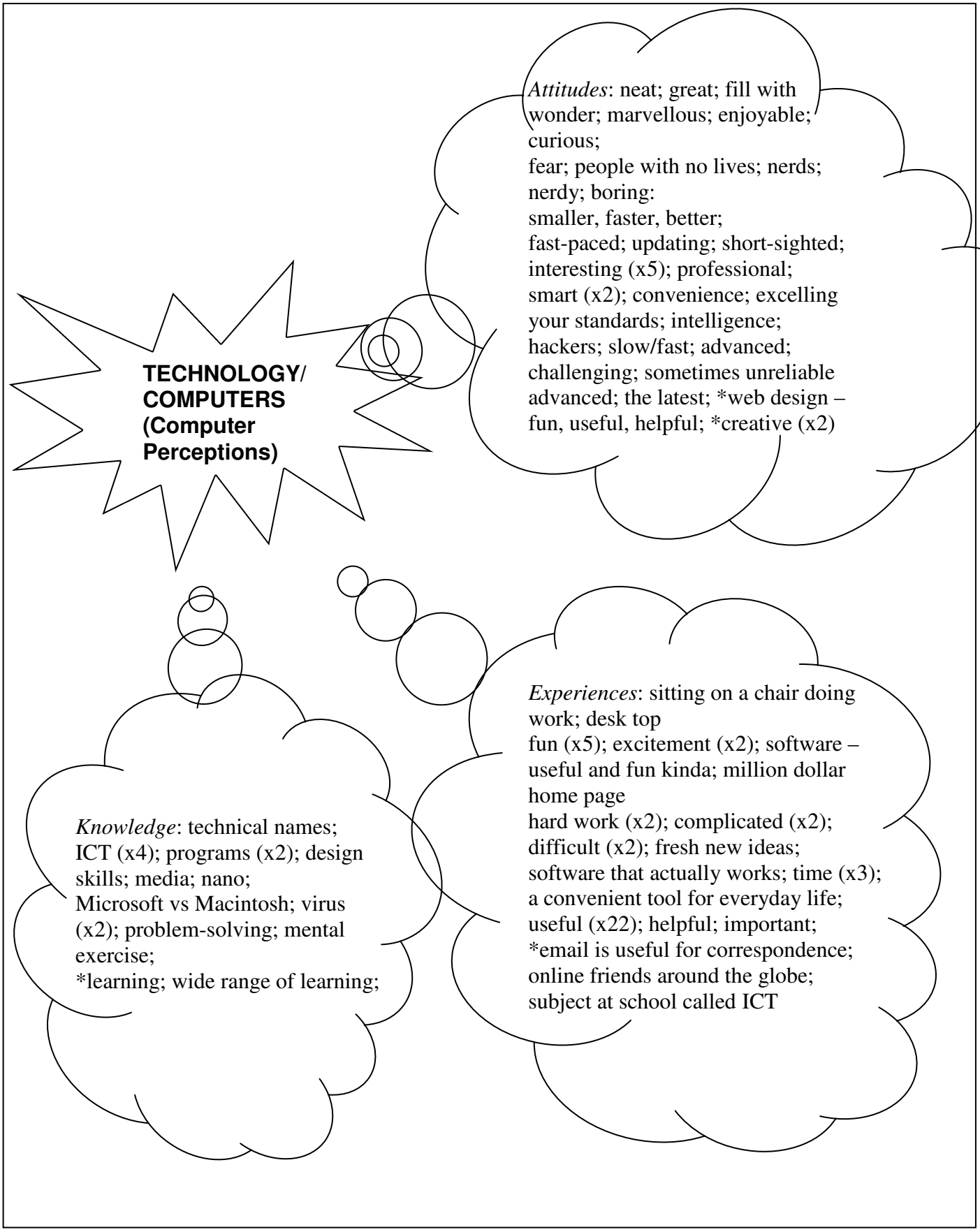
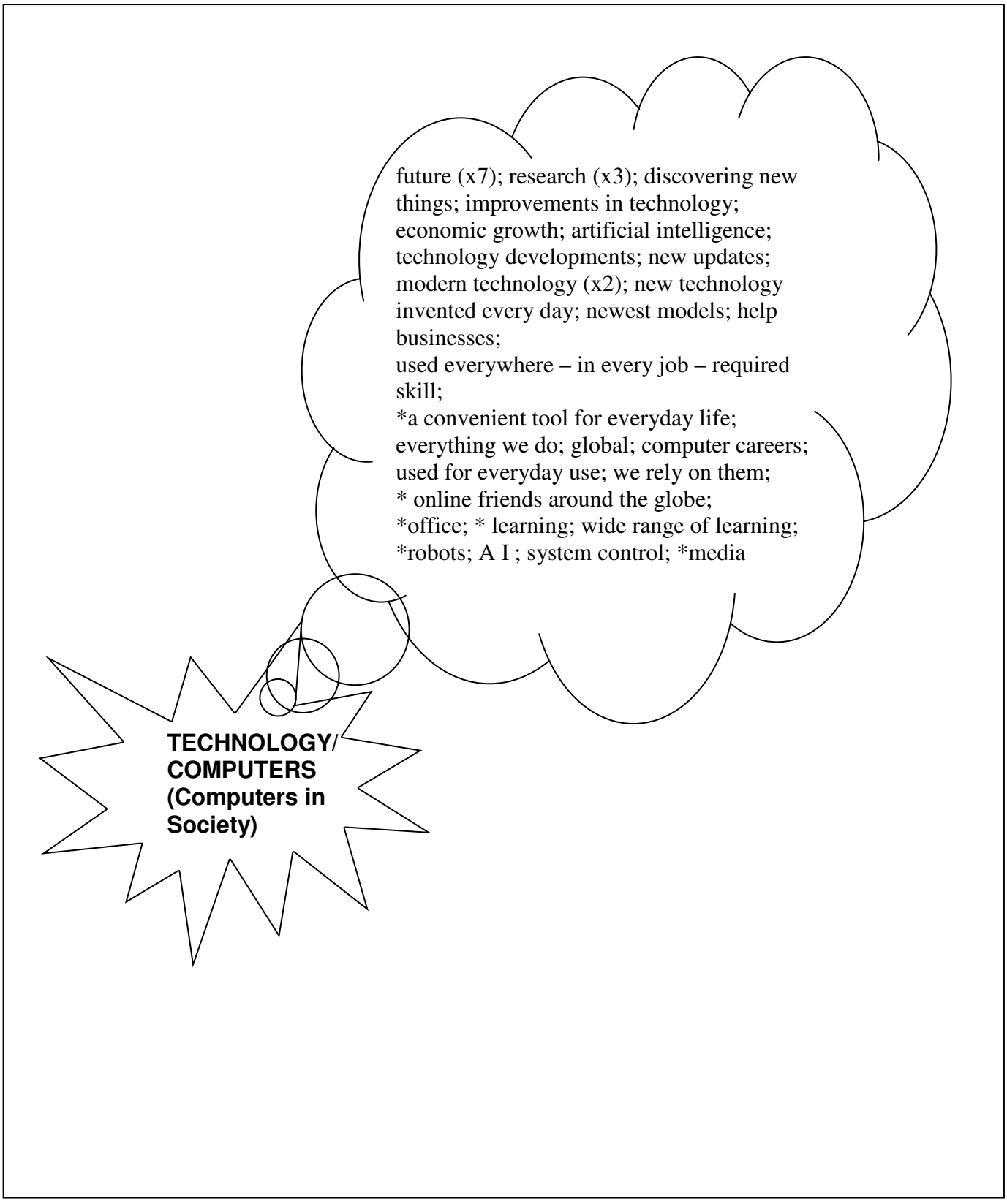


Figure 5: Computers in Society



language, this could indicate a variety of things such as lack of knowledge or interest among the students.

The responses in the **Computer Use** grouping have been divided into the possible areas of home, school, workplace and entertainment. There appears to be a widespread association of the word technology/computers with communications and entertainment. This could reflect the importance of relationships, people and socialising to these female students or something else. There was a noticeable response to using the Internet (x12) and Internet related programs such as email (x4) TradeMe, MySpace and Google. The mention of cell phones (x5), MP3 players, computer games (x2) and Playstation/Xbox suggest an awareness and familiarity of these tools among the girls. A number of responses appear to relate to school work, which would be understandable given that the participants are still at school. The response of ICT (x4) and Typing (x6) and the software mentioned in the **Computer Use** grouping, could reflect the terminology and content of courses taught at school. There appeared to be little response to the use of computers in the workplace. The large number of responses overall to the use of the computer may suggest that these students have no problem in using the computer and software or may reflect the fact that they are in a computer specialist course. From the holistic overview, there is an impression of computers used at home as a tool as a matter of course, and computers used at school, to learn specific skills such as typing and design.

The responses to the grouping of **Computer Perceptions** seem to suggest that these students find computers very useful (x22), and fun (x5) to use. There was a sense of the computer giving the students the freedom to use it as a tool for creation – be it a document, animation, web design or email. Responses appeared to suggest a positive attitude "marvellous, enjoyable, interesting (x5), smart (x2)". A small number mentioned that they were "difficult", and conjured up the idea of "people with no lives". Responses indicating an experience of ICT seemed to be honest and reflected a range of experiences: "hard work (x2); complicated (x2); difficult (x2); fresh new ideas; time (x3)". The overall impression though, was that there was no major problem in using the technology. When

some of these responses were considered together with the responses from **Computers in Society**, there was a suggestion of a sense of vibrancy, of the latest *in thing*; "neat, great, filled with wonder, modern technology, newest models, faster, better, the latest, new technology invented every day." The responses to the grouping **Computers in Society** indicated that students appeared to be aware of technological developments beyond school and home. There was acknowledgment of the widespread use of computers in "everything we do". They mentioned that computers would be used in many jobs, and would be important in the future (x7), and in research (x3) but did not appear to see computers/technology as a career in itself (only one response of computer career). Students can see computers as "a required skill, used everywhere – in every job; a convenient tool for everyday life; helpful; important; used for everyday use". This suggests that they can see value in everyone being able to use the computer for basic communication using word processing and documents, and email communication, but they did not respond with ICT as a job in itself.

There was one mention of program writing from a student in the Class Case C but no mention of any programming languages, or of computer hardware beyond the screen, hard drive and RAM. This could be interpreted as the girls having no or little knowledge of these topics, little exposure to them, or having knowledge but just not having an interest in them. There is also mention of web design, animation and design skills (x3). I am aware that these students were in classes where the computer was essential to the learning, so that in terms of my definition, they were in a computer specialist course. However the content of the courses differed across the class cases (see Chapter 3) which may have influenced their responses. All the responses of 'ICT' and 'typing' came from Class Case B; the hardware and software responses came mostly from Class Case C; nine of the 12 'Internet' responses came from Class Case A. This seems to indicate that the perceptions of girls on computing as a subject at school may be shaped by the content of courses offered at the schools.

Having discussed some of the things that come to students' minds when they think of Technology/Computers, but really having limited power from the 'brainstorming mind map' to explain why these things come to mind, I will now discuss the questionnaires which give more detail and insight into what the female students are thinking about computers.

Questionnaire

Data from the questionnaires of 49 female students across the three class cases was analysed. Appendix D gives the results for each of the class cases collated in a spreadsheet. The results for the totals across the class cases have been collated in a spreadsheet and are given in Tables 4 - 11. The survey attempted to determine Computer-Related Attitudes and Future Intentions.

Under the topic 'Perceptions of Support Items', there were questions relating to teacher support and parent/caregiver support (see Appendix C for the structure of the questionnaire).

Table 4: Perceptions of support items: Teacher support

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
2. My teachers think I'm the kind of person who could do well in high technology/computers.	4	4	23	9	9
10. My high technology/computer teachers have been interested in my progress in high technology/computers.	3	8	25	9	4
* 19. Getting a high technology/computer teacher to take me seriously has usually been a problem.	10	15	17	7	0
23. High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.	0	7	21	14	7
*29. My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.	14	13	13	7	2
*33. When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.	12	18	17	1	1

For teacher support, between 27% and 51% neither agreed nor disagreed with each of the statements. Forty three percent of students agreed that technology computer teachers made them feel they have the ability to study further in technology/computers, and only 4% (2 students) felt they had been ignored when talking seriously to their technology/computer teachers. The negatively and positively worded questions yielded much the same results, supporting the validity of the data. From these results, it would

appear that girls already in computer specialist courses feel encouraged rather than discouraged by their teachers to continue with further computer/technology related courses.

Table 5: Perceptions of support items: Parent/Caregiver support

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
6. My parent/caregiver has always been interested in my progress in high technology/computers.	2	11	15	12	9
15. My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.	2	2	21	16	8
* 17. My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.	14	11	14	9	1
*27. My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.	19	18	11	0	1
*36. My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.	22	17	8	2	0
39. My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.	2	10	24	10	3

For parent/caregiver support, only one-third or less of the students indicated a lack of support or interest from the parent/caregiver. Seventy six percent of the students disagreed that they would not be encouraged to plan a career which involves technology/computers, and 80% disagreed that their parent/caregiver thought computers/technology was a waste of time for them. I realise that the respondents are in computer specialist courses, and have possibly been encouraged by someone at some time to take these courses. Certainly those in the specialist classes who were surveyed report generally positive attitudes to their participation from parent/caregivers. There were only 8% (4 students) who disagreed that their parent/caregiver thought they could do well in technology/computers. Only one student thought they would not be encouraged to plan a career using ICT. The high percentages indicating that good computer skills are well regarded by parent/caregivers seem to suggest that parent/caregivers support is not an inhibiting factor for girls to take computer specialist courses and may be an encouraging factor. However there were 27% for and 24% against in the statement that their parent/caregiver thinks computers/technology is one of the most important subjects they have studied. This is interesting in that the students think that their parents/caregivers do not regard technology/computers as a waste of time, but that individual students may or

may not feel any pressure to take the subject based on parental expectation. It should be noted that the students from the Computer Science class (Class Case C) had 0% of students thinking that their parents/caregivers thought computers were a waste of time and would not encourage the students to plan a career in high technology/computers.

Under the topic 'Computer-Related Attitudes Items', there were questions relating to Confidence, Intrinsic Value, Usefulness and Gender Stereotyping.

Table 6: Computer-related attitudes items: Confidence

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
3. I am sure I could do advanced work in high technology/computers.	1	6	20	15	7
20. I think that I could handle more difficult high technology/computer courses.	3	9	20	11	6
*28. I'm no good in high technology/computers.	13	17	15	4	0
*30. I'm not the type to do well in high technology/computers.	12	16	12	8	1

For the questions on confidence, 45% thought they could do advanced work in high technology/computers, and 35% thought they could do more difficult high/technology courses. In both cases there were 41% who neither agreed nor disagreed. This seems to indicate that there is confidence among girls for being able to do the high technology/computer specialist courses, but there are also a number who were unsure about their competence or suitability. Only 8% (4 students) agreed that they were no good in high/technology computers. This appears to indicate a strong self esteem in ability for these courses, keeping in mind that the respondents were students who had selected an ICT course. Nine students (18%) did not see themselves as the 'type' to do well in high/technology computers, which is interesting given that they have chosen to take a specialist IT course and may suggest that stereo-typing is not necessarily an inhibiting factor in girls choosing to take specialist computer courses. Or, these girls may represent enthusiasts who are more likely to challenge the stereotype. There did not appear to be any significant difference between the three class cases.

Table 7: Computer-related attitudes items: Intrinsic value

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
*5. Figuring out high technology/computer problems does not appeal to me. .	9	9	15	13	3
14. I like high technology/computer problems.	4	8	14	14	9
*34. High technology/computer problems are boring.	9	14	11	12	3
38. High technology/computers are enjoyable and stimulating to me.	1	5	16	18	9
8. Figuring out multimedia/computer problems does not appeal to me. .	11	15	13	9	1
*21. Multimedia/computers are enjoyable and stimulating to me.	0	2	11	26	10

For the questions on intrinsic value 47% agreed that they liked high technology/computer problems, and only 12% (6 students) disagreed with the statement high technology/computers are enjoyable and stimulating. Less than 33% were undecided in this section, which suggests a more definite commitment one way or the other. Seventy three percent agreed that multimedia/computers are enjoyable and stimulating. It was interesting to note that 90% of the students in the Computer Science class (Class Case C), who will have covered a topic on multimedia, found it enjoyable and stimulating. This raises the question: if schools offered a computer specialist course which included multimedia, would more girls be encouraged into this ICT course?

Table 8: Computer-related attitudes items: Usefulness

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
9. I'll need high technology/computers for my future work.	0	2	14	21	12
* 11. Taking high technology/computers is a waste of time.	27	16	4	1	1
35. I will use high technology/computers in many ways as an adult.	0	2	8	26	13
*40. High technology/computers are of no relevance to my life.	24	16	7	2	0
*13. I'll need multimedia/computers for my future work.	1	6	13	19	10
41. Multimedia/computers are of no relevance to my life.	24	16	9	1	0

For the questions on the usefulness of the computer, 100% of the students in the co-educational school (Class Case B and Class Case C) disagreed that it was a waste of time, and only 8% (4 students) were undecided at the all girls' school. It must be remembered that the students surveyed were in ICT specialist courses, and so would have had experience of in-depth computer use. One student who thought computers were a waste of time and would not be used for her future work, disagreed that computers would have no relevance in her life. Another student who somewhat agreed that taking high technology computers is a waste of time, still somewhat agreed that she would need computers for her future work. Sixty seven percent of the group thought they would need

high technology/computers in their future work, and 82% saw high technology/computers as having relevance in their lives and would be used in many ways as an adult. This is interesting that computers are regarded as very relevant, but not necessarily for work. This may reflect the difference between who likes computers and what they could be used for, and who likes computers at school. What students perceive as the uses for the computer may be indicated in their responses to the mind map (see page 47). Perhaps the perception of how the computer is used could be a factor in the choice of computer specialist courses, as the courses may not relate to the prior experience of the girls.

Table 9: Computer-related attitudes items: Gender stereotyping

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
7. Studying high technology/computers is just as appropriate for women as for men.	1	0	4	6	38
*16. Writing computer programs is for men; using computer applications, such as word processing, is for women.	31	10	6	1	1
26. Women certainly are logical enough to do well in high technology/computers.	0	0	6	12	31
*32. It's hard to believe a female could be a genius in high technology/computers.	35	9	5	0	0

For the questions on gender stereo-typing, less than 12% were undecided, and 80% thought that high technology/computers was just as appropriate for women as for men. Eighty eight percent thought that women are logical enough to do well in high technology/computers. It was interesting that 84% disagreed with the statement that writing computer programs is for men, and using computer applications such as word processing is for women. This may illustrate a difference between their ideals and principled response, and what they choose to do or experience in reality, a phenomenon discussed by Abbiss (2005b). It could be that girls regard themselves as being able to write the computer programs, but choose not to. There was 100% disagreement that women could not be geniuses in ICT and 100% agreement that they are logical enough to do well in high technology/computers. It could also be that there is a strong aversion to any stereo-typing that appears to put women at an inferior level to men.

Under the topic **Future Intentions Items**, there were questions relating to Future Academic Intentions and Future Occupational Intentions.

Table 10: Future intentions items: Future academic intentions

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
1. I will definitely be taking more courses in high technology/computers.	2	2	13	20	12
*18. I won't be taking any more courses in high technology/computers.	16	14	15	3	1
*22. My future academic plans do not include any high technology/computers.	13	15	16	5	0
37. High technology/computers is a subject I will continue to take after I finish high school.	2	7	18	14	8
25. I will definitely be taking more courses in multimedia/computers.	1	5	19	16	8
*31. I won't be taking any more courses in multimedia/computers.	14	19	13	2	1

For the questions on future academic intentions between 27% and 39% were undecided. Sixty five percent would definitely be taking more courses in high technology computers. There was good re-enforcement between the negatively and positively worded questions, showing a high degree of survey validity. It was interesting that the group from the co-educational school in the TIM class (Class Case B) had 77% responding they would definitely be taking more courses in high technology/computers. This may reflect on the teacher they had, or on their confidence to continue with this subject as they perceive it to be, or maybe something else. Forty five percent indicated that high technology/computers is a subject they would take after school, while 37% were undecided. Fifty seven percent disagreed with the statement that their future academic plans did not include any high technology/computers, and 61% disagreed with the statement that they would not be taking any more courses in high technology/computers. This seems to indicate that there is the intention for further study in this field, and a perception of the relevance of computers in other fields of study.

Table 11: Future intentions items: Future occupational intentions

	Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree
*4. I am not interested in pursuing a career in high technology/computers.	8	14	16	11	0
* 12. I am not seriously considering the possibility of pursuing a career in high technology/computers.	6	12	13	17	1
24. I am seriously considering the possibility of pursuing a career in high technology / computers.	2	11	24	10	5
42. If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.	0	7	19	14	8

For the questions on future occupational intentions, 45% indicated they were interested in a career in high technology/computers, with 33% undecided. However 31% were seriously considering a career in high technology/computers with 49% undecided. Only 14% (7 students) would not have high technology/computers in a list of potential careers. This may suggest that girls who are already in ICT classes are more likely to follow a career in ICT; to some extent they have already made a choice to study computing in some form. What are the factors that encourage them to choose specialist computer classes in the first place? By analyzing the interview data as described in the next chapter, and listening to the student voices, more may be learnt about their perceptions of ICT and the implications for teachers and schools.

Chapter 5: Data analysis: individual cases

Introduction

As discussed in Chapter 4, the data from the survey has set the scene and illuminated some perceptions that girls have about computing. The face-to-face interviews which followed gave the opportunity to explore ideas in more depth and detail and generate more themes and issues; this iterative process is a feature of qualitative research. Although a global analysis of all 10 interviews was undertaken, five individual cases form the focus of this chapter. The reader is given an opportunity to hear the voices of the five girls through the descriptive narrative summaries of their experiences of computers. In this descriptive narrative I include a brief background of the girls, some of their interests and experiences that may have led to their current perceptions of ICT as well as some of my initial analytical thoughts and questions raised by the girls' accounts. The participants, Andrea, Helen, Sandra, Sheryl and Monica were selected for their variations in response, reasons for choices, and differences in class contexts. The summary of the interviews from the five selected students provides a 'within-case' analysis to focus in depth on specific experiences that underpin and shape their perceptions and understandings about computers and computer courses before the cross-case analysis to highlight a range of experiences and responses is undertaken in Chapter 6.

Voices of the girls

Andrea

Andrea is a Year 13 student at a large co-educational secondary school in New Zealand. She was interviewed in the first term of Year 13 at school.

She has had access to a computer at home for as long as she can remember. Currently she and her younger brother share a laptop. In the context of her home use, she acknowledges her brother's superior knowledge about computers as "*he doesn't say he knows a whole lot but anything that goes wrong with our computer he tends to fix and things like that – he just seems to know his way around the computer very well*." She is a confident user of "*general programs*

like Word and Excel sometimes and like MSN, Hotmail sort of thing and I can do the search engines on the Internet."

She took the ICT course in junior secondary as she could see relevance in knowing the basic office applications and a need for keyboarding skills to do school essays. Although she has not taken any further courses in ICT, she admits that there could be word processing skills that could be useful, but did not know what they were, and implied she was not really interested. This may indicate that personal interest is a factor in her not taking specialist courses.

Her understanding of a specialist computer course is:

> *… basically being taught everything that if what went wrong on your computer hard drives and things like that, basically what happens when you delete something and how to find it again … like everything to do with how you can set up a Website … I guess for some people it would be a game. Just how to set up things on the computer and like make your own files and things like that.*

These comments reflected the content of the Year 13 computer course for the previous year, although additional new courses were being offered at this school. Andrea said none of them interested her apart from the one that had robots, as she thought they might be pertinent to her interest in taking clinical psychology after school. However, she decided against taking the robot course at school, saying the programming would be "*too hard*."

Her main interests and activities outside school revolved around sport (hockey, soccer, swimming, and cricket) and volunteer work, both as a life-saver and at Trade Aid, indicating a practical person with a strong social conscience and broad interests outside of computers.

When asked what she thought ICT meant, her response was "*Just typing, like learning how to type, touch type on the computer and probably making posters or something on Word*." This appears to reflect a lack of knowledge about ICT in the wider computer industry. When asked her understanding of the term IT industry, she thought it meant movie making,

animation and design on the computer. This could be peer influence as she mentioned her friend was considering the new Multimedia course at the school. It is interesting that although Andrea's brother appeared to have in-depth computer knowledge of the hardware functions of the computer, Andrea did not associate this with the IT industry. She had no idea what electro technology or computer science meant. For her, information systems was using search engines on the Internet, to find out information about a topic. Applied computing meant:

> *… basically applying it to what you do in other parts of your life, like other aspects of your life like say you do something to do with forestry and outdoors and stuff like that and you will need to do something, work something out statistics or something, you would apply computer skills to that, to make it your report and like understandable and simplified for other people who need to analyze it and things like that.*

Andrea felt that if girls could be shown how computers could be applied to what they were interested in, and given guidance as to how such courses would benefit them in the future, they might be more inclined to take a computer course. She was quite definite that the stereotype of a nerd or geek sitting in front of a computer playing war games would not appeal to most girls of her age. Andrea thought that they might be more interested if there was perhaps movie making involved, or really "*whatever their interest is at the time and if they could be shown how they could apply it to their interest*." Andrea explained that she and her peers basically were interested in talking, shopping, socializing and playing sport together: "*… we just do, like, everyday things, yeah, it's more to do with people and like interacting with each other*." It would appear she viewed the computer as isolating her from people, and social interaction was important for her.

When Andrea was asked directly what her perception of specialist computing courses in secondary schools was, her reply was:

> *I think basically the problem with them is that no one knows what they're about, like girls just generally do not know what you do for them and understand anything about them. Like, if anyone came up to me and said 'oh, you should do this computer thing!' I would be like,*

'but what does it involve?' Like how is it going to help me or interest me or how am I going to use it and find it like help me in my future and things like that. Like we know general computer skills are useful, just for basically you need to know how to touch type, you need to know simple things like that, you need to know how to use Word, probably some people need to know how to use Excel, but beyond that girls just don't see why they need it basically, like to me it doesn't seem to relate to what I want to do… and probably that's the same with quite a few of my friends.

Helen

Helen was interviewed in the first term of her Year 12 at school. She attended school up to an intermediate level in China. Her school program was quite comprehensive with six subjects that year, but she gave the impression of being a very able student, and was enjoying the challenge of doing some Year 13 courses while in Year 12.

She was introduced to computers and their use at a very early age, about six, as her father was "*a professional computer person, in database or something*" and left the computer at home when her parents separated. Helen remembers playing on the computer, using it to draw and paint pictures, as if it was a toy. It could be that she saw the computer as a link to her father and possibly an encouraging factor that influenced Helen to get involved with computers was a need to associate with her parent, or it could just be a reflection of the role model of a parent. After her family moved to New Zealand she didn't use the computer much for school work until she decided to take a course at school in Year 12. Helen did not choose to do the ICT course of keyboarding and word processing, as she thought they were too easy, implying a fair amount of knowledge on her part, and discernment as to levels of difficulty in the course. She chose to do the programming course as she thought it would be more challenging.

She still felt that the pace in the programming course was a bit slow for her, but was thoroughly enjoying the current topic of robotics. Although she had not had exposure to this topic before, she was able to transfer knowledge she had gained from previous programs. *"… yeah, but you can kind of like see the connection when he tells you that this is a tool*

pallet – you can just see what everything does." This may indicate that exposure to a variety of programs, could lead to transfer of knowledge, and therefore make the learning easier as well as help students make informed choices about the courses they wish to study. Because Helen had a computer at home, she would 'play' on it. For her, playing on the computer covered everything from computer games, to fixing viruses, using the Internet effectively and teaching herself about Photoshop, Macromedia and "*making little movies and things … using a thing called Edit to do sound, you know like my voice, change your voice to make it sound really cool*." It seemed for Helen that discovery and learning about different software packages by self-motivated experimentation was using the computer for entertainment, rather than work. Perhaps having exposure at an early age to do fun things on the computer gave Helen the confidence to learn more about the computer as she grew older. Growing up in China could be a factor as the gender stereotype of girls and computers may be different in different cultures. It may also be Helen's individual proactive, curious and independent character as she herself admits that she really likes computers and wants to learn more about them.

> *Yeah – I like to use Photoshop and things like that to do, pictures, graphics kind of things. But I like to learn.*
>
> *Well… I just use the program and like, for example if like I'm changing my own voice, I record it into the thing and then I just use the different things to see what comes out, and then I might look up online to see … how they do it and see why they do it and then I try to change something here and do it myself and things like that. And for Photoshop, I just use a picture of my own and then do some changes or something.*

She expressed an interest in learning about how to write games, having already downloaded a program, only to find it wasn't quite what she thought, but decided to learn about 3-D animation anyway. When asked about schoolwork she replied "*I don't have much school work that needs to do on the computer. If I have any, I'll do it on the computer*."

When asked her understanding of a specialist computer course, Helen replied:

Things like what hackers know. Things like – may be it's just how the computer works, like every little part of it. How its components does things and also how the program Windows, for example XP, how it is like designed and all those things in it.

After some thought she acknowledged that the programming course she was doing could be regarded as a specialist course. However, she did not regard the other courses offered at the school as specialist computer courses, in that:

… is more basic for people who don't know computers at all, how to turn on a computer – or maybe not that basic it's just …

I feel that they (the other girls) don't regard computer as really that important. Like in my class right now – there's only about 10 of us, so computer really isn't all that popular with girls I don't think.

Researcher(R): What would you put that down to, Helen? Why do you think that is?

Helen(H): Probably because girls are more interested in make up and things like that. I don't know. But I like computers.

R: Alright, so this is what interests me. Why is it that you were interested, but there are only 10 of you in this whole school for girls that are interested? How do we get more girls interested?

H: Well they probably just don't know how fun a computer can be. They can't really get to know computers very much. I mean, there are some girls who like computers, but they don't have their own computers at home, so they don't have access to it.

Helen then went on to explain that in fact there were three computers at her home, so that each family member had one. Her outside activities included piano, violin, dancing and badminton, which showed that she did not spend all her time on the computer. The terminology that Helen used showed an extensive knowledge that appears to have been gained from the home and self study, rather than from a school environment.

When Helen was asked what came to mind when she heard the term ICT, her response was "*a computer*." Her thoughts on programming were "*You can program all these things like games, maybe antivirus programs for specialists not really for us, but anyway, program all those different things."*

She thought a course on computer hardware would be good for people who were interested in the structure of computers, and although she was reasonably interested in that, she was more interested in the computer programming part. This could be due to her finding that more of a challenge and perhaps thinking it would be easier to learn in a class structured environment than on her own at home. Or it may be that computer programming was more connected to her personal interests and career aspirations.

Her favourite subject was Latin, "*because first I like it because it's one of the first western languages, and if you know Latin then it becomes English, French, you know that - and the other reason is because I can do it well*." When asked what certain terms and words meant, Helen thought IT industry was the developing of computers. Computer science she wasn't sure about. Information systems made her think of databases, and electro technology would be all the things that used electricity, like TV and computers. Applied computing would be the application of computers, where they were used to run some program.

A career in ICT meant being a computer programmer or a system developer. A career in computing had a great range as she thought most things in the future would be done by computers "*… so if you learn computers, there would be many jobs that open for you … the use of computers, how to use it properly*."

Helen then went on to relate a story that was a news item of how a 13 year old boy had taught himself programming, and had hacked into government computers. Helen was not attracted to a career in ICT as she had set her sights on becoming a heart surgeon and saw the computer as more of an interest or hobby activity. However she could see that having extensive knowledge of computers would help her in the highly technical equipment that would be used. She could see value in the high technology/computer courses for a career not necessarily labelled ICT.

H: I think computers will be very useful for a doctor.

R: In what way?

H: In his equipment and things like that, you need computing. Yeah. But mainly I learn computers because I like it – I really like it, and I want to know more about it.

When asked the direct question of what she thought about a specialist computer course, Helen thought it a brilliant idea and that it would be fun to learn. When asked what other girls might think about it, she said:

Other girls might think it's not really a girl's thing.

R: Why do you think that?

H: Oh, I don't know, probably there's a stereotype of people who just think that it's more for boys and things like that. Probably. I mean, some of my friends are quite interested in computers but for a specialist course, they probably wouldn't really go to it because would be more like, more for a professional they might think.

When asked about possible content for specialist computer courses, Helen thought there would be different levels of computing. The difficult level she thought would be like what the young boy who hacked into the system might know, while there would be more basic levels that were a bit easier than what she was currently doing. She commented that it was hard to get everybody together doing the same thing as they were at different levels of computer knowledge and skills. She had taken the graphics course the year before, but had found the computer use very elementary because of her already extensive self taught knowledge of Photoshop. She would like to see more challenging courses offered at school.

Sandra

Sandra was interviewed in the first term of Year 13 at school. She was enjoying her Year 13 subjects though beginning to find some of them challenging. Her comment was that she wasn't very good with theoretical stuff like Chemistry, but found ICT really easy.

Sandra couldn't remember when her interest in computers started, but thought it was in primary school. There was a computer in her classroom and it was almost a treat to have time on the computer to type "*long letters*" and add in pictures. In Intermediate school she had a technology unit for a term where she learnt some basic applications. Having this exposure sparked her interest and she decided to take it as an option in Year 9 at secondary school. She has taken ICT as a subject every year since. At her school ICT content covered all the office application software, and used to be known as TIM. Sandra's perception that a particular course may not suit her could be due to a lack of knowledge about the possible course content. Sandra did not take a multimedia course offered in 2006 as she thought she was not artistic enough, yet she enjoyed the ICT course as she was able to use her creativity to design documents using all the office tools. She knew what the ICT course would contain from previous exposure in earlier years. Although she regarded herself as 'scientific' (in contradiction to not liking chemistry theory), she thought programming would be boring.

> *… one was design (the course title was Multimedia), and, I wasn't really interested in that 'arty' side, because I'm more scientific… one was computer programming, and (laughs) I'm not good at computer programming, just bores the heck out of me.*

Although she had never done any programming before, it appeared she rejected the subject on hearsay from friends. *": umm, a lot of my friends are computer nerds, so they do a lot of that sort of stuff, so, I've heard a lot of the computer 'jargon'… no, it didn't grab me.*" However she really enjoyed the applications course and was challenged by a technology unit in the previous year based on research about cars.

> *… find the most interesting thing about it is probably, designing the documents and putting presentation, putting my thoughts into the presentation and things like that, we had to do an entire process, it's a big process. Took about a term. We had to narrow it down and find a car to specific specifications. We had to go through the entire process of doing a brief and finding out specification and research and, then got to make a pamphlet and everything at the end of*

> *it. It was just using the computer in lots of different ways and using all types of programs and things like that. Yeah, it was cool because you got to use a bit of everything.*

Sandra has a computer at home and is regarded as the expert by her family, being called upon to solve problems from removing viruses to helping her mother learn about using a computer. A friend's father looks after the hardware side of things. Her younger sister is at another local co-educational school, and taking a computer course, but Sandra did not know what it was called or its content. Most of her use of the computer at home was for leisure oriented applications such as email, talking to her friends on MSN, using TradeMe and completing homework assignments when necessary. She had no interest in computer games. Her activities outside school included netball, playing the flute, participating in Rangers and Brownies. She was also working part-time at a rest home, as well as studying an extra course of Chemistry at the local Polytechnic. Her motivation for this additional study was to enable her to do a Bachelor of Nursing.

When asked what the phrase ICT meant to her, Sandra replied "*Basically I'd say it means manipulating documents, and things like that … I usually think about using Excel and Word and Publisher when I think about Information Communication Technology.*" Her understanding of a specialist computer course was one of design/creativity or one of programming or "*then the other one would be, the actual typing documents and things like that*", implying she thought office applications was also a specialist course. Her experiences in the computer class have been positive and she regarded ICT as her best subject "*but that's 'cause I'm reasonably good at it, I've mainly had no trouble with computers. I've always picked it up relatively quickly.*" A sense of achievement and coping well in the computer specialist course appeared to be an encouraging factor for Sandra.

An additional motivation for studying ICT was the perception it would be useful after school.

> *Actually, I know I'm gonna need computers when I leave school, and so having that knowledge – it means if I need to get a job somewhere, temporary, I've got computer skills*

> *that some other people don't have … I'm not sure exactly where I picked it up but I just, picked it up from somewhere that most use computers now.*

An example she quoted was reception work in a doctor's surgery, and using a database with names and addresses, which is perhaps influenced by her interest in the medical field. Even though she acknowledged that "*having some computing skills would be important especially in this day and age when everything is so technology orientated*", she was concerned that people were losing the personal touch in their communication, and she saw this as a down side. This concern is perhaps a reflection of her intention to work in a nursing environment, and a perception from her own observations of the use of technology.

> *… just that every job has got some sort of computer in it. Probably need communication skills - use computers such a lot these days, a lot of things are becoming so impersonal, and people don't have those communication skills with people.*

When asked what would be of value to students leaving school, she rated computer skills high on the list, and thought probably numerical skills, English and communication skills were important. Sandra associated the phrase 'computer science' with programming. Information systems made her think of the Internet. Applied computing she thought was using the computer for applications like spreadsheet and a word processor. Electro technology was using technology with electricity. She cheerfully acknowledged that there was confusion with the terminology "*like half the time you're like 'what do they mean'*?"

Her view of a career in ICT was: "*That would probably be somebody who's doing design on computers or who's done like an ICT certificate and has gone into business, commerce type of thing. Setting up their own business using computers or something like that*." The IT industry Sandra thought was people using computers in a range of different ways. Her examples were a database, or data entry operator, or making of business cards, which appeared to reflect the tasks she had done in her school course. This may suggest that her view of career opportunities available is narrowed by her experiences of computer use at school. However she did include in her ideas of the IT industry people who could fix computers. In her circle of friends, the males who were doing the design (or multimedia) course or the

computer programming course were thinking of engineering as a career. None of her female friends were thinking of becoming engineers, and Sandra was not sure what those in her ICT class intended doing after school.

Sandra's view of computing indicated concern in that she saw specialized courses as isolating people from each other, because they would focus more on the machine and email communication and lose the personal touch.

> *… people tend to rely more on email and things like that, so that they lose that personal contact with people. So people are all like robots, so they're – but it's been a lot better like with processing documents and yeah being able to have availability of information, computers have made a lot of information more available and more manageable.*

When asked directly her perception of computing at school she replied:

> *Well, I think it's a good thing. It's a definite skill for after you leave school, it can apply to any job. It's definitely a skill you should have, just being able to use the computer, like knowing how to manipulate the file and how to do a simple document. And maybe how to use Excel so you can do budgeting from home. Everybody should know at least something about computers. How to use it – because I mean, it's, it's a wonderful tool to have for everything – especially for high school students because you can do assignments and things on it.*

She thought that the new courses being offered at her school were good as they enabled students to study further in a number of computer related fields. She said students taking the programming course could study engineering; those doing the design (she was referring to the multimedia) course could study further at design school, "*and you've got your normal applications which can be applied to, degrees like a commerce degree or a business degree - things like that - so I reckon what they've got now is pretty good.*"

Sheryl

Sheryl is a Year 13 student at a specialist secondary school with a strong focus on computing. Sheryl was interviewed at the close of her Year 13 at school. She has enjoyed

this year as has felt very comfortable with the small numbers compared to her previous school.

She really only became interested in using computers about three years previously, when her father and brother brought a computer home for their work use, and Sheryl wanted to know how to use the email and Internet. She then wanted to learn more about it "*because, I knew that it would be handy if I knew how to use computers, in jobs."* Sheryl realized that skills are necessary in the future workforce, and she would need more than what could just be picked up along the way.

> *Well I just realised that more people are using computers for jobs. I just thought if I had just the general knowledge for it, for that I went into TIM. And then instead of just word processing I thought I'd like to learn more about programming and so on.*

Sheryl's father and brother now do most of their work on laptops, and as "*they realised that most houses had computers, they just had one for family use. So me, my sister and my Mum could use the Internet."* Sheryl classified general use as email, the Internet and word processing.

The computer at home is maintained by Sheryl's brother, although she would like to be able to do more of the practical 'hands-on' maintenance for her own learning. She is looking forward to having her own laptop and the freedom to do what she would like with it.

Her best computing subject this year out of Applications, Programming, Hardware and Multimedia has been Applications (productivity software) because she could do well in it from her TIM background, and she liked the set rules. She enjoyed the logical thinking of programming, but found the hardware topic the most difficult. Probably because she had no prior hardware knowledge, but recognizes that she understands it a bit more now. She was enjoying combining her skills and knowledge from Applications and Multimedia in a project designing business cards and letterheads for her mother. Computer games did not appeal to her, apart from playing solitaire when she was bored. Her perception of computer games was "*the main graphical wondrous stuff that all the boys do,"* displaying a

strong, gender stereotype identification. She did not think she would write games *"because I've seen such flash graphics, and watching people trying to write codes for it,"* and she thought that was too intimidating and time consuming.

Sheryl's sport is Kendo, a form of Japanese Martial Art in which she has competed to a high level. She thinks it is good to have a physical interest or activity beyond computers. It was interesting to hear that having some form of Japanese cultural activity was important to her as later in the interview she revealed that wanting to know more about Japan was a motivating influence in her wanting to use the Internet when her father first brought a computer home.

When asked her understanding of the phrase 'specialist computer course', she thought it was:

> *Something that most people won't pick up by just having a computer, by themselves. I think it's more trying to understand it in depth, more something that actually contributes to the development of computers. Or like the development of computer use - producing something by using computers. 'Cause I don't think you'd pick up skills for that if you were just, if you didn't take a computer specialist course.*

She thought that an advertised specialist course would include something beyond word processing and spreadsheets.

> *I've just realized that I wouldn't know how to use a database, or how to create a database, nobody would. A normal person wouldn't know, how to create a database. Things more like programming and, just the general, how the computer works, the background, how the hardware works, how to fix it.*

When asked who may have influenced her in attending her current school, Sheryl replied that it was really her own decision for a number of reasons. She wanted to get away from the large numbers of students at her previous school and her course options all seemed to have a common thread of computing. Her present plans for the following year included further study for a Bachelor in Information and Communication Technology. She

acknowledged that she found programming difficult as she didn't have any prior knowledge, but once she knew more about it, she enjoyed solving the problems with a computer program. On computer hardware her comment was that it was hard to learn if you didn't actually do the practical aspect of it, which she thought she might do once she had her own computer and learnt about installing software and trying to fix hardware problems. The impression gained was that it was difficult for her to prevent her elder brother doing everything for her. "*You'd never understand it until you actually get a computer for yourself and actually try it out. Or try putting software in and trying to fix it, I think I just don't get it because I've never tried*."

Sheryl did not mind the gender imbalance in the classes of far more boys than girls. She commented "*I actually don't mind, the number of girls, because I just found girls in groups scary! Like in other schools. And it's good because there's not much fights, and stuff.*" This may be one of the underlying reasons of her not wanting to be in a school with large numbers of students, and suggests there may have been some unpleasant experiences.

The subject she enjoyed last year was Electronics as there was a practical hands-on aspect. That led her onto taking part in the robotics competition this year as it entailed both practical and programming skills. Her main hobbies outside school are drawing and making things. In fact she was considering going to art school and doing a Graphics Art course, "*… but I thought it really wouldn't lead to a job. I think it's because people around me, make me think that art isn't much of a job, or a studying thing*." She found Applications relatively easy to understand because she had done some of it before, but liked the extension work "*and it was fun trying to learn things you wouldn't learn if you were just typing things out*." The Multimedia course appealed to her artistic sense, but once she had mastered the basic tools, found she preferred working with actual art and crafts, rather than virtual objects. "*… but I think its more I like the actual real thing, not virtual things, and I leave it to my own time to do things like that*."

Sheryl's ideas of necessary skills to take a specialist computer course would be a general knowledge of how to operate the computer, together with good keyboard skills. When

asked about necessary abilities, her response was: "*Their abilities, well I don't think that really matters, I think it's how eager you are, and how much you take in new things. Because technology, it's ever changing, and if you had just one hard straight mind, you wouldn't really take in anything*." This seemed to indicate a perception that enthusiasm and an attitude of learning and wanting to actually understand were vital to students in the computing field.

When asked about her understanding of a career in ICT, she replied: "*Well, it could be practically anything, anything at the moment, because everything is actually related to computers, or uses computers, information technology. Yeah, I can't really say, every job they have for it, 'cause there are more every day*." She also made the comment, that having been exposed to the different computing pathways at her current school, she could pick any one of the subject lines and come up with something different, and yet it would still be ICT. Her idea of an IT industry was one based around the people who actually used IT to make the industry expand, "…*but the main people would be the software engineers, that expand it, and the hardware engineers, and then the networking people*." However she didn't see herself following any of these careers. Her preference was for end user tasks, "*somebody that just uses the computer, to perform a task. I don't really mind if it's just data entry! I quite like simple tasks like that. And if it's my job I wouldn't really mind*." Although Sheryl realized that there were many opportunities in many different fields, and was going to study a degree in ICT, her personal preference would dictate what type of job she would look for. This may be influenced by her positive achievements in one area, and could change as she started to excel in other areas.

When asked her understanding of the phrase 'computer science', Sheryl thought it was programming and the insides of the computer, and how the computer actually works. Information systems she thought were how people communicated with each other. Applied computing evoked the response *"… is what I think I have in mind at the moment, just using computers to actually get some product or, some outcome of it*." Electro technology she thought referred to the hardware, making the chips smaller and the computer more efficient and faster.

Her ideas of what should be taught in school included Business Communications, a compulsory course at the current school, as she thought that was quite relevant. The course had two parts which included the practical aspects of writing business letters and proposals and secondly, learning how to co-operate with people. Perhaps if Sheryl had not been exposed to this particular course, she may not have thought it was important. Her ideas then divided up into what should be essential knowledge that everyone should know, and specific knowledge for those interested in computing.

> *I think computer science programming would be good. I think, applications you could just pick up along, any place I think, because they all … actually applications from Windows, they're like the main thing - they always work the same, you can find where the tools are - what the tools actually do. So I don't think you really need to touch on that in depth that much. So I think you really need to know the hardware. Because you can't really do anything if the computer actually broke down or if there's trouble there. And then programming, I think it's good to know too … the logical things …*

Her perspective on girls taking specialist computer courses was that girls generally did not think of buying and upgrading computers and were more inclined to like the application side of things, as Sheryl reflected was true of herself. She had been a bit hesitant of attending her current school as she had been concerned at her lack of knowledge of the hardware. " *... why I was reluctant to come here last year, even though I was quite sure I would come here, is because I didn't know anything about the hardware. Yeah, it's more like how girls can't like cars*." She then went on to say:

> *I think girls don't really like the computer or, is because they can't really be social with it, unless they do things like the Internet or emails and stuff with their friends. Because then they just have to sit there in front of it - hitting away like, I think they like more physical things, like actually meeting people.*

Most of her male friends were keen computer users, but less than half of her female friends used the computer on a general basis. Following on this comment, Sheryl was asked what made her step out of the female stereotype and take more of an interest in

computing. Her answer revealed that there was an initial motivating interest to find out more about her Japanese heritage, something personal and relevant to herself, and as she used the computer more extensively, her interest in the computer as a tool developed.

> *For me - I just think, I was using the computer a lot to find information on the Internet. I think the Internet was a big influence, because I really wanted to know about my - about Japan!*
>
> *Yeah and I just actually get information about it - the only way is the Internet, because actually it's up to date, get songs and news and things. That's why I was on the Internet a lot, which made me want to use the computer more.*
>
> *So then I started doing my homework on the computer, and after that I then thought I wanted to know how the computer worked, or, what the computer did in more depth, so then I could have my own computer - and use it in privacy. So I think, how girls get into computing is more from their social life, and then they start using it for other uses and then when they know that, it's kind of like their main - or if they know that they are good at it, they'll keep on making, they'll make it a job, I think.*

Sheryl also made the interesting observation that if girls thought they were good at using the computer, they would continue to use it and extend their knowledge, like Sandra who says in her interview that she continued to take ICT as she was good at it. However Sheryl did make the comment that it took time for girls to get to that point.

Her comments on the relative benefits or not of computers were that computers were essential for the future, but that there were negatives in that posture could be affected by sitting for long periods of time in front of the computer; the ease of digitizing objects such as music, images etc made it very easy to copy things and could lead to theft and plagiarism.

Her view of what she actually learnt at school the previous year was that though programming had been introduced, she didn't really understand it as there hadn't been enough time. A number of topics had been touched on, but not in any great depth. Her

perception was that she had learnt the basics of how to operate a Windows program, but the computing she had learnt was mostly her own learning. She didn't think she would have learnt programming, PowerPoint or Excel if she hadn't specifically taken a course in it. At the end of last year she was really confused at what she could or could not do, and thought she could narrow down the options by attending her current school. She felt she now had a clear view of what she could do and a direction to move in. "*I have a clear view of what I can do, of where I can go to. Yeah.*"

Monica

Monica is a Year 13 student at a co-educational school. She had taken the semester computer courses in Year 9 and 10, the Year 11 IM course followed by Computer Science in Year 12, but is not taking any specific computer course in Year 13. She had found Year 12 quite straightforward but was finding this year quite a step up in work and was now having to do more homework to keep up with requirements.

Monica had a computer at home since she was 13 years old. Her initial use was the Internet (perhaps for email and communication) and then school use. "*It was just for me going on the Internet, and maybe typing out some of the essays for English and oh, you know, that's the use of it before I started doing computing at school*." The computer at home is now also used by her parents for Internet Banking (Dad) and chatting online and games (Mum).

Monica liked computers because she valued their use for school work (helped her produce neat and tidy documents), and also on a personal level for music, movies and chatting online.

> *… everything looks neat and tidy because sometimes if you are in a rush, you can't write it properly and afterwards you can't even read what you have been writing, so yeah, very convenient in that way and … also because now our school require, as you get you know - bigger, like the year level gets higher like teachers require you to, you know you have to do things on the computer and print things out like proper and neatly and so they can read it.*

So, I also really like computers because I use them to go online download music, movies very often, so, yeah and now it's very useful for Math especially with Statistics.

Topics in Computer Science last year, included PowerPoint, designing a website, programming (though she couldn't remember the language Visual Basic until prompted), a little bit of Microsoft Excel, and working through a booklet "*about like how, what are the components in the computer and, how does it work, the CPU and the memories and the disc. Yeah, basic things about the computer*." For Monica the term ICT meant Information of Computing Technology *"… you use computer to process data that - to gather information and process data*."

Monica perceived ICT and Computer Science as two very different subjects. Computer Science could lead to vast areas of new knowledge and more learning, but ICT was just using the computer to record thoughts and ideas and allow creation of designs.

Monica(M): Oh, I really find those two are very different so I can't really -

R: You say those two, do you mean the ICT and the Computer Science?

M: They were very different. I think I see Computer Science as very, very computing. I mean it has, I know, from this course, there are - I know there are huge - amounts of knowledge, you know, you can do from that point onwards, whereas in ICT, I find that I can use the - the programs in the computer to design a lot of stuff to, create things, so it's kind of - kind of different. Computer Science is apply, you know, learning - how to maybe making computers or like doing things and on the other hand there's, processing of thoughts and, your ideas from - you know using your computers. So I find them quite different.

Monica did not have a good experience in the Computer Science class.

I think, most people, well most of my friends and I find ICT is much more interesting and, you know, much more appealing compared to Computer Science and, most of us didn't - most of us didn't know what to do during Computer Science last year. We were asking each other what we should do from this step onwards and gather ideas from other people instead of making our own. Like, expressing our own ideas because we really don't know how to do it

> *although if - although if we have the idea in our mind, we couldn't really express it because we don't know how to use the - yeah, the tools.*

She thought the teacher was too inexperienced and not able to really help them when they got stuck with a programming problem. She felt she used other people's ideas (possibly the actual code in the program), as she did not have the expertise to express her own ideas. She was not critical of the teacher and acknowledged that it was hard to teach and hard to learn Computer Science. But she did comment that she couldn't remember as she found no application/relevance to daily life. Monica's learning approach could also be a factor in her liking of computer programming in that her preferred mode of learning was memorization of facts, which could indicate why she struggled with the problem-solving element in programming. Perhaps she was not able to apply principles to new situations, and why she was finding the higher levels of school work more challenging. "*I used to be good at learning but not anymore*." She was familiar with ICT and would have had some repetition in the topics over the number of years of taking the subject, but she would need to apply concepts, logical thought and problem-solving in programming, and perhaps did not have enough confidence, or maybe the connections had not been made clear for her in the teaching. She talked about her friends so there did not appear to be any peer isolation. No problems with gender were mentioned – more a frustration at not being able to do what she thought she ought to be able to do. Although she was able to do the work in the Computer Science class, and achieved good results, it did not satisfy her.

> *I feel that I learned more in ICT than in Computer Science – although, well I passed all the, yeah, assignments and for achieved standards there, I also got merits. I wasn't really bad, I have done quite well in the class but I - I still don't really feel that I've learnt something during the lesson. I don't know why but …*

The implication is that although she achieved, there had to be some personal engagement or relevance to give meaning to that achievement. She enjoyed the designing in ICT and could see the value in this subject for other subjects and after school. She found Mathematics interesting, but not the programming in Computer Science. Maybe there

wasn't enough of a challenge in problem solving? Or was it the individual's personality? Or was it something else? Monica had no interest in computer games or using a PlayStation. Her outside interests included playing tennis, basketball, badminton and walking.

She had a good idea of the terms software engineering, applied computing and electro technology. The word 'engineering' made her think of constructing things like bridges and roads, and software engineering would be "*designing computer programs like - like Microsoft Word or Microsoft Excel or maybe codes and stuff like that*." Applied computing was using computer programs in daily situations; electro technology was designing computer chips that could be used in microphones or cell phones or computers; information systems would refer to the way you get information. Her idea of computer science was in-depth knowledge of the components of the computer and all the various tools using the computer; a greater focus on the computer as the object, and not just a tool for the user as in ICT. Computer science "*is really learning about computers like how do you use various tools of the computer, and learn how does the components of the computer - and all the things about the computer I guess*". Her understanding of the phrase, 'specialist computing in school' was learning all the things about the computer, "*from the basics to the very depth of computing*".

Monica did not have any subjects that she particularly liked, in fact she found her subjects interesting "*but it doesn't mean that I like to do them*." Her choice of career appeared to be influenced more by her choice of subjects and academic strengths, rather than an interest in something specific.

> *Ah, maybe dentist and doing medicine, but this is because you know all the subjects that I have been doing are about science. But, I also have to consider do I really like that job or am I going to succeed in this - this area and that there are, a lot of things that I should consider before I really want to step into this. And especially I don't really know if I like science or not. I, did these subjects because I was good at them back in Year 9 / Year 10 but now it's getting harder and I was wondering, you know, it's just before going to, it's Form 7 now. You have*

> *to decide what do I want to become in the future, so it's kind of a thing I really need to find out during this year to see which, yeah.*

She had taken science subjects – because she was good at them, and "*trusted*" them, but didn't feel particularly passionate about them. This raises the question of how much subtle influence there may have been from home, though she denies any parental influence, or how much peer pressure there was; or perhaps it was just an inclination to stick to what she was comfortable with and not wanting to step out of her comfort zone and take on more challenges. She admits later in the interview that ICT could be a career option, but she had very little idea of what the possibilities could be.

Monica thought typing and basics such as word processing and spreadsheets were an essential skill to be taught at school. She herself had found them useful in her other subjects. She also thought efficient use of the Internet for information was important. She did comment that if there was an interest, more in depth knowledge such as website design or computer games could be developed. She acknowledged that computers are becoming more important in daily lives and would be used in all fields of work. She made the observation that people in office work should be professional in their typing. Where was her exposure to the many people who couldn't type?

> *I think you have to know how to type. I've seen many people that are doing office jobs but they cannot type. They don't know where - where the letters are and they have to look and look up and look down and look up. I think, I find that very unprofessional. Yeah, I think that's the very essential thing that, I think they should at least know how to use the basic, you know, like Microsoft Word or Excel and Publisher. These are the three main things you need to know how to use. All basic and then from there onwards maybe, you know, you have to - out of interest you want to know how - what are the components in the computer, then you know maybe you want to know, how to design websites and maybe you want to know how to design like games software and …*

Monica thought these basics had certainly helped her in her other subjects. A career in ICT would appeal to her.

> *… it would actually, yeah well because, why did I start doing computing? Because I know that as, years gone past computers become more and more important in our daily lives and I really - I know also that no matter what field you are in like, what jobs you are going to do, computer is always going to be helpful. It will always help you no matter what job you are going to do, so I think it's very important.*

Her idea of a career in ICT was secretarial work, or using the computer for design work. She acknowledged that professionals like chemists and physicists would need to know how to use the computer because of its ease and speed, but she didn't elaborate on whether it was useful for writing reports, or using as a tool within a specific discipline. Monica liked interacting with people and was very keen on public speaking, but did not see how this passion could be translated into a possible career. Her other interest was shopping, but couldn't perceive how this could be translated into a career with the subjects she had. When asked why she hadn't taken the multimedia course offered this year, as she was interested in design, she said she had no space on her time-table. Her motivation in continuing with the science subjects she had always taken was *"and I can't trust anything else, so I will have to stick with this kind of subject again this year."* There was no pressure from home; this was entirely her decision. Her thoughts on a possible Year 13 specialist computer course was:

> *I think there should be designing. I mean, I like designing stuff so I think design would be - maybe webpage or, whatever you want to design about. Maybe computer games - maybe you know fashion, maybe just art or like computer design yeah, also probably, you need to know how to use the Internet more efficiently … you know you can get information much more faster so you don't have to waste a lot of time using computers. And also, I think, yeah probably more PowerPoint is very worthwhile, and maybe some multimedia. Yeah, using animation, like designing something that's animated - and I know some people like, you know, putting things together like maybe, how to put a computer together or like this kind of course.*

Summary

The five narratives presented here reveal a complex variety in personal history and early use of computers, in interests, in motivation to take specialist computer courses and previous experience. There seem to be similarities in perceptions of computer careers and what would, or would not appeal to girls in computing, but also differences and disparities as each shared their own very unique experiences. Merriam (1998, p. 193) writes that the "range of data resources may present disparate, incompatible, even contradictory information," reminding the researcher of the need to be cautious and aware of variation when looking to generalise across cases. The qualitative researcher is warned to be aware of the complexities within each case, before looking for patterning of variables across the cases. This is indeed the case in my research as having explored and described the complexities of the individual cases, my task now was to determine what are the common themes and factors across all participants, from all the interviews, as well as the mind maps and questionnaire that may give some answers to the research questions. This is discussed in the next chapter.

Chapter 6: Data analysis: Cross case

Introduction

In this chapter a cross case analysis is undertaken, drawing on the narratives presented in Chapter 5, as well as the other five participant interviews, and the questionnaires. As a case researcher I am aware that I may pass along to the reader some of my personal meanings and interpretations, and fail to pass on others. However, by illustrating how some phenomena occur in several of the embedded and additional cases, valuable knowledge is provided. From listening to the voices of the girls, and by criss-crossing the landscape of the content domain (Stake, 2003), I have drawn out some attributes of interest. They are presented in sections relating to some themes and issues that emerged from the data collected and are drawn from the research question focus on 'How do girls perceive computing as a school subject and career path?'

Language

Stake (2003, p.141) writes "the nature of cases are situational and influenced by happenings of many kinds." Students in this study appear to see computer specialist courses in terms of content, and particularly in the situational context of computing in their schools. I came to understand that for me as well as for the students, different words could mean the same concept, or the same word could mean different concepts; the meaning attributed and assumed is important rather than the word per se.

Technology terminology

Language in any field has its specialist jargon, but in the rapidly changing IT world new terms and new applications appear frequently, perhaps justifying why it is difficult to pin meanings to terms. Most of the participants interviewed associated ICT with typing, possibly because the text and information courses in junior secondary school would emphasise touch-typing under 'keyboarding skills'. For Sheryl, ICT was anything to do with computers. In industry, ICT has a much broader meaning namely, software, electronics and telecommunications. On Seek (www.seek.co.nz), a website advertising jobs, ICT positions are now categorised as IT and T (Information Technology and

Telecommunications). For Helen, computer programming was anything that the teacher thought was relevant - robots, webpage design, programming language. Monica associated computer programming with the language Visual Basic. Computer Science made Sandra think of programming while Gillian thought of Physics and Chemistry. Sandra mentioned hearing the jargon from her friends, but had no personal experience of programming. Phrases such as applied computing, the IT industry, and electro-technology revealed confusion and ignorance over terminology. Jepson and Perl (2002) interpret this confusion and ignorance over terminology as one reason why girls are less likely to pursue computer careers.

Association with mathematics and science

Gillian didn't take Computer Science because she associated the word 'science' with Biology and Physics, and she had not achieved well in these subjects in the previous year. Susan said she wasn't interested in the subject Computer Science as "*it just came across to me as the scientific part of computers rather than the actual … publishing and doing something.*" Erica commented: *"I talked to quite a lot of people who took Computer Science last year, instead of Applications. And I'm very glad I didn't take that because they said it was more mathematical and they didn't really … experience all the different … office programs."* Norma said *"I sort of think science and smart and academic and, it freaks me out."* It appeared the phrase computer science meant it was associated with other scientific disciplines such as physics or biology which may historically be associated with 'difficult'.

Although Monica found mathematics interesting, she struggled with the computer programming. Esther enjoyed mathematics, computers and music. Thus there are varied responses to the association with mathematics and science among the participants. Data from the survey reported in Chapter 4 indicates 47% of those surveyed liked high technology/computer problems showing that almost half the participants surveyed had a positive association with problem solving logic in the computer context. Klawe (2002) suggests it is a myth that girls have to be good at mathematics to do computing as the gender divide in mathematical achievement has disappeared in most countries, but there

is still a gender divide in computing. Some of the girls, who saw Computing as scientific, were turned off, while others like Helen were challenged and embraced the course. Those, like Sandra and Gillian, who associated computing with ICT or multimedia or design were enjoying the courses, were still doing a high level of computing, but did not appear to have negative associations with the subject. The varied responses from the participants indicate that perhaps one problem with the gender gap in computing is related to how schools label and structure their courses. Research suggests that computer science should not be positioned as an extension of mathematical thinking or as an applied science because while sophisticated mathematical skills and understanding are required in some areas of computer science, they are not relevant for other areas (Clegg, 2001). Academic research and pedagogy has far-reaching influences outside the institution in defining the field (Clegg, 2001).

Specialist computer courses – girls' perceptions

Focus on the computer

All the students in the research would have been limited to Text and Information Management as the specialist IT subject in Years 9 to 11. In Year 12, they would have had, for the first time, a choice between two specialist computer classes (see Chapter 3). A Year 13 Multimedia course and Year 13 Hardware course was being offered in Class Case B and C for the first time in 2006. I had changed my definition of a specialist ICT course to include any that had computers as essential to the course. However, this was not always the perception of the students. Although the participants viewed computing as a school subject in two specific areas in Year 12, they did not appear to view them both as computer specialist courses and didn't always recognise the Year 12 or 13 ICT course as a computer specialist course. When asked their perception of a 'computer specialist course', their first reaction was seldom to mention the ICT course, but rather to talk about the hardware or the functions of the computer. Gillian said "*ICT is more, we learn how to format things… it's not like design.*" Norma replied "*I have no idea what you mean*" when asked her understanding of a specialist computer course, but did think of Visual Art: Design as a computer course as "*the uni I want to go to is all about designing, computing*." Esther thought

a specialist computer course was "*a computer course that does one area of computing… for example, computer programming, like high tech.*" Abbiss (2005b) reports that students in her study associate computer studies with computer science models of computer practice and information systems. This view is supported by students in my research where they associate specialist computer courses with learning about the computer rather than computer use. Sheryl described a computer specialist course as:

> *More something that actually contributes to the development of computers. Or like the development of computer use, producing something by using computers. 'Cause I don't think you'd pick up skills for that, if you didn't take a computer specialist course.*

Helen said it would include "*… just how the computer works like every little part of it. How its components does things and also how the program Windows XP, is like designed and all those things in it."* Gillian said it "*is more like getting to know all the itty bitty bits of it all*."

Gillian and Norma were taking Visual Art: Design as a subject, which required a high level of computer use in specific software but Norma did not regard this as a computer specialist course. However, Gillian was also taking the Multimedia course and commented that Visual Art: Design could also be regarded as a specialist computer course. This supports the view that academic computing is diverse; embracing the applied as well the theoretical, and applications and media technologies are bridging the arts/science divide (Clegg, 2001).

Levels of knowledge

The students see a distinction between knowing how to use general application packages on the computer which they may refer to as ICT, compared to how to trouble-shoot hardware faults, say, or programming. Knowing how to fix the computer appeared to Andrea as a higher level of computer knowledge, which would be taught in specialist courses. Helen spoke about the different levels of computer courses, indicating basic applications skills as a lower level to say, computer programming. She also viewed content in terms of levels "*Some like, multimedia and things … probably a level a little bit harder than this one, (ie basics and not knowledge like how the boy hacked into a system*.) Monica

was quite emphatic in her comments that ICT and Computer Science were two very different courses. Students tended to view 'the basic skills' course which included typing, word processing, spreadsheet and document enhancing as something everyone could (and should) learn, but that the more specialist course would require a higher level of expertise and would be for those who showed interest in knowing how things worked or if they wanted to design computer games, for example. The perceptions of the girls about computer courses most likely reflect their experiences from both home and school. Their views would support current research which explains computing not just as a concrete science, but rather to also include a range of practical knowledge and skills (Clegg, 2001), although the students perceive levels or hierarchies in the type of knowledge and skills.

Labels

How schools label and describe their courses affects perceptions of them and how students label courses. To quote Esther:

> *If the course was more to do with graphics or something more girls might be interested in taking it because at the moment they see a course and it's called Computer Programming and they like go, programming, who wants to program a computer?*

Perhaps part of the problem or issue with girls taking specialist computer courses is that they are defined in a manner that has little meaning for prospective students. Looking at the course descriptions in the schools surveyed, it could be argued that the terminology used is too technical, and assumes knowledge the students don't have. It might be useful to have courses described in terms of simple language and in the context of the real world. One of the commissioners for AAUW (2000) calls for a revisioning of Computer Science and suggests that if it was called Communications (say), female students would probably enrol in the course. Two students from Class Case B or C had enrolled in the new Multimedia course and were enjoying it. The multimedia label may have been enticing or the course descriptor may have been an encouraging factor to taking the course.

While schools tended to label courses from a content perspective, students seemed to label courses from an experience perspective. There seemed to be a tendency to classify and

label the applications course as 'easy' and achievable while the so-called specialist course was 'hard'. Personal interest and knowledge affected this viewpoint as Helen liked the challenge of the programming courses, while Sheryl could not determine her level of expertise at the end of Year 12, but knew enough about ICT at the end of Year 13 having learnt about applications, programming, multimedia and hardware to consider a degree in ICT. Susan was enjoying both the ICT and her multimedia course. Sandra said ICT was her best subject and found it easy, but thought programming would be 'boring' while Helen thought it would be 'fun'. Gillian said: "*just the basics would be all right because, the specialist classes you go on to at university or something*."

Stereotypical perceptions of computing

The disparate, incompatible, even contradictory information that Merriam (1998) talks about in qualitative research is highlighted in literature on this topic, as well as in the findings of my research. From the responses in the questionnaire to the gender stereotyping of computer-related attitudes, there appears to be a political statement being made to deny gender based superiority and inferiority. The data appears to be showing that the stereo-type assumption of biological determinism, that portrays women as inferior and somehow lacking, is not true. However this ideal that no-one is inferior and of course there is no difference does not appear to be translating into action. Andrea did not set the same value on her skills and computer knowledge as her brother's. Sandra regarded herself as less 'arty' and more 'scientific' but did not think she would be good at computer programming.

The stereotype image of computer science students as narrowly focused, intense hackers and a computer culture that is male-dominated with 'macho' connotations (Margolis & Fisher, 2002; Selby, 1995) is supported by some of the data collected, both directly and indirectly. Andrea commented that the stereotype of a male in front of a computer playing war games was not encouraging for girls to get involved with computers on a more specialized basis. Beyond using the computer for the basic skills, she said, girls don't know what they are about and what computers could do for them. Helen commented that

although girls might be interested, they may only have seen males in computer technician positions. She identified herself as different, indirectly supporting the stereotype, in that she liked computers and finding out more about them and extra software programs other than the basic skills applications, whereas other girls did not regard the computer as important and were more interested in "*make-up and stuff.*" Esther had grown up with an exposure to computers from her father and brothers and their encouragement influenced her in a choice of computer science as a career. Esther thought many girls probably associated computing and programming with males as they only ever saw male technicians around the school. Her perception was that girls in general were not interested in the high technology/computer courses like programming or hardware and did not see themselves as contributing to the development of technology, "*they just use the things and they're convenient.*" Norma saw computer courses as typing for girls and computer hardware for boys as that "*kinda comes to mind as boys like just playing with things.*" Susan explains her point of view:

> *Obviously there's lots of different types of computing like just for me the ICT sort of part of it would be more into jobs like Reception, and obviously mostly females in that job. So I don't think that would appeal to guys much 'cause they don't really wanna make things pretty and you know all that stuff and not interested in typing long things, obviously they would be more interested in the hands on, like creating the computers and seeing how they work, and like girls are more interested in the final product.*

confirming the research that girls tend to be users, rather than creators of the technology (AAUW, 2000).

Turkle (as cited in Margolis & Fisher, 2002) writes that a key advantage in the world of computer science is "to be an intrepid explorer who delights in risk taking" (p. 29). She believes that much learning goes on while playing around with the computer to see what it can do. Research indicates that childhood influences encourage risk taking in boys, while girls are encouraged to be more cautious and careful (Margolis & Fisher, 2002). Helen steps outside this stereotype by revealing herself as an intrepid explorer, delighting

in trying new software and seeing what she could do, but perceives herself as being different to other girls in this respect. Helen was exploring on her own, whereas Gillian was learning a new software package in Multimedia, "*new to everyone*", but within the safety and comfort of a classroom with other students and so was not stepping outside a perceived stereotype. Susan's perception that girls liked to chat and type stuff, but "*don't see behind it*", implies that girls don't appear to focus on what makes the computer work, and has her buying in to a stereotypical association based on her perception and experience.

Martinson's study (2006) reveals that gender differences in childhood have been identified with boys more likely to tinker and go on to computer science, while girls are less likely to tinker. Some of the responses from the students prove the exception to Martinson's study and the stereotype in that Erica was encouraged by her brothers to tinker and knew how to put a computer together. Helen loved to explore the different kinds of software. Sheryl was frustrated that she didn't get the opportunity to put hardware together as her brother always did it. Perhaps because they liked to tinker with the computer, these participants enjoyed computing beyond the general office applications. Martinson comments that conventional wisdom suggests one of the best ways to learn about computers is to tinker with them; to play with the various software commands and even dismantle the computer.

A number of the girls were concerned at the isolating image of the computer, and commented that socializing with their friends was more important. Sandra said "… *just that every job has got some sort of computer in it … a lot of things are becoming so impersonal, and people don't have those communication skills via people*." Sheryl commented that girls didn't really like the computer and preferred to actually physically meet people. This supports the research (Margolis & Fisher, 2002; Turkle, 1998) that girls' play and comfort are located in relationships, and in the computer world girls are put off by what they see as boys' fascination with machines and objects, and a possible loss of femininity by getting too close to a machine. Gillian rejects this stereotypical view by saying *"you think the*

hardware is more for boys because they like, the technical things, but then I don't really look at it like that."

Experience, relevance and students' choices

Sheryl commented that girls get into computing from their social life and a personal interest, and as their confidence increases, they extend their knowledge. Past research (Durndell, Glissov, & Siann, 1995; Margolis & Fisher, 2002; Selby, 1995) quote lack of experience and the context in which computers are used as a factor in the persistent gap in computer courses. In my research, however, most girls said they liked computers and all the students interviewed had a computer at home, although Helen commented that some girls did not take a specialist computer course as they did not know what fun a computer could be due to not having a computer at home. This suggests that the students or Helen at least, think that a lack of experience or opportunity affects attitudes and confidence. Having parents and siblings interested in computers as Esther explained, creates positive experiences and could be a motivating factor to take specialist computer courses. Churchman (1993) and Klawe (2002) suggest that girls enjoy using a computer when given the opportunity to use one in a comfortable situation for an activity they liked and that matched the goals and interests of individual students.

Research by Durndell et al. (1995) reveals that even those women and girls who are reasonably confident of their own potential ability at computing are not necessarily drawn to computing as a discipline. From the responses in the survey to usefulness and future intentions, girls think they could do well and that technology careers are for women as well as men – but they don't necessarily have this as a priority career. However, just because girls aren't doing it, doesn't mean that they don't think they can. What this data is showing is that as in other studies, there is a disjunction between principles and ideals and the reality of what is happening with students' choices (Abbiss, 2005b). Research refers to this particular feature of female orientation to computers as the "I can, but I don't want to" syndrome (Durndell et al, 1995). Susan said: "*Yeah, like if they wanted to then yeah*

they would be able to but I just don't think many of them want to" learn what goes on behind a computer.

'Useful' was given as a response in the mind maps and a number of the participants mentioned the usefulness of computer courses. Most of the girls agreed that basic skills, what most thought of as ICT, were essential knowledge for everyone. Even though Norma did not have a good experience in the computer classroom with her design subject, she still agreed "*it's really important that I have the basic sort of typing skills and stuff like that and I do feel that's important too as computers are used for like everything now*." However there were conflicting views on the utility of the other specialist computer courses. Some of the girls needed to see relevance as to why they should learn about computers, beyond just the necessary application skills, while others wanted to learn just because they liked computers. Andrea wanted to know how a computer course would relate to what she wanted to do in the future. Monica's issue with the Computer Science class was more a case of finding relevance of the course to her daily life. Gillian who had taken the 'new' Multimedia course, found she had to learn a new program, but said it was worthwhile as it complemented what she had to learn in the Visual Art: Design class. Some appeared to want a valid reason for taking a course that seems to appeal to 'nerdy/geeky' people, and not to their (girls') interests. Andrea suggested that girls may be more interested in the computing field if "*it was more to do with movie making, the movie side or if it was to do with, I don't know, whatever their interest is at the time and if they could be shown how they could apply it to their interest*." These views support the research that suggests factors influencing girls' decisions in a scientific field depends on their belief in its ultimate utility and how much they value working with and for people (Arbor, 2003). From the data, reasons given for not taking the course were as simple as interest in the topic, as well as not enough space in the timetable. This suggests that some choices are purely pragmatic and nothing to do with relevance or experience, although relevance appeared to be a consideration for many of the participants.

On the one hand, the girls seem to be saying that they could do the courses if they wanted to, but on the other hand, some of the factors that seem to negatively influence their choices are social interests, gender stereotypes and utility.

Summary

The answer to the moral panic that girls are not doing computing, therefore they are not interested, is that there may just be other things in which they are more interested. It's not that they don't value it, but that there are a wide variety of factors that they may consider that influences them in their choices. Further discussion on the factors influencing girls' choices to take computer courses with reference to relevant literature and the research questions is presented in the next chapter.

Chapter 7: Discussion

Introduction

In this phenomenological study girls perceive computing as a school subject and career path within their particular frames of reference, which includes home use, school context and exposure to the wider society. Phenomenology as an ideology focuses on lived experience. The knowledge the girls have of computing, and the meanings they attach to the words used, are constructed from their experiences. It must be remembered that most of the students interviewed were already in a computer specialist course (by the researcher's definition). This may present bias in the results in that they have already shown an interest in computing; but the researcher believes there is still value in what they are saying (or not saying) about computing because of their unique experiences, their ideas, thoughts and comments on computing and their motivation (or not) to persist with computing education and take specialist computer courses in the future. They are a legitimate group of interest. Other studies may explore perceptions of students who do not have experience of computing courses and inform the debate further, but they are not the focus of this study. From considering the research questions and listening to the voices of the girls, some themes and issues that emerged from the data collected are discussed and related to current literature.

Back to the research questions

1. What are the inhibiting or encouraging factors that influence girls in their choice to take specialist computer courses in secondary school?

Factors influencing girls' choices of specialist computer courses are not clear-cut; they are complex and inter-related. Factors that may have contributed to girls choosing to take the ICT basic skills course included a perception that it was easy; that they could see a use for it in other subjects and after school; that it was familiar as most had taken it as a semester in Year 9 and Year 10 and found it to be non-threatening; that it allowed them to create documents that were neat and tidy and where they could process their thoughts into something concrete; the enthusiasm of the teacher; that it gave them confidence and a

sense of achievement; that it was necessary for their chosen career (e.g. police force). However some students who were self taught from having computers at home, did not take the ICT skills course as it was 'too easy'. Some of the girls did not take what they perceived to be the more specialist computer courses as they were considered 'hard', and did not appear to be relevant to daily life. Other students wanted to take the more specialist course as they thought they would be challenging, were encouraged by their teacher and had an idea of what the course content was. One student took computer courses as a secondary reason, more serendipitous than conscious, as her primary reason was wanting to be in a smaller school and class and she had some interest in computing.

The courses that had more programming and hardware content may have been perceived to be 'difficult' for some of the girls as they did not appear to be as confident in their ability to achieve in these courses. This may indicate that perceived ability to achieve in a subject is an influencing factor to take the subject.

Research has shown the common practice of grouping computer science with mathematics and science, both informally and organizationally in school departments and faculty structures, may contribute to the gender gap in computing (Clegg, 2001; Jepson & Perl, 2002; Margolis & Fisher, 2002). Four of the participants interviewed mentioned this association, and gave it as a reason for not choosing a specialist computer course.

The teacher is a factor that may influence choices about which courses students take as evidenced by one student deciding not to continue with Computer Science in Year 13 after taking both courses in Year 12 because of the teaching. Monica said: "… *ICT much more interesting, more appealing compared to Computer Science. I know computers are hard to teach, it's harder to understand because teacher didn't explain it very well although she did try her best."* From the survey, in the section investigating students' perceptions of teacher support, there were very few fence-sitters in Class Case B, and most felt they were strongly supported by the teacher. Some of the comments that arose in the interviews indicate that participants found ICT (or IM) 'easy'; they were familiar with the content having taken the subject in junior secondary, and therefore felt comfortable and able to achieve in this

course. How much of the success was because the subject was easier versus the encouragement of the teacher to instil confidence to succeed? Research shows that teacher experience and classroom culture is a strong factor in either encouraging or inhibiting girls to take specialist computer courses (Churchman, 1993; Jepson & Perl, 2002; Klawe, 2002; Margolis & Fisher, 2002).

Abbiss (2005a) points out that students attribute specialist IT subjects with gendered cultures or identities which could explain some of the perceptions girls have of computer courses. Some of the issues highlighted by research into gender-related issues with computers and girls are: a) there is a legacy from mathematics and science, b) girls have a stereotype perception of computer science, c) confidence and experience are limiting factors for girls, d) girls have a pragmatic approach to computing and e) girls' interests are different (Durndell et al, 1995; Jepson & Perl, 2002; Klawe, 2002; Margolis & Fisher; 2002; Selby, 1995). The multiple and varied responses from the interviews highlights the contradictory nature of gender and computing; it's not simple, it's complex. Some of the statements made by the interviewees are uncannily resonant of the responses in the research conducted by Margolis and Fisher (2002) with American high school students: in her story (p. 18) Sasha tells how she liked exploring and having fun on the computer, just like Helen; Carole (p. 30) tells of her frustration in not gaining hands-on experience as her father always maintained the computers, just like Sheryl with her brother; Kathryn (p. 31) tells how her father and brother expected her to participate with them, and so knew a lot about computers, just like Erica. Further similarities in responses from the participants in my research confirm Margolis & Fisher's findings that the context of computing is important for women and the culture of computing promulgates a typically male orientation towards computing. The context of their research is similar to New Zealand in that students learn basic computing skills in an introductory course and advanced courses are offered as electives.

I don't have any data on what role models the girls associated with computing, as it was a question I omitted in my interviews, but perhaps exposure to role models such as Wendy Hall would encourage more female risk takers.

> 'There is nothing traditional or geeky about me' says Wendy Hall, leading computer scientist and working with Tim Berners-Lee, the 'father of the web'. Does she ever regret leaving the abstract field of pure mathematics and choosing the world of computers? 'All the wonderful things I am doing are because I am a computer scientist, 'she says. 'IT and computing are the basis of everything.' (Biever, 2006, p. 2)

This is an aspect which may be explored in further studies.

2. How do girls perceive the relevance/attractiveness of a career in ICT?

The data revealed that the girls saw a distinction between using ICT in a career and ICT as a career. Most of the girls interviewed had already decided on a career path by the start of Year 13 and only two (possibly three) out of the 10 interviewed were considering a career in computing, although from the questionnaire results, 86% of those surveyed would have had high technology/computers in a list of potential careers. From a study for the MOE in 1995, Selby writes that "there is a widespread lack of understanding amongst girls about the real nature of computing as a career" (p. 26). She writes that there is little knowledge about the interesting aspects of computing careers; that girls tended to view computing as "office work or as theoretical, mathematical or solitary"; that there was little understanding of the diversity of technical and interpersonal skills required. Ten years later on in my research, there appears to be little change in this perception.

From my perspective, though not perhaps from theirs, the students showed a limited knowledge of careers available in the computer field, and therefore did not see the relevance of courses at school. A number of students associated an ICT career with office skills and reception work only, contributing to the narrow perception of a career in ICT. For one student, a career in ICT was typing - she had taken a Year 9/10 course and nothing further. An "IT career" to another student meant "*anything at the moment, because everything is actually related to computers, or uses computers, information technology … Well,*

being here and learning the different pathways, I could pick anyone of them (pathway) and end up with something completely different, and it would still be ICT!" She was the exception who had attended a school specialising in computing and had been shown many possible pathways of careers using computers. Erica was going to be a primary school teacher and thought an ICT career could be an ICT teacher: "*I'm so confused 'cause to me every single career has ICT in it but not to the extent of - an ICT teacher of course but yeah, I don't know.*" Choice of careers seem to be influenced by various criteria. One of the students was following a course in clinical psychology as a result of a serendipitous moment at an open day at a local university and had happened to see a psychology demonstration using mice, and was inspired to think how experiments could be done without mice. This begs the question of how computer teachers could create these serendipity moments for computer careers as my data doesn't indicate any such inspiring moment for those considering a career in computing. Another student was trying to work out what careers suited the subjects she had taken, none of which she particularly enjoyed. One student who had taken ICT and Visual Art: Design had a good idea of what she wanted to do, namely architecture. Another was going to do computer science, as she had a father and brother who were both into computing and had encouraged her.

For some students there still appears to be a lingering perception of an ICT career implying sitting in front of a computer screen all day and not having much social interaction. This could have implications for teachers and schools in informing students about the high level of team work and communication required in many computer related careers. The question is also raised about what the IT industry is doing about the image it presents to young women. Orlov (2008) writes that enterprise IT is a fantastic field for young women today as it capitalizes on their strengths of communication, collaboration and problem solving, but it suffers from an outdated image, inadequate promotion and misconceptions about exactly what the work is.

I realise that because of my passion and background, I may perceive the lack of girls in ICT careers as a problem; the IT industry certainly acknowledges the lack of ICT

graduates as a problem; but the girls in my research do not appear to see it as a problem. Responses in the mind map included "*future (x7); research (x3); discovering new things; improvements in technology; economic growth; artificial intelligence; technology developments; new updates; modern technology (x2); new technology invented every day; newest models*." These responses seem to indicate that girls are not uninformed about technology, and yet they do not seem to be making the link to careers in ICT; or if they know there are careers (even if they don't know about specific careers) they don't seem to be sufficiently stimulated to want to find out more. In the end, they will make their own choices. But it would be good to try and ensure that they are informed choices; that the girls can be shown that perhaps they have a responsibility to be a part of developing new technologies, for example by developing websites that are easy to navigate, or designing cell phones that cradle easily between their shoulder and ear, as women are bigger consumers of technology than men (Tahmincloglu, 2008). This issue may be an implication for not only teachers and schools but for society and the media as well.

> We want a diversity of perspectives when we are designing new technologies, and if girls are not at the table when the technology is being designed and created, this technology is less likely to speak to all of us (Bystydzienski & Bird, 2006, p. 277).

3. What are the implications for teachers and schools?

Literature shows that recognition is now being given to what many social science researchers and gender studies scholars have been advocating for some time, that the barriers to women's progress in the fields of science and engineering is systemic. According to the computer industry, computer science as a discipline needs to change, with more emphasis and interest in the end users; more teaching and explanation of the complex realities of computers and their applications within work organizations. What have the girls' voices told us about how computing is taught in schools? What changes are needed in the computer culture in the educational context to improve its image and make it more appealing to girls and women?

How do we overcome the idea that girls who like computers are 'different'? How could we as teachers encourage girls to want to see 'behind' the use of programs, and relate it to what they do? There does not appear to be a desire of wanting to know how to create the tools that are used, or how the communications actually work. I am aware that this could reflect on the historical nature of the technology, like motor cars, as I myself am happy to use a car, but was never really encouraged to know how it works. The implication for schools could be to redesign computer courses and content, so that in addition to current computer courses being offered, girls are encouraged to learn more about creative computing and how to design the tools, as well as use them. Computer programming as a specialist course could appeal to girls, if they could see the fun and creativity and relevance in it. This raises the question of how good are our schools at encouraging innovation and facilitating new courses.

Language used to describe a course may have been a contributing factor in student choices of taking specialist computer courses. The data shows that how schools name their courses, and describe the content covered in the courses, may determine what students associate with specialist computer courses and terminology, and could influence them in taking the course or not. Thought needs to be given to the labelling of courses, and the associations they invoke. Course descriptions should perhaps be in a language that clearly relates the content of the course to everyday life, and makes it useful and relevant to learn.

From the data, it would appear that experience of computers for girls in this study is mainly from the context in which girls use the computer: home, school, work and leisure/entertainment. Perceptions of meanings and computer culture are gained from family, peers, school and the media. Familiarity through introductory school classes of keyboarding and productivity software encouraged girls to continue with ICT-related courses in senior years as they were able to achieve in it. Perhaps what schools could do is start in Years 9 and 10 with including a small introduction to various aspects of the computer such as simple hardware, simple programming, simple multimedia, as well as keeping a focus on the essential keyboarding skills and application software. This may

alleviate some of the myth of it being 'too hard'. Only introducing it in senior years could be "too much too late" and too overwhelming, especially given evidence from girls in the study that they already have career paths planned. Research from Durndell et al. (1995) show that attempts to narrow the gender gap in computing at higher levels should concentrate on interesting and attracting girls in the middle and latter years of secondary school. There will certainly be no quick-fix solution as it took a number of years for Mathematics to be a subject girls were happy to take and excel in, implying that the closing of the gender gap in computing may be a long term process.

Data suggests that career choices may be made early in secondary school, therefore teachers need to inform students of opportunities in ICT careers in junior secondary school, so that they could make more informed choices of career paths. School career advisors can't keep up with the swiftly changing scene in IT and T. Computing, after all, is only one subject among many that they have to know about. A number of the participants indicated that their parents did not quite understand what they were doing in the computer courses, so perhaps evenings with parents would help inform them about available computer careers, as students are influenced by parents and caregivers in their choice of careers. For the girls, meeting people face to face and talking with them, may be of value to counter the perception of "*sitting in front of a computer and typing*". It may be that had there been some career guidance in earlier years informing her of career opportunities, especially in the field of design and multimedia, Monica may have been encouraged to make a change in her choice of subjects as she admitted to being really interested in clothing and public speaking, and didn't particularly like her science subjects.

Girls expressed concern at the perceived isolation of a computer worker. As specialist computer teachers we should inform students of how many opportunities there are for jobs using all sorts of computer skills and packages, as well as people and communication skills. Technology has blossomed in all aspects of life, and both students and parents need to be educated in the opportunities that abound.

Another point mentioned by some of the students, for example Sheryl, was the lack of opportunity in practical aspects. If there was more 'hands-on' teaching, it could take away some of the mystery of the how the computer works, build up confidence, remove the idea that (only) boys like to see how things work, and maybe encourage girls into some of the more practical aspects of specialist computer courses. Esther and Helen in Class Case A were enjoying the practical robot topic, and Andrea had considered the course which included robotics "*the only reason why I wanted to do that was that I got to play with robots*" though decided against it. Today's Year 9 students are in a different technology space to where the current Year 13 girls were five years ago. Courses should reflect this change, and it is achievable, as shown by the positive results of this kind of initiative at Carnegie Mellon University (Margolis & Fisher, 2002). If there is a constructive end-point, to learning about robots, say, other than destructive war games, girls' interest may be stimulated; for example, robots to help the handicapped or to protect people from dangerous situations. Girls could be enlightened to the possibilities of programs to enhance and improve aspects of society.

Turkle and Papert (as cited in Clegg, 2001) challenge the notion that there is only one way to do computing. They describe the strategy of a 'bricoleur' whose point of entry into computing is through graphics, sound and text; by being inside the process rather than through formal methods of programming. From the survey data, there was an indication that the multimedia courses using sound, images and sophisticated software were well supported. Could this be the bricoleur approach? How could we as teachers ensure that the girls have positive experiences in computer specialist courses? Sheryl commented that girls get into computing from their social life, and as their confidence increases, they extend their knowledge. This is strengthened by the responses from the mind map which seem to indicate a significant use of the computer for communications and information gathering. Research relating to communications and leisure pursuits presents some possibilities and may present teachers with another bricoleur approach.

Current literature suggests that girls are interested in games with engaging characters, opportunities for communication and collaboration, a rich narrative and roles involving positive social action (Margolis & Fisher, 2002). Though there was some mention of games in the mind maps responses, it was noticeable that none of the interviewees were interested in computer games. Martinson (2006) writes that computer games for girls have received considerable research attention, but that the leisure experiences of a particular group need to be considered in the context of that experience, and that more studies in the use of computer technology in leisure pursuits need to be undertaken. She comments that recent research suggests that in the digital realm, email and chat rooms constitute leisure environments for women. Learning how to use the Internet correctly was a suggestion of one of the students "… *you know you can get information much more faster so you don't have to waste a lot of time using computers*", and learning about design from another. Perhaps specialist courses that incorporated these topics, with some programming as incidental learning, may prove more attractive to the girls.

Nuthall (2001) mentions that a high degree of learning comes from social interaction with peers. A number of the girls interviewed said how they used the computer extensively for email and the Internet, and phrases from the mind map indicate a lively interest in this area of social communication. Monica explains how she and her friends "… *were asking each other what we should do from this step onwards and gather ideas from other people*." How much peer teaching could we use? How could teachers use student knowledge to keep each other informed? Perhaps a different approach in teaching methods could stimulate interest in computer courses; especially in technology where it is impossible to know and keep up to date with everything. And if students are better informed about the many facets of computing (according to my ideas) they could be a positive influence on their peers.

In summary, some suggested actions that schools could take as a starting point to try and break down stereotypes and myths that seem to be discouraging girls into computer specialist courses are:

- Be aware of the labelling of courses; keep the language and descriptions simple.
- Inform students of the team work and communication skills required in computer careers.
- Inform students while they are still in junior secondary school of the many and varied computer careers available.
- Hold career guidance evenings to inform parents of the many and varied computer careers available.
- Include more 'hands-on' teaching to encourage confidence in girls as to how the computer works.
- In Years 9 and 10 include a small introduction to various aspects of the computer such as simple hardware, simple programming, simple multimedia, as well as keeping a focus on the essential keyboarding skills and application software.

Conclusion

The findings of this study raise as many, if not more questions than they present answers. They reveal a complex situation relating to the perceptions of girls to computing. There is a positive note in that some schools are attempting to make changes in courses for the junior secondary school, and work is progressing on the Digital Technology Framework initiative of the MOE (now known as the Digital Technology Guidelines). Research in five years time may reveal further interesting data as to how initiatives currently being implemented in schools as well as the rapid development of technology and the ongoing impact of computers on society affect girls' perceptions on computing.

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Appendix A

Master of Teaching and Learning Research paper

Survey

I am a researcher interested in finding out what your perceptions and ideas of specialist computer courses are. Your responses, which are confidential, could be used to plan courses that are of interest and value to you. Your answers, therefore, are very important. However, completion of this survey is voluntary. You have the right to withdraw at any time.

Name of your school: _____

This survey is in two sections:

***Section One** is a 'brainstorming mindmap'.*

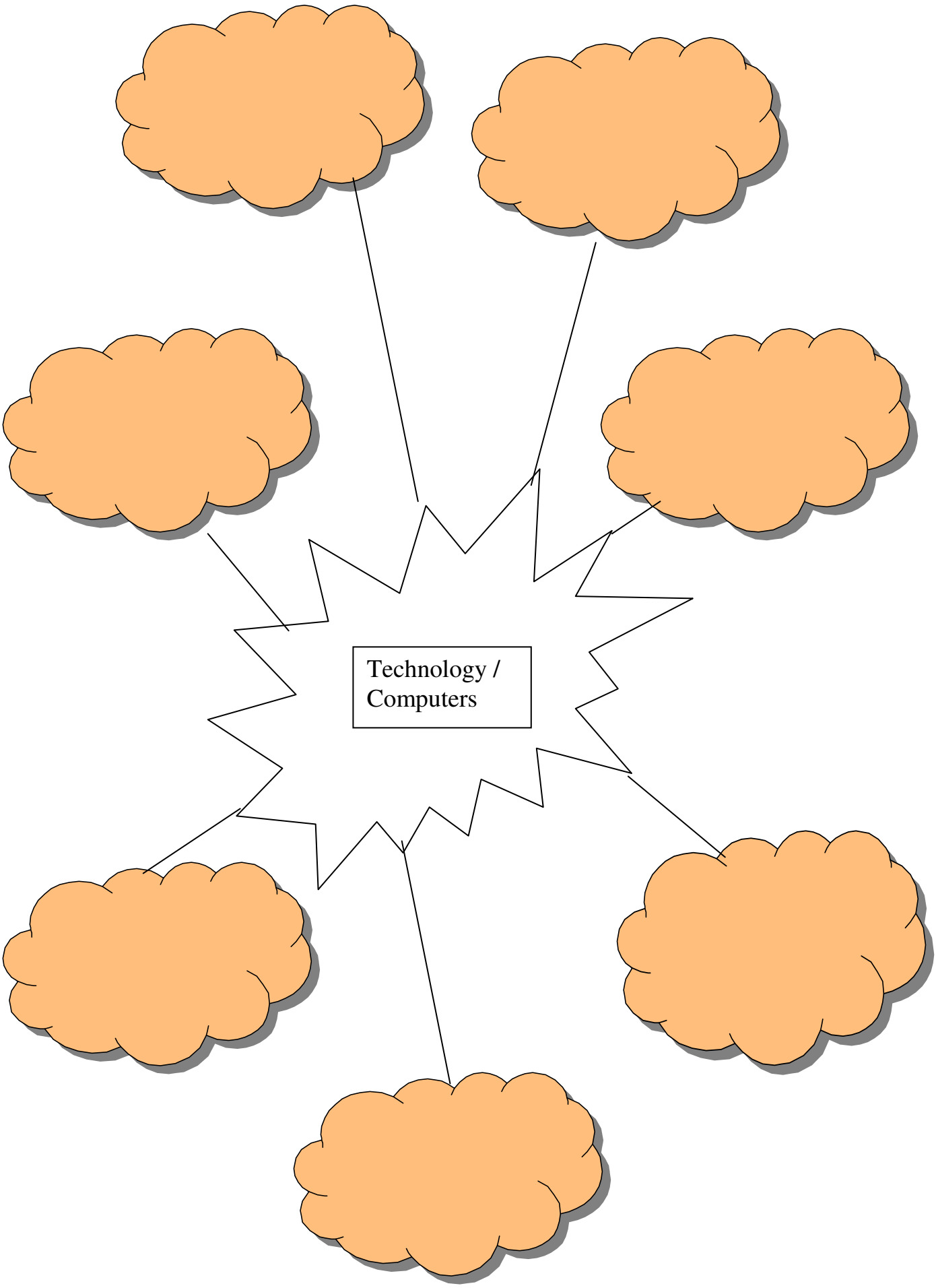
What ideas or thoughts or feelings come to mind when you hear the phrase: "Technology/Computers"?

Write down your thoughts and/or ideas and/or feelings in the bubble/clouds on the map. You can add more bubbles if you wish.

***Section Two** is a multi-choice survey form.*

High Technology/Computers refers to what you understand by ICT, Computer Studies, Information Management, Computer Science, etc.

Thank you for taking the time to complete this survey!


Technology /
Computers

Section Two:
Please circle the letter of the answer you think is best eg (a), (b) or (c) etc.

1 I will definitely be taking more courses in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

2 My teachers think I'm the kind of person who could do well in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

3 I am sure I could do advanced work in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

4 I am not interested in pursuing a career in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

5 Figuring out high technology/computer problems does not appeal to me.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

6 My parent/caregiver has always been interested in my progress in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

7 Studying high technology/computers is just as appropriate for women as for men.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

8 Figuring out multimedia/computer problems does not appeal to me.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

9 I'll need high technology/computers for my future work.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

10 My high technology/computer teachers have been interested in my progress in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

11 Taking high technology/computers is a waste of time.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

12 I am not seriously considering the possibility of pursuing a career in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

13 I'll need multimedia/computers for my future work.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

14 I like high technology/computer problems.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

15 My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

16 Writing computer programs is for men; using computer applications, such as word processing, is for women.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

17 My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

18 I won't be taking any more courses in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

19 Getting a high technology/computer teacher to take me seriously has usually been a problem.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

20 I think that I could handle more difficult high technology/computer courses.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

21 Multimedia/computers are enjoyable and stimulating to me.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

22 My future academic plans do not include any high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

23 High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

24 I am seriously considering the possibility of pursuing a career in high technology / computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

25 I will definitely be taking more courses in multimedia/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

26 Women certainly are logical enough to do well in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

27 My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

28 I'm no good in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

29 My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

30 I'm not the type to do well in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

31 I won't be taking any more courses in multimedia/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

32 It's hard to believe a female could be a genius in high technology/computers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

33 When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

34 High technology/computer problems are boring.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

35 I will use high technology/computers in many ways as an adult.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

36 My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

37 High technology/computers is a subject I will continue to take after I finish high school.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

38 High technology/computers are enjoyable and stimulating to me.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

39 My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

40 High technology/computers are of no relevance to my life.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

41 Multimedia/computers are of no relevance to my life.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

42 If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.

A	B	C	D	E
Strongly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Strongly Agree

43. Which gender are you?

(a) Male
(b) Female

44. Which ethnic group, or groups, do you identify with?

(a) NZ European/Pakeha
(b) Maori
(c) Pacific Nation(please name) _____
(d) Asian Nation (please name) _____
(e) Other (please state) _____

45. Would you like to be interviewed to talk about your ideas and thoughts on computing in schools?

(a) Yes
(b) No

46. If you answered Yes to question 45, Please write down your name:

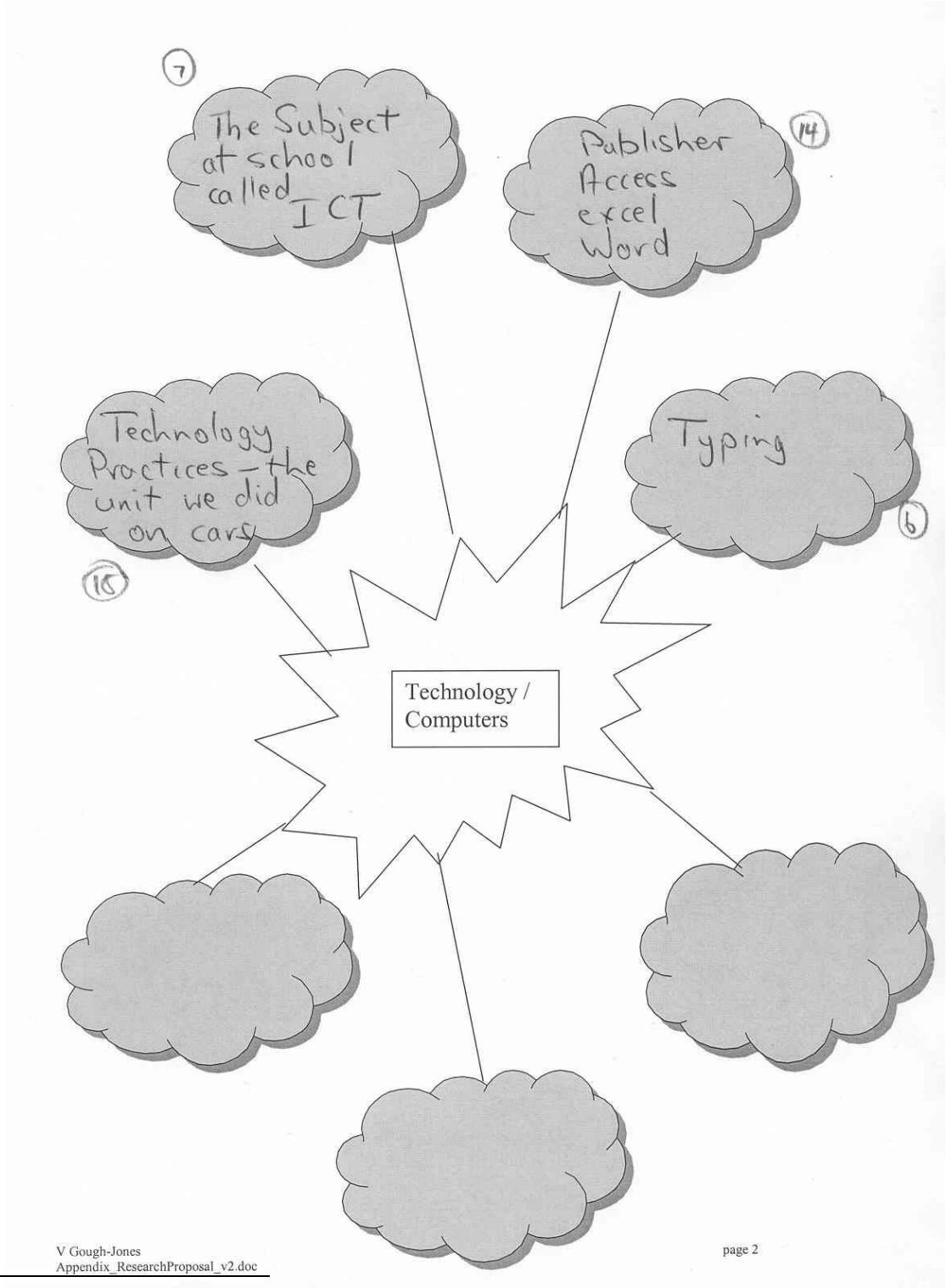
_____

Thank you for taking the time to complete this survey!

Appendix B

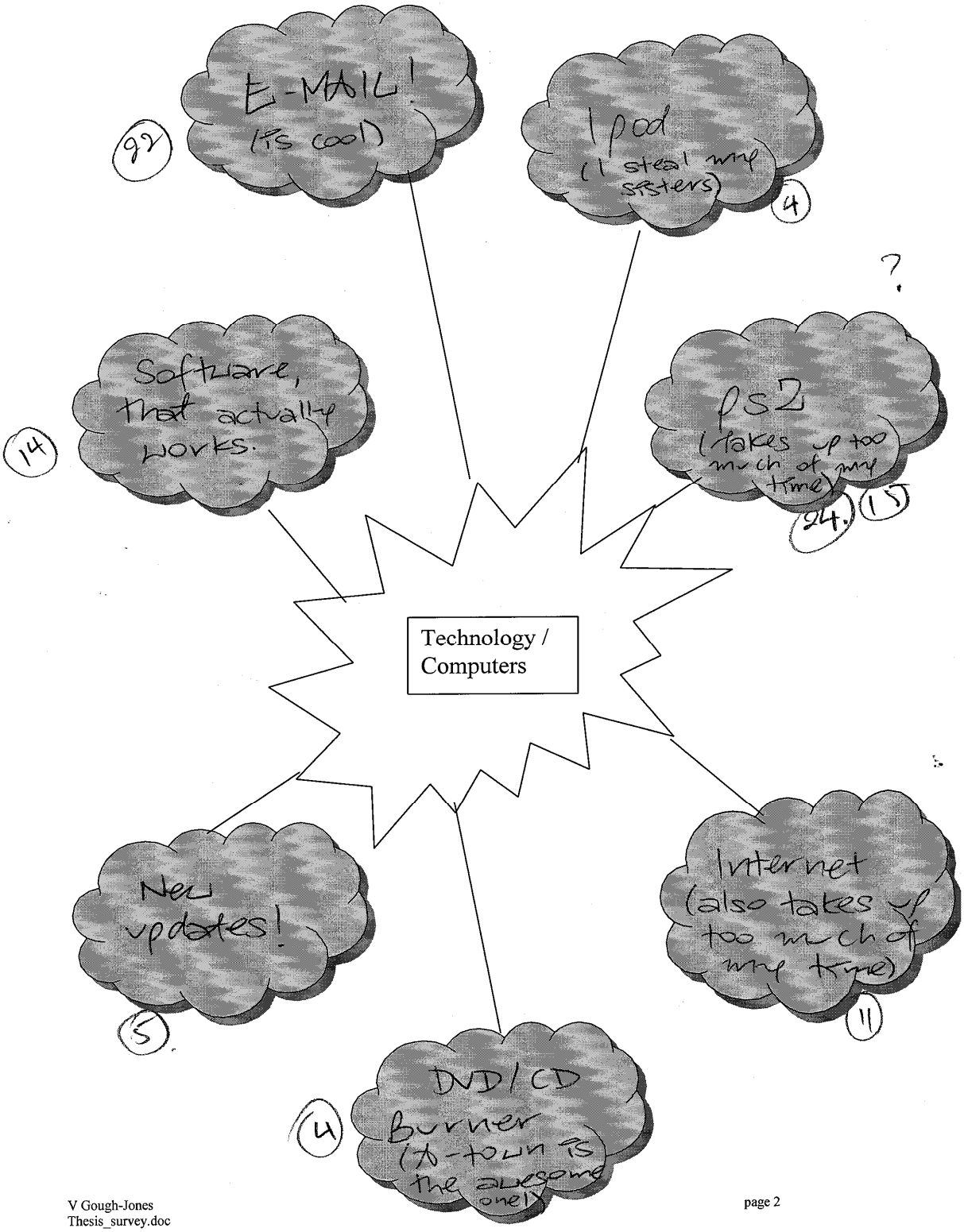
Examples of student response to mindmaps[3]

Student 1

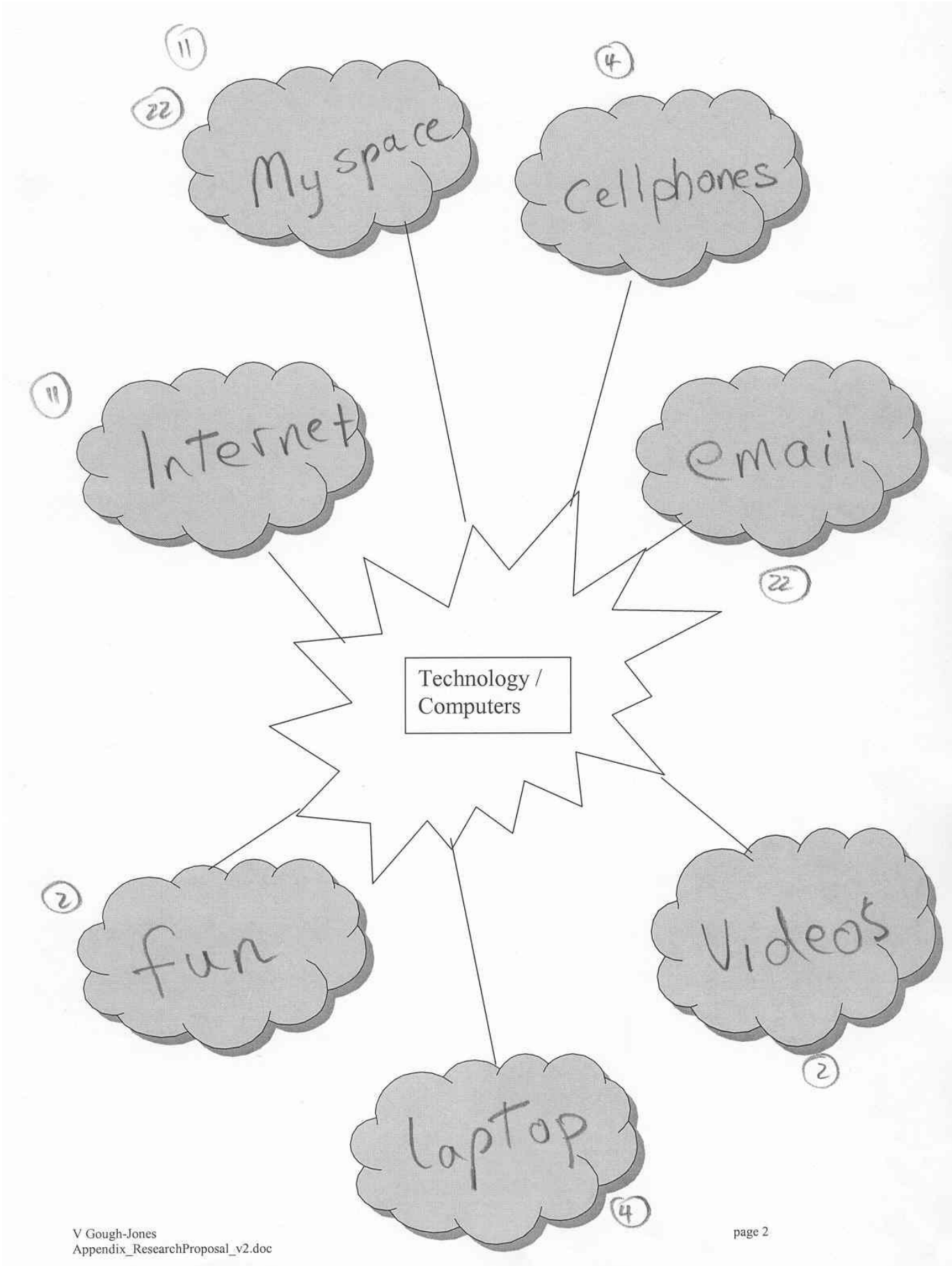


[3] The numbers next to each bubble refer to my personal coding system

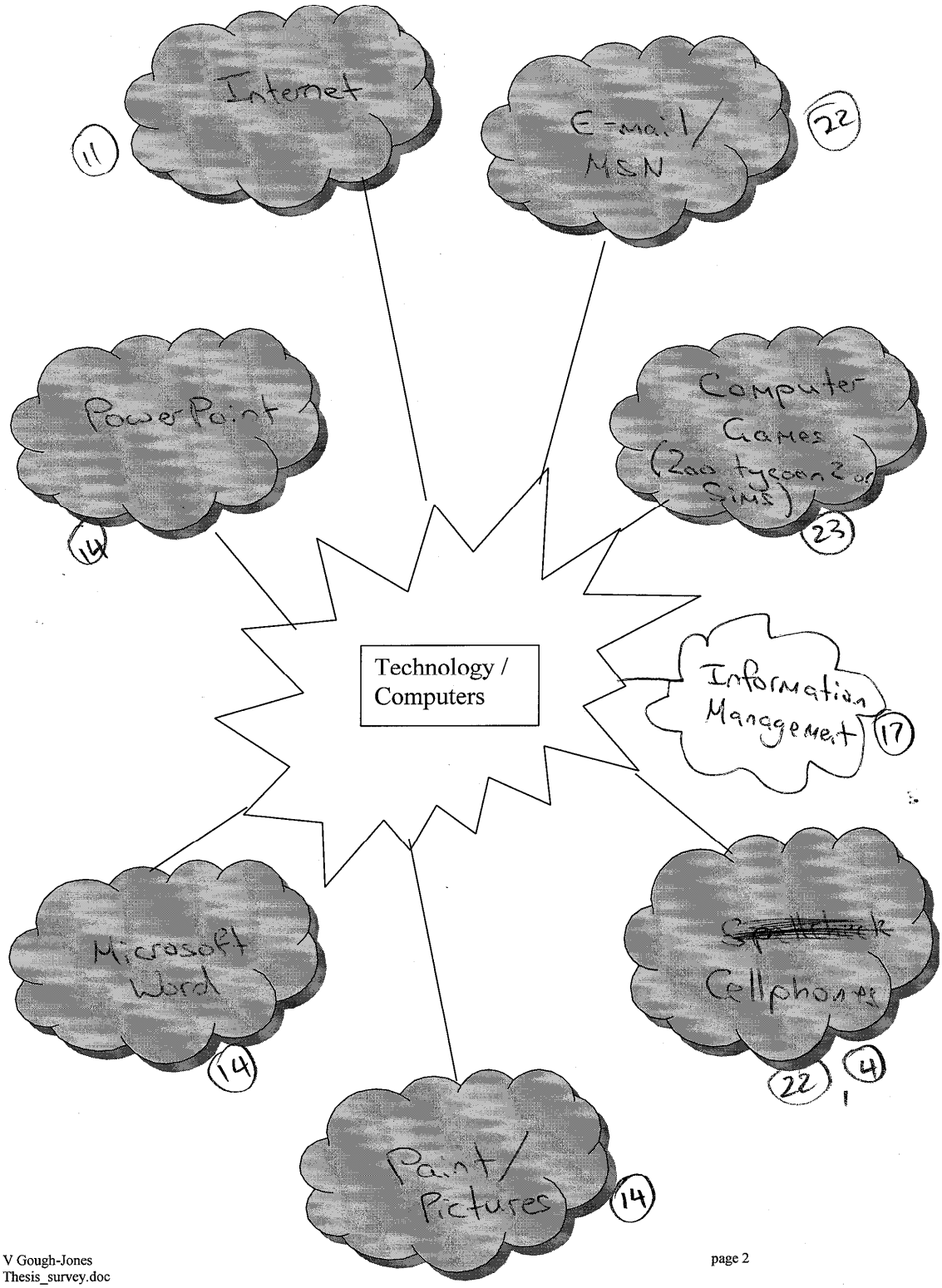
Student 2


E-MAIL! (is cool)
92
Ipod (I steal my sisters)
4
?
Software, that actually works.
14
PS2 (takes up too much of my time)
24.
15
Technology / Computers
New updates!
5
Internet (also takes up too much of my time)
11
DVD/CD Burner (A-town is the awesome one!)
4

Student 3


11
22
My space
4
Cellphones
11
Internet
email
22
Technology / Computers
2
fun
Videos
2
laptop
4
V Gough-Jones
Appendix_ResearchProposal_v2.doc
page 2

Student 4


Internet
11
E-mail/ MSN
22
PowerPoint
14
Computer Games (Zoo tycoon 2 or Sims)
23
Technology / Computers
Information Management
17
Microsoft Word
14
Cellphones
22
4
Paint/ Pictures
14

Appendix C

Explanation of structure of questionnaire

Computer-Related Attitudes and Future Intentions

Perceptions of Support Items

Teacher Support:

2. My teachers think I'm the kind of person who could do well in high technology/computers.
10. My high technology/computer teachers have been interested in my progress in high technology/computers.
* 19. Getting a high technology/computer teacher to take me seriously has usually been a problem.
23. High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.
*29. My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.
*33. When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.

Parent/Caregiver Support:

6. My parent/caregiver has always been interested in my progress in high technology/computers.
15. My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.
* 17. My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.
*27. My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.
*36. My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.
39. My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.

Computer-Related Attitudes Items

Confidence:

3. I am sure I could do advanced work in high technology/computers.
20. I think that I could handle more difficult high technology/computer courses.
*28. I'm no good in high technology/computers.
*30. I'm not the type to do well in high technology/computers.

Intrinsic Value:

*5. Figuring out high technology/computer problems does not appeal to me. .
14. I like high technology/computer problems.
*34. High technology/computer problems are boring.
38. High technology/computers are enjoyable and stimulating to me.
8. Figuring out multimedia/computer problems does not appeal to me. .
*21. Multimedia/computers are enjoyable and stimulating to me.

Usefulness:

9. I'll need high technology/computers for my future work.
* 11. Taking high technology/computers is a waste of time.
35. I will use high technology/computers in many ways as an adult.
*40. High technology/computers are of no relevance to my life.
*13. I'll need multimedia/computers for my future work.
41. Multimedia/computers are of no relevance to my life.

Gender Stereotyping:
7. Studying high technology/computers is just as appropriate for women as for men.
*16. Writing computer programs is for men; using computer applications, such as word processing, is for women.
26. Women certainly are logical enough to do well in high technology/computers.
*32. It's hard to believe a female could be a genius in high technology/computers.

Future Intentions Items
Future Academic Intentions:
1. I will definitely be taking more courses in high technology/computers.
*18. I won't be taking any more courses in high technology/computers.
*22. My future academic plans do not include any high technology/computers.
37. High technology/computers is a subject I will continue to take after I finish high school.
25. I will definitely be taking more courses in multimedia/computers.
*31. I won't be taking any more courses in multimedia/computers.

Future Occupational Intentions:
*4. I am not interested in pursuing a career in high technology/computers.
* 12. I am not seriously considering the possibility of pursuing a career in high technology/computers.
24. I am seriously considering the possibility of pursuing a career in high technology / computers.
42. If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.

Note. Item numbers refer to random order of presentation in the questionnaire.
All items are answered on scales ranging from 1 to 5. Items which are reverse coded (i.e., negatively worded items) are indicated by an asterisk.
Response Format

A	**B**	**C**	**D**	**E**
Strongly Disagree	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Strongly Agree**

Appendix D

Results for Totals over all Cases

Computer-Related Attitudes and Future Intentions	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Strongly Agree**
Perceptions of Support Items					
Teacher Support:					
2. My teachers think I'm the kind of person who could do well in high technology/computers.	4	4	23	9	9
10. My high technology/computer teachers have been interested in my progress in high technology/computers.	3	8	25	9	4
* 19. Getting a high technology/computer teacher to take me seriously has usually been a problem.	10	15	17	7	0
23. High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.	0	7	21	14	7
*29. My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.	14	13	13	7	2
*33. When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.	12	18	17	1	1
Parent/Caregiver Support:					
6. My parent/caregiver has always been interested in my progress in high technology/computers.	2	11	15	12	9
15. My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.	2	2	21	16	8
* 17. My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.	14	11	14	9	1
*27. My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.	19	18	11	0	1
*36. My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.	22	17	8	2	0
39. My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.	2	10	24	10	3
Computer-Related Attitudes Items					
Confidence:					
3. I am sure I could do advanced work in high technology/computers.	1	6	20	15	7
20. I think that I could handle more difficult high technology/computer courses.	3	9	20	11	6
*28. I'm no good in high technology/computers.	13	17	15	4	0
*30. I'm not the type to do well in high technology/computers.	12	16	12	8	1
Intrinsic Value:					
*5. Figuring out high technology/computer problems does not appeal to me. .	9	9	15	13	3
14. I like high technology/computer problems.	4	8	14	14	9
*34. High technology/computer problems are boring.	9	14	11	12	3
38. High technology/computers are enjoyable and stimulating to me.	1	5	16	18	9
8. Figuring out multimedia/computer problems does not appeal to me. .	11	15	13	9	1
*21. Multimedia/computers are enjoyable and stimulating to me.	0	2	11	26	10

Usefulness:

9. I'll need high technology/computers for my future work.	0	2	14	21	12
* 11. Taking high technology/computers is a waste of time.	27	16	4	1	1
35. I will use high technology/computers in many ways as an adult.	0	2	8	26	13
*40. High technology/computers are of no relevance to my life.	24	16	7	2	0
*13. I'll need multimedia/computers for my future work.	1	6	13	19	10
41. Multimedia/computers are of no relevance to my life.	24	16	9	1	0

Gender Stereotyping:

7. Studying high technology/computers is just as appropriate for women as for men.	1	0	4	6	38
*16. Writing computer programs is for men; using computer applications, such as word processing, is for women.	31	10	6	1	1
26. Women certainly are logical enough to do well in high technology/computers.	0	0	6	12	31
*32. It's hard to believe a female could be a genius in high technology/computers.	35	9	5	0	0

Future Intentions Items

Future Academic Intentions:

1. I will definitely be taking more courses in high technology/computers.	2	2	13	20	12
*18. I won't be taking any more courses in high technology/computers.	16	14	15	3	1
*22. My future academic plans do not include any high technology/computers.	13	15	16	5	0
37. High technology/computers is a subject I will continue to take after I finish high school.	2	7	18	14	8
25. I will definitely be taking more courses in multimedia/computers.	1	5	19	16	8
*31. I won't be taking any more courses in multimedia/computers.	14	19	13	2	1

Future Occupational Intentions:

*4. I am not interested in pursuing a career in high technology/computers.	8	14	16	11	0
* 12. I am not seriously considering the possibility of pursuing a career in high technology/computers.	6	12	13	17	1
24. I am seriously considering the possibility of pursuing a career in high technology / computers.	2	11	24	10	5
42. If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.	0	7	19	14	8

Note. Item numbers refer to random order of presentation in the questionnaire.
All items are answered on scales ranging from 1 to 5. Items which are reverse coded (i.e., negatively worded items) are indicated by an asterisk.

Results for Class Case A

Computer-Related Attitudes and Future Intentions	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Strongly Agree**
Perceptions of Support Items					
Teacher Support:					
2. My teachers think I'm the kind of person who could do well in high technology/computers.	3	3	13	1	6
10. My high technology/computer teachers have been interested in my progress in high technology/computers.	3	4	14	2	3
* 19. Getting a high technology/computer teacher to take me seriously has usually been a problem.	4	7	11	4	0
23. High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.	0	4	12	5	5
*29. My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.	6	6	9	4	1
*33. When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.	6	6	13	1	0
Parent/Caregiver Support:					
6. My parent/caregiver has always been interested in my progress in high technology/computers.	1	6	9	4	6
15. My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.	0	1	12	8	5
* 17. My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.	6	6	7	7	0
*27. My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.	9	10	6	0	1
*36. My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.	12	8	5	1	0
39. My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.	1	7	11	5	2
Computer-Related Attitudes Items					
Confidence:					
3. I am sure I could do advanced work in high technology/computers.	1	3	9	9	4
20. I think that I could handle more difficult high technology/computer courses.	2	4	10	5	5
*28. I'm no good in high technology/computers.	7	8	10	1	0
*30. I'm not the type to do well in high technology/computers.	6	9	7	4	0
Intrinsic Value:					
*5. Figuring out high technology/computer problems does not appeal to me. .	7	4	9	5	1
14. I like high technology/computer problems.	1	4	7	6	8
*34. High technology/computer problems are boring.	6	7	7	4	2
38. High technology/computers are enjoyable and stimulating to me.	1	3	8	7	7
8. Figuring out multimedia/computer problems does not appeal to me. .	6	8	8	4	0
*21. Multimedia/computers are enjoyable and stimulating to me.	0	2	6	12	6

Usefulness:

9. I'll need high technology/computers for my future work.	0	2	7	12	5
* 11. Taking high technology/computers is a waste of time.	14	6	4	1	1
35. I will use high technology/computers in many ways as an adult.	0	1	6	10	9
*40. High technology/computers are of no relevance to my life.	11	7	6	2	0
*13. I'll need multimedia/computers for my future work.	0	5	8	7	6
41. Multimedia/computers are of no relevance to my life.	12	7	7	1	0

Gender Stereotyping:

7. Studying high technology/computers is just as appropriate for women as for men.	1	0	3	4	18
*16. Writing computer programs is for men; using computer applications, such as word processing, is for women.	15	7	4	0	0
26. Women certainly are logical enough to do well in high technology/computers.	0	0	3	6	17
*32. It's hard to believe a female could be a genius in high technology/computers.	19	3	4	0	0

Future Intentions Items

Future Academic Intentions:

1. I will definitely be taking more courses in high technology/computers.	2	0	7	11	6
*18. I won't be taking any more courses in high technology/computers.	7	10	7	1	1
*22. My future academic plans do not include any high technology/computers.	5	9	9	3	0
37. High technology/computers is a subject I will continue to take after I finish high school.	2	2	10	7	5
25. I will definitely be taking more courses in multimedia/computers.	1	1	12	7	5
*31. I won't be taking any more courses in multimedia/computers.	7	11	6	1	1

Future Occupational Intentions:

*4. I am not interested in pursuing a career in high technology/computers.	5	4	11	6	0
* 12. I am not seriously considering the possibility of pursuing a career in high technology/computers.	4	8	6	8	0
24. I am seriously considering the possibility of pursuing a career in high technology / computers.	0	5	14	3	4
42. If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.	0	4	11	4	6

Note. Item numbers refer to random order of presentation in the questionnaire.
All items are answered on scales ranging from 1 to 5. Items which are reverse coded (i.e., negatively worded items) are indicated by an asterisk.

Results for Class Case B

Computer-Related Attitudes and Future Intentions	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Strongly Agree**
Perceptions of Support Items					
Teacher Support:					
2. My teachers think I'm the kind of person who could do well in high technology/computers.	0	0	2	8	3
10. My high technology/computer teachers have been interested in my progress in high technology/computers.	0	1	4	7	1
* 19. Getting a high technology/computer teacher to take me seriously has usually been a problem.	6	4	2	1	0
23. High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.	0	0	4	7	2
*29. My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.	5	3	1	3	1
*33. When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.	5	7	1	0	0
Parent/Caregiver Support:					
6. My parent/caregiver has always been interested in my progress in high technology/computers.	0	3	3	5	2
15. My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.	1	1	3	5	3
* 17. My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.	6	3	3	1	0
*27. My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.	7	2	4	0	0
*36. My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.	6	4	2	1	0
39. My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.	0	2	8	2	1
Computer-Related Attitudes Items					
Confidence:					
3. I am sure I could do advanced work in high technology/computers.	0	1	7	3	2
20. I think that I could handle more difficult high technology/computer courses.	1	3	4	4	1
*28. I'm no good in high technology/computers.	4	6	3	0	0
*30. I'm not the type to do well in high technology/computers.	4	5	2	2	0
Intrinsic Value:					
*5. Figuring out high technology/computer problems does not appeal to me. .	2	2	5	3	1
14. I like high technology/computer problems.	1	2	4	5	1
*34. High technology/computer problems are boring.	2	5	3	2	1
38. High technology/computers are enjoyable and stimulating to me.	0	0	6	6	1
8. Figuring out multimedia/computer problems does not appeal to me. .	3	3	3	3	1
*21. Multimedia/computers are enjoyable and stimulating to me.	0	0	4	7	2

Usefulness:

9. I'll need high technology/computers for my future work.	0	0	4	5	4
* 11. Taking high technology/computers is a waste of time.	10	3	0	0	0
35. I will use high technology/computers in many ways as an adult.	0	0	1	9	3
*40. High technology/computers are of no relevance to my life.	7	5	1	0	0
*13. I'll need multimedia/computers for my future work.	1	1	3	7	1
41. Multimedia/computers are of no relevance to my life.	7	4	2	0	0

Gender Stereotyping:

7. Studying high technology/computers is just as appropriate for women as for men.	0	0	1	1	11
*16. Writing computer programs is for men; using computer applications, such as word processing, is for women.	10	2	0	0	1
26. Women certainly are logical enough to do well in high technology/computers.	0	0	3	1	9
*32. It's hard to believe a female could be a genius in high technology/computers.	10	2	1	0	0

Future Intentions Items

Future Academic Intentions:

1. I will definitely be taking more courses in high technology/computers.	0	1	2	6	4
*18. I won't be taking any more courses in high technology/computers.	7	2	4	0	0
*22. My future academic plans do not include any high technology/computers.	4	2	5	2	0
37. High technology/computers is a subject I will continue to take after I finish high school.	0	3	4	4	2
25. I will definitely be taking more courses in multimedia/computers.	0	2	4	4	3
*31. I won't be taking any more courses in multimedia/computers.	5	5	3	0	0

Future Occupational Intentions:

*4. I am not interested in pursuing a career in high technology/computers.	1	6	3	3	0
* 12. I am not seriously considering the possibility of pursuing a career in high technology/computers.	2	1	5	4	1
24. I am seriously considering the possibility of pursuing a career in high technology / computers.	2	4	5	4	1
42. If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.	0	1	5	6	1

Note. Item numbers refer to random order of presentation in the questionnaire.
All items are answered on scales ranging from 1 to 5. Items which are reverse coded (i.e., negatively worded items) are indicated by an asterisk.

Results for Class Case C

Computer-Related Attitudes and Future Intentions	**Strongly Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Strongly Agree**
Perceptions of Support Items					
Teacher Support:					
2. My teachers think I'm the kind of person who could do well in high technology/computers.	1	1	8	0	0
10. My high technology/computer teachers have been interested in my progress in high technology/computers.	0	3	7	0	0
* 19. Getting a high technology/computer teacher to take me seriously has usually been a problem.	0	4	4	2	0
23. High technology/computer teachers have made me feel I have the ability to go on in high technology/computers.	0	3	5	2	0
*29. My teachers would think I wasn't serious if I told them I was interested in a career in high technology/computers.	3	4	3	0	0
*33. When it comes to anything serious I have felt ignored when talking to high technology/computer teachers.	1	5	3	0	1
Parent/Caregiver Support:					
6. My parent/caregiver has always been interested in my progress in high technology/computers.	1	2	3	3	1
15. My parent/caregiver thinks I'm the kind of person who could do well in high technology/computers.	1	0	6	3	0
* 17. My parent/caregiver has shown no interest in whether or not I take more high technology/computer courses.	2	2	4	1	1
*27. My parent/caregiver wouldn't encourage me to plan a career which involves high technology/computers.	3	6	1	0	0
*36. My parent/caregiver thinks that advanced high technology/computers is a waste of time for me.	4	5	1	0	0
39. My parent/caregiver thinks that high technology/computers is one of the most important subjects I have studied.	1	1	5	3	0
Computer-Related Attitudes Items					
Confidence:					
3. I am sure I could do advanced work in high technology/computers.	0	2	4	3	1
20. I think that I could handle more difficult high technology/computer courses.	0	2	6	2	0
*28. I'm no good in high technology/computers.	2	3	2	3	0
*30. I'm not the type to do well in high technology/computers.	2	2	3	2	1
Intrinsic Value:					
*5. Figuring out high technology/computer problems does not appeal to me. .	0	3	1	5	1
14. I like high technology/computer problems.	2	2	3	3	0
*34. High technology/computer problems are boring.	1	2	1	6	0
38. High technology/computers are enjoyable and stimulating to me.	0	2	2	5	1
8. Figuring out multimedia/computer problems does not appeal to me. .	2	4	2	2	0
*21. Multimedia/computers are enjoyable and stimulating to me.	0	0	1	7	2

Usefulness:

9. I'll need high technology/computers for my future work.	0	0	3	4	3
* 11. Taking high technology/computers is a waste of time.	3	7	0	0	0
35. I will use high technology/computers in many ways as an adult.	0	1	1	7	1
*40. High technology/computers are of no relevance to my life.	6	4	0	0	0
*13. I'll need multimedia/computers for my future work.	0	0	2	5	3
41. Multimedia/computers are of no relevance to my life.	5	5	0	0	0

Gender Stereotyping:

7. Studying high technology/computers is just as appropriate for women as for men.	0	0	0	1	9
*16. Writing computer programs is for men; using computer applications, such as word processing, is for women.	6	1	2	1	0
26. Women certainly are logical enough to do well in high technology/computers.	0	0	0	5	5
*32. It's hard to believe a female could be a genius in high technology/computers.	6	4	0	0	0

Future Intentions Items

Future Academic Intentions:

1. I will definitely be taking more courses in high technology/computers.	0	1	4	3	2
*18. I won't be taking any more courses in high technology/computers.	2	2	4	2	0
*22. My future academic plans do not include any high technology/computers.	4	4	2	0	0
37. High technology/computers is a subject I will continue to take after I finish high school.	0	2	4	3	1
25. I will definitely be taking more courses in multimedia/computers.	0	2	3	5	0
*31. I won't be taking any more courses in multimedia/computers.	2	3	4	1	0

Future Occupational Intentions:

*4. I am not interested in pursuing a career in high technology/computers.	2	4	2	2	0
* 12. I am not seriously considering the possibility of pursuing a career in high technology/computers.	0	3	2	5	0
24. I am seriously considering the possibility of pursuing a career in high technology / computers.	0	2	5	3	0
42. If I were to make a list of potential careers at this point, high technology/ computers would be one of my choices.	0	2	3	4	1

Note. Item numbers refer to random order of presentation in the questionnaire.
All items are answered on scales ranging from 1 to 5. Items which are reverse coded (i.e., negatively worded items) are indicated by an asterisk.

Appendix E

Interview questions

1. So, how are things going?
   Listen for and ask about: last year's grades, this year's courses, etc. Non-threatening to put subject at ease.

2. Can you tell me the story about you and computers?
   Listen for and ask about: When, what, who, why and how did they become interested or not?

3. Do you have a computer at home? If so, who uses it?
   Family computing history; listen for and ask about: Computer in home, who uses it, parent's occupations, siblings, who are caregivers (who do they live with)?

4. What do you like most (or not) about computing?
   Listen for and ask about: software used, technologies used, projects completed, etc. why not interested (if relevant)

5. How much time would you estimate you spend on the computer in a week?

6. Computer games: Do you play computer games?
   Listen for and ask about: do they play games? What games? Do they write computer games? Would they like to learn how to write games?

7. Do you have any sport or hobbies? What do you enjoy doing?
   Extracurricular activities

8. What do you understand by the phrase "specialist computer course" at school?
   What are their perceptions – meanings for terms – really have to listen here

9. Can you tell me why (or not) you would enrol for such a course if you could?
   Listen for and ask about: experiences that were influential, mentors, peers, teachers, interests, aspirations, other.

10. What are your thoughts on computer programming?
    Listen for and ask about: what is it, do you like it? not like it? Why?

11. What are your thoughts on computer hardware?
    Listen for and ask about: what is it, do you like it? not like it? Why?

12. Tell me about your experiences in a computer class.
    Atmosphere, peers, teachers, content, size of class, ratio boys to girls in class, confidence

13. What subjects do you enjoy doing at school?
    Cognitive strengths, preferences. Listen for and ask about: what are your academic strengths?, likes?,

14. How do you learn best?

Learning styles: By example? By trial and error?

15. What skills do you think are necessary for specialist computing?
    Listen for what they think has importance re specialist computing.

16. What is your understanding of a career in ICT?
    Plans for the future.

17. Would a career in ICT appeal to you? Why/whynot?

18. What do you understand by computer science? by information systems? by applied computing? By electro technology?

19. What training do you think should be done at school for an IT career?
    Listen if they intend to study further – what/ why?

20. Do you have any ideas of why girls take or don't take specialist computer courses?
    Any ideas on what would have to be different to attract /excite more women into specialist computing?

21. What do you think is good about computers and technology?
    Ethics and influence of computers on society

22. What do you think is bad about computers and technology?

23. What is your understanding of ethics? In computer use?

24. If you could design a specialist computer course for schools, what do you think should be taught?

Appendix F

Documents seeking informed consent:

(a) Letter to Principals
(b) Consent form for students under 18
(c) Information for participants
(d) Information for Parents/Caregivers

24 Bidwell Place
Hillmorton
Christchurch
Email: gj@ccc.school.nz

7 August 2005

Principal
[School]
[Address]

Dear [Name]

I am currently working on a research paper which is a requirement of the Master of Teaching and Learning at the Christchurch College of Education. I am working under the supervision of Jane Abbiss and Julie Mackey, senior lecturers at the Christchurch College of Education.

The title of my thesis is: "**Girls' Perceptions of Studying Specialist Computer Courses at Secondary School."** Results and implications from the research could raise questions and guide changes to Information Technology (IT) courses that are of interest and value to female secondary students. I would like to use students from a year [ ] class in your school as participants in the project.

A class of year [ ] students will be asked to fill out a survey. Four female students from the class will be asked to participate in a semi-structured interview. Four female students from the class will be asked to participate in a group discussion. All participants will be volunteers.

Students will be asked to fill out a survey during term 4, 2005 or term 1, 2006 which will shed light on their perceptions of specialist computer courses, and provide guidelines for the interviews and group discussions. The surveys should take about 30 minutes to complete and will be done at the convenience of [staff member]. They will be collected by the staff teacher and processed by the researcher. The interviews and group discussions will be scheduled for the first and second terms in 2006. They should take approximately 45 minutes and will be completed outside school time in an environment that is safe and non threatening to the participants.

I will maintain the confidentiality of any information gathered and the anonymity of anyone involved. No findings that could identify any individual participant will be published. With students' permission, all interviews and group discussions will be tape recorded. This will assist with transcription and analysis. Confidentiality of raw data will be maintained between the researcher and her supervisors. For the group discussions, I will ask each participant to respect and be aware of the need for confidentiality, but as the researcher, I cannot guarantee the confidentiality and anonymity in the same way as for the interviews. The person who completes the task of transcribing the interview will be obliged to respect confidentiality.

Participation in the research project is, of course, entirely voluntary. Students who agree to participate can withdraw at any time. They may also choose not to answer some of the questions.

The Christchurch College of Education Ethics Committee has reviewed and approved this study.

Complaints Procedure
The College requires that all participants be informed that if they have any complaint concerning the manner in which a research project is conducted, it may be given to the researcher, or, if an independent person is preferred, to:

The Chair
Ethical Clearance Committee
Christchurch College of Education
P O Box 31-065
Christchurch
Phone: (03) 348 2059

Please contact me if you have any other queries or concerns about the project or would like to be informed of the aggregate research finding. I can be reached by phone on: 03 374 5100 or by email: gj@ccc.school.nz

Thank you for taking the time to consider my request and I look forward to hearing from you in the near future.

Yours sincerely

(Signature)

V Gough-Jones

Declaration of Consent

Participant

I consent to participate in the research project,

Girls' Perceptions of Studying Specialist Computer Courses at Secondary School.

I have understood the information provided to me about the research project and what will be required of me if I participate in the project.

I understand that the information I provide to the researcher will be treated as confidential and that no findings that could identify either me or my school will be published.

I understand that my participation in the project is voluntary and that I may withdraw from the project at any time without incurring any penalty.

Signature: _____

Parent/Guardian

I give permission for _____ to participate in the project,

Girls' Perceptions of Studying Specialist Computer Courses at Secondary School.

I have read and understood the information provided to me concerning the research project and what will be required of participants.

I am satisfied that _____ understands what will be required of participants in the project.

I understand that the information participants provide to the researcher will be treated as confidential and that no findings that could identify either them or their school will be published.

I understand that participation in the project is voluntary and that either I or the participant may choose to withdraw from the project at any time without incurring any penalty.

Name: _____ Date: _____

Signature: _____

7 August 2005

Information for Participants

Project Title:

Girls' Perceptions of Studying Specialist Computer Courses at Secondary School.

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My name is Vilna Gough-Jones and I am studying for a Master of Teaching and Learning at the College of Education.

I am looking for students in Year [ ] who are willing to fill out a survey which asks what they think about specialist computer courses.

I am looking for female students in Year [ ] who are willing to
(a) volunteer to have an interview with me,
(b) volunteer to be part of a discussion group.

The survey should take about 30 minutes to fill out and will be done during class time during term four in 2005 or term one in 2006. The interview will take approximately 45 minutes of your time, and will be scheduled outside school hours, at a time and place convenient to you. The group meeting will take approximately one hour of your time, and will be scheduled outside school hours, at a time and place convenient to you.

With your permission, all interviews and group discussions will be tape recorded. This will help me with transcription and analysis. A copy of the transcript of the interview will be given to you, so you may check the text for accuracy and can make any comments or corrections. When I write up the results of my research, no students' real names will be in the thesis or subsequent papers. The College rules say that I must keep all the information I use to write my paper for at least five years. All raw data from the interviews and group discussions are confidential to me, my supervisors and the person making the transcript. For the group discussions, I will ask each participant to respect and be aware of the need for confidentiality, but as the researcher, I cannot guarantee the confidentiality and anonymity in the same way as for the interviews. Remember that you do not need to answer any question you are uncomfortable with, and you may withdraw from the group at any time. All the raw data will be stored securely on a computer that has a password known only to me. There will be a back-up copy on a portable storage device that will be stored along with the field notes in a locked cabinet at my home. Data will be used only for this thesis, any conference papers, journal articles or subsequent reports drawn from the data.

If you agree to take part, you can withdraw at any time by writing to me or getting your parent or guardian to write for you. You may also choose not to answer some of the questions. If you have any questions, you or your parent or guardian can contact me at the number on this information sheet. Because it is important that no one is forced to take part in research when they don't want to, no student can take part in this research unless both they and their parent or guardian has said they want this to happen.

The Christchurch College of Education Ethics Committee has reviewed and approved this study.

The College requires that all participants be informed that if they have any complaint concerning the manner in which a research project is conducted, it may be given to the researcher, or, if an independent person is preferred, to:

The Chair
Ethical Clearance Committee
Christchurch College of Education
P O Box 31-065
Christchurch
Phone: (03) 348 2059

Thank you.

(Signature)

Vilna Gough-Jones

Phone: Work: 03 374 5100
Home: 03 339 0451
Email: gj@ccc.school.nz

7 August 2005

Information for Parents/Guardian of Participants

My name is Vilna Gough-Jones. I am working towards a Master of Teaching and Learning at the Christchurch College of Education. As part of my degree I am required to undertake a research project. I will be working under the supervision of Jane Abbiss and Julie Mackey, senior lecturers at the Christchurch College of Education.

My project is called:

Girls' Perceptions of Studying Specialist Computer Courses at Secondary School.

.

What is the aim of the research project?
The aim of this research is to discern some of the perceptions that secondary school girls have about specialist computing. Results and implications from the research could raise questions and guide changes to Information Technology (IT) courses that are of interest and value to female secondary students.

What is a specialist computing course?
A course about the **study of the principles and use of computers** as well as the **social and ethical** learning and knowledge. This includes learning about the computer as to how it works from both a hardware and software perspective; software engineering (programming); using the computer to critically analyse and solve problems using higher-order thinking skills; what are the social and ethical issues to be addressed

What types of participants are being sought?
Female students in Year 8, 9, 12 and 13 classes.

What will participants be asked to do?
Students will be asked to fill out a survey which asks what they think about specialist computer courses. Four female students will then volunteer to have an interview with me, and four female students will volunteer to be part of a discussion group.

How much time is involved?
The surveys should take about 30 minutes to complete and will be done during class time in term four, 2005 or term one, 2006. The interview will take approximately 45 minutes and will be scheduled outside school hours. The group discussions will take approximately one hour and will be scheduled to take place after the interviews are completed.

How will confidentiality and anonymity be addressed?
No findings that could identify any individual participant will be published. Data must be stored for at least five years according to college regulations. All raw data from the interviews and group discussions are confidential to me, my supervisors and the person making the transcript. For the group discussions, I will ask each participant to respect and be aware of the need for

confidentiality, but as the researcher, I cannot guarantee the confidentiality and anonymity in the same way as for the interviews. The participants do not need to answer any question they are uncomfortable with, and they may withdraw from the group at any time. The raw data will be stored securely on a computer that has a password known only to me. There will be a back-up copy on a portable storage device that will be stored along with the field notes in a locked cabinet at my home. Data will be used only for this thesis, any conference papers, journal articles or subsequent reports drawn from the data.

Are all students required to participate?
No, participation is voluntary.

What happens to students who choose not to participate?
Students who are not taking part will not complete the questionnaires. Children who do not participate will not be penalized or disadvantaged in any way.

If I agree to let my child take part, can I change my mind and withdraw my child from the study?
If you agree to have your child take part, you can withdraw at any time by writing to me. Your child may also choose not to answer some of the questions.

The Christchurch College of Education Ethics Committee has reviewed and approved this study.

Complaints Procedure
The College requires that all participants be informed that if they have any complaint concerning the manner in which a research project is conducted, it may be given to the researcher, or, if an independent person is preferred, to:

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Please contact me if you have any other queries or concerns about the project or would like to be informed of the aggregate research finding. I can be reached by phone on: 03 339 0451 (home) or 03 374 5100(work) or by email: gj@ccc.school.nz

Thank you.

(Signature)

Vilna Gough-Jones