Community Attitudes and an ICT Intervention Program for School Girls

Amber Beth McLeod

BSC (Applied Biology), Grad Dip Ed, MA (Applied Linguistics)

Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

Faculty of Education, Monash University, Victoria, Australia

November, 2014

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Abstract

Women are under-represented in Information and Communication Technology (ICT). The proportion of females to males is low in the workforce, in tertiary institutions, and at secondary school. Intervention programs designed to encourage more females to have an interest in ICT have, in many cases, failed to have the expected impact of a growth in female numbers. A possible explanation is that ICT and gender stereotypes held in society are discouraging females from an interest in the area. In this thesis, the importance of community attitudes towards ICT to the outcome of the Digital Divas Intervention (DD) Program, run in secondary schools in Australia from 2009 to 2012, is investigated. The communities surrounding two DD program cohorts from secondary schools in Victoria, Australia, were surveyed in terms of their attitudes towards gender and ICT, ICT people and jobs, and the importance and enjoyment of computing. These community attitudes were then compared with attitudinal change among the DD students after participation in the DD program. A pattern emerged indicating that changes in attitude among the DD students, after participation in the DD program, generally occurred when there was a diversity of attitudes across community sub-groups; when community sub-group attitudes were uniform such changes generally did not occur. In addition, the assumptions underpinning the DD program were not always correct; this may have inadvertently negatively influenced its outcomes.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other institution and, to the best of my knowledge, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signed:

Name: Amber B McLeod

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Acknowledgments

I would like to express my gratitude to my supervisors, Professor Helen Forgasz and Associate Professor Catherine Lang, for their guidance and kindness. I have learned so much from you both and your support has been invaluable.

I am indebted to the other members of the Digital Divas team, Julie Fisher and Annemieke Craig, as well as the schools, teachers, parents, and students; without their cooperation this study would not have been possible.

Thank you to my partner, Andy, and my wonderful children, Benjamin and Joshua for putting up with me through the highs and lows. Thanks also to my grandmother, Daphne, for feeding me tea and biscuits in her quiet, peaceful house every week as I worked on this thesis.

Finally, thanks to my mother, Dale, for her encouragement, patience, and for never doubting that I would make it to the end of this journey.

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Lists of Abbreviations

ABS	Australian Bureau of Statistics.
ACARA	Australian Curriculum, Assessment and Reporting Authority.
ANOVA	Analysis of Variance.
ARC	Australian Research Council.
CC4G	Computer Club for Girls.
DEECD	Department of Education and Early Childhood Development.
DEEWR	Department of Education, Employment and Workplace Relations.
DICTA	Department of Communication, Information Techology and the Arts.
ICSEA	Index of Community Socio-Educational Advantage.
ICT	Information and Communication Technology.
IPM	Information Processing and Management.
IS	Information Systems.
IT	Information Technology.
MMV	Multimedia Victoria.
MORI	Market and Opinion Research International.
NAPLAN	National Assessment Program - Literacy and Numeracy.
NCWIT	National Center for Women and Information Technology.
NESB	Non-English Speaking Background.
SCSEEC	Standing Council on School Education and Early Childhood.
STEM	Science, Technology, Engineering, and Mathematics.
TAFE	Technical and Further Education.
VCAA	Victorian Curriculum and Assessment Authority.
VCE	Victorian Certificate of Education.
VTAC	Victorian Tertiary Admissions Centre.

Chapter One: Introduction

Males dominate the Information and Communication Technology (ICT) field in Australia. The proportion of females to males in the workforce, tertiary institutions, and at secondary school is low. Intervention programs designed to encourage more females to have an interest in ICT have, in many cases, failed to have the expected impact of a growth in female numbers. In this thesis, the premise that ICT and gender stereotypes held within society were discouraging females from participating in the area was explored. In particular, this thesis investigated the influence of community attitudes on the outcomes of a specific program, the Digital Divas Intervention Program (hereafter referred to as the DD program). The DD program was conducted at ten secondary schools in Victoria, Australia, from 2009-2012. It was an elective subject for female students only, which aimed to increase the girls' enjoyment of, and confidence in, the use of ICT, while expanding their knowledge of careers in the field. Using prescribed modules it was hoped girls would be encouraged to pursue an interest, future course, or career in the area.

Community attitudes towards females and ICT were investigated through: a media review; a survey of Victorian parents; and a survey of two school communities including parents, teachers, and peers of those participating in the DD program. In addition, data collected by the DD research team from the two participating schools were used, allowing a deeper investigation of each school's ICT culture and the DD program teachers. The DD research team gathered data from the participating schools, students, and teachers through observation, questionnaires and interviews. From the gathered data, the relationship between attitudes held by the community about ICT and the findings from the DD program was examined in order to explore how important these community attitudes were to the success of the DD program in these two cases. The PhD study suggested that community attitudes were important to the outcomes of the DD program. In particular, it suggested that changes in attitude among the DD students, after participation in the DD program, generally occurred when there was a diversity of attitudes across community sub-groups; when community sub-group attitudes were uniform such changes generally did not occur.

In this chapter, the research topic is introduced through an explanation of the background and context of the problem, and the theoretical framework used in this study. This provides a rationale for this study and leads to the statement of the research question. The method adopted for the conduct of the research design is described and the ways in which the findings may contribute to the field of research are discussed. This is followed by a clarification of the concept of intervention programs, an explanation of the terms used in this study, and an outline of the contents of each chapter.

Context

Women have declining representation in the expanding ICT industry (Department of Education, Employment and Workplace Relations [DEEWR], 2013). Bernhardt (2006) pointed out that while technology affects all aspects of our lives it also surrounds us with the prejudices of its creators. She went on to suggest that in order to free technology from inherent bias, representatives from all groups in society should be included in its design and creation, making it accessible to everyone. If women are not involved with the development of technology, then the influence of their ideas, perspectives, and imagination will be absent (Jewell & Maltby, 2001). MacKenzie and Wajcman (1999) suggested that a passive attitude towards technological change "focuses our minds on how to *adapt* to technological change, not on how to *shape* it." (p. 5) which evokes the scenario that women will adapt to male led technology, rather than technology broadening to include women. Female involvement is considered important in the development of ICT as not only do females represent half the population, but they are believed to approach problems from a different perspective from men (Margolis & Fisher, 2002). In addition, the perception of the ICT industry as a male domain discourages further involvement from women (Sandberg, 2011).

Over the past few decades there has been increasing governmental, industrial and educational awareness of this imbalance. Examples of this growing awareness are: the Australian Federal Government's "partICipaTion Summit" held in September 2005 (Department of Communication, Information Technology and the Arts [DCITA], 2005; 2008); reports commissioned by the Victorian State Government (Multimedia Victoria [MMV], 2001; 2004; 2007; 2010; 2013); and, in conjunction with industry, ongoing sponsorship of organisations such as the Victorian ICT for Women Network (http://www.vicictforwomen.com.au), as well as events to promote the discipline to schoolgirls such as *Go Girl* (http://gogirl.org.au/). The focus of research has more recently shifted from equal access in education and at home so that girls could use ICT as a tool, to the ways in which girls create or adapt technology (National Centre for Women and Information Technology [NCWIT], 2012).

The declining representation of women in ICT is not just an Australian issue. Intervention programs designed to attract more females to ICT have been conducted for over 25 years in various parts of the world (Cohoon & Aspray, 2006; Craig, Lang, & Fisher, 2008). While some instances of localised success have been reported, they have failed to achieve widespread changes in attitude and the overall percentage of females in ICT has remained low in Australia (DEEWR, 2014b). The reasons these interventions have not been successful remain unclear and justify the need for further research into the lack of females in ICT.

The views held in society may exert a negative influence on females when they make decisions with regard to ICT. Weisgram and Bigler (2007) note that "the belief that gender discrimination is common within some fields reduces the expectations and aspirations of stigmatized group

members" (p. 263). Acceptable interests and career pathways for children based on their gender and social standing are thought to be ascribed through a process of socialization (Bem, 1981; Fagot, Rodgers, & Leinbach, 2000; Lott & Maluso, 2001). When deciding which interests to include in their lives, a child is guided by the attitudes of their parents, teachers, peers, the media, and the wider community (Leder, Forgasz, & Solar, 1996; Margolis & Fisher, 2002; Roger & Duffield, 2000; Trauth, 2012).

It is possible that, through the use of negative stereotypes, females have been socialised away from ICT as an acceptable interest or career pathway. Community beliefs that might influence females' achievement-related choices involving ICT appear to be widespread (Herbert & Stipek, 2005; Leder & Forgasz, 2012; Sainz & Eccles, 2012; Trauth, Joshi, Kvasny, Chong, Kulterel, & Mahar, 2010). These include suggestions that males are naturally better at mathematics, science, and technology as they are assumed to have more analytical, logical minds, and are not averse to working alone, a perceived requirement of an ICT job. Females, on the other hand, are considered to prefer jobs that involve empathy, communication and humanitarian qualities which are not considered to be connected with ICT careers.

That many ICT intervention programs have thus far not had the influence hoped for is both interesting and of some concern. This thesis focused on a particular aspect of the phenomenon, more specifically, the role the community may play in ICT intervention programs, in particular the DD program in two Victorian secondary schools.

The workforce

In the United States, the National Centre for Women and Information Technology (NCWIT, 2009a) predicted that computing-related occupations would grow by 22% by 2018, more than any other profession. In 2010, a variety of ICT professions were on the Australian Government's Department of Education, Employment and Workplace Relations' skills shortage list (Department of Innovation Industry and Regional Development, 2010) and between 2009 and 2013, recruitment activity for ICT Professionals was up to five times greater than the average for all other occupations (DEEWR, 2013). By 2014 only Software Engineers were still considered to have "recruitment difficulty" (Department of Employment, 2014a) and while, reportedly, the situation may have improved slightly in recent years with "no widespread shortages within the ICT industry" (Department of Employment, 2014b, p. 2), the gender imbalance has not. While females have been well represented in ICT in areas such as training, it is interesting to note that while 55% of ICT trainers were female in 2011 (DEEWR, 2011), by 2014 that percentage had dropped to 31% (Department of Employment, 2014c). In addition, males continue to dominate other ICT related positions with female representation ranging from 9% for computer network professionals, to 19% for multimedia specialists and web developers, to 26% for ICT business and systems analysts (Department of Employment, 2014c). In Victoria, only 18% of those employed in the ICT industry were female (MMV, 2011). Similarly, in 2013 in the United States, 26% of all computing jobs went

to women (NCWIT, 2014) and comparable statistics can be found in most other western countries (Bovee, Voogt, & Meelissen, 2007; Corneliussen, 2004; Sainz, Palmen, & Garcia-Cuesta, 2012). A similar underrepresentation at school levels is discussed in the next section.

Education

In this section, an outline of ICT education in Victoria, Australia, where the present study was conducted, is provided. Victorian data on enrolment in ICT studies are the focus. This section provides an overview of education in secondary schools and the process of gaining University entry in Australia.

The Victorian Essential Learning Standards (VELS)

In Victoria, students attend primary school for seven years, followed by six years of secondary school. At the time of data collection, the Victorian Essential Learning Standards (VELS) provided suggested levels of achievement that schools across Victoria used in their planning and assessment (Victorian Curriculum and Assessment Authority [VCAA], 2009).

The VELS recommended that ICT not be taught as a distinct subject but be integrated into other subjects. The amount of ICT exposure students had was, therefore, dependent on the ICT experience of the individual teachers, the importance the school and the teachers placed on ICT skills, and what the teachers actually did in the classroom. In 2008, the Australian Government committed two billion dollars over seven years to ensure teachers were trained and that appropriate resources were available so that students could reach the standards outlined in the VELS (Australian Information and Communications Technology in Education Committee [AICTEC], 2009).

Table 1.1 outlines the ICT skill levels expected in each of the six VELS levels (VCAA, 2009). It is interesting to note the importance placed on correctly using ICT to enhance school work by using it as a tool. In this case a tool refers to a computer program that helps to make a process more efficient and effective. Students were encouraged to use ICT for presentations and to help with visualising problems, for organising and analysing data, and as a collaborative, communication, and research tool. Being able to use ICT tools and conforming to basic ICT standards for activities such as filing and presentations were also heavily emphasised. Use of learning objects such as those developed for use by teachers and students by “The Le@rning Federation”, a project funded jointly by the State, Territory and Australian Governments to manage the national digital curriculum resources and infrastructure, emphasises the use of ICT as a tool. The Le@rning Federation’s “learning objects” were computer game like activities based around a variety of educational topics. Access to these objects was provided free of charge to all government schools in Australia through *Scootle* (http://www.scootle.edu.au/ec/p/home).

Table 1.1

Learning focus and standards of VELS aligned with school year levels (VCAA, 2009)

VELS Level	Aligned with	ICT skills
Level 1	Prep	Safety, using memory sticks correctly, names of ICT equipment and familiarity with common icons, use of the mouse, create simple products, navigating, and use of multimedia resources.
Level 2	Grades 1-2	Access websites , assess accuracy/suitability of information, use PowerPoint, basic word processing, basic spreadsheet skills – graphs/charts, file naming systems for saving and retrieving, emails.
Level 3	Grades 3-4	Using tools to assist visualized thinking (sequencing, relating ideas), purpose and structures of information in different media (e.g., robots), animations, proof reading, spellchecking, extending word processing and spreadsheet skills, ergonomic practices, passwords, improving searching skills.
Level 4	Grades 5-6	Some programming - a language, simulation software, object oriented; organising and analysing data, evaluation of efficiency and effectiveness of software, evaluating their products, considering audience, making an electronic portfolio, working collaboratively with peers and seeking advice from experts via ICT.
Level 5	Years 7-8	Secondary school – some schools require students to have their own laptop. Databases, spreadsheets and other tools for problem solving, judging capabilities and limitations of technology, legal/illegal uses of ICT, email, blogs, and publishing work.
Level 6	Years 9-10	Tools, simulation packages, working in virtual teams, adhering to presentation conventions, efficiency of students' work, developing criteria to evaluate own and others' work, more precise searching, interacting – e.g. Wikipedia.

As can be seen in Table 1.1 the more technical aspects of ICT development were introduced around VELS levels 3 and 4 when it was recommended that students create an animation, program a simple robot to move around a room, and use object oriented programming. It was suggested that students in levels 5 and 6 of the VELS could present their work using quite advanced ICT skills such as using simulation packages and working in virtual teams.

At the time of data collection, the VELS system was used to teach and assess Victorian students. The Australian Curriculum, Assessment and Reporting Authority (ACARA) released the Australian National Curriculum in 2009, which was due to be implemented in schools in 2011. In Victoria, however, during the transition to the Australian National Curriculum, the VELS were combined with the Australian National Curriculum and the resulting "AusVELS" was implemented in Victorian Schools from 2013 until completion of transition to the Australian National Curriculum (VCAA, 2014a).

In the Australian National Curriculum, ICT was still integrated into other subjects rather than existing as a stand-alone subject (ACARA, 2013). The ICT skills outline in the new curriculum comprised five elements:

1. Applying social and ethical protocols and practices when using ICT (e.g., recognising intellectual property and identifying the impacts of ICT in society).
2. Investigating with ICT (e.g., locating, selecting and evaluating data and information).
3. Creating with ICT (e.g., generating ideas, plans, or solutions to challenges).
4. Communicating with ICT (e.g., sharing, collaborating and exchanging).
5. Managing and operating ICT (e.g., using hardware and software or managing digital data).

In the AusVELS ICT skills were organised into three dimensions:

1. ICT for visualising thinking (e.g., reflecting on thinking strategies, allowing students to visually represent their thinking, using tools such as visual models that assist in filtering, reorganising, and refining).
2. ICT for creating (e.g., using ICT tools to solve problems, demonstrate their knowledge, manage and retrieve files, plan and manage tasks, capture and manipulate data, improve appearance and functionality, examine ethical/legal implications, evaluate).
3. ICT form communicating (e.g., presenting ideas, awareness of audience, creating and sharing knowledge in teams, understanding protocols for receiving, transferring and publishing information) (VCAA, 2014b).

The AusVELS comprised eleven levels which corresponded to the school years Foundation to 10 and ICT skills continue to be integrated into other subjects, as outlined in Table 1.2.

Table 1.2

AusVELS levels and domains (VCAA 2014b)

Levels	ICT for visualising thinking skills	ICT for creating skills	ICT for communicating skills
1	Basic formatting, inserting clip-art, drawing images, locating websites, using a mouse, opening files.		
2	Manipulate text to create and improve simple information products, retrieve and save files, compose and send electronic messages, locate and retrieve information from a variety of sources.		
3	Logical sequencing of ideas, using and manipulating basic editing software, e.g. concept mapping tools, retrieving and editing visualising thinking files, e.g. deleting and inserting text and shapes, text boxes and callouts.	Saving files on a network, creation of a persuasive, entertaining or educational information product collaboratively and individually, saving digital images from a camera, using spellcheck.	Sorting emails, using search engines.
4	Using tools to list ideas, order them into logical sequences, and identify relationships between them, retrieving and editing, visualising thinking. Using the products for different problems or situations.	Organising files into meaningful folders, understanding passwords, follow simple plans to create informing, persuading, entertaining or problem solving, capture, save and edit images, editing work (spelling, grammar), evaluating own products, awareness of ergonomics.	Creating and organising email folders, composing and replying to and sorting emails, locating information on an intranet, and using a search engine, simple evaluation of located information.
5	Creation of graphic organisers, manipulating images, text and numbers, use of databases, electronic portfolios.	Creating electronic portfolios, awareness of formatting, creating layout designs, simple programming, controlling a robot.	Refining keywords in a search string, uploading files/ folders, sharing information electronically.
6	Use tools and techniques to represent and explore processes, patterns and cause-and-effect relationships and organise, analyse information to identify relationships, reviewing and documenting stored thinking strategy files to identify similarities and differences in their thinking patterns.	Process and produce different data types, use design tools to represent solutions, selecting efficient data processing techniques, improving the appearance of the finished product, modifying products to improve meaning and judging their products, create and maintain a bank of digital evidence, password protect, back up and use naming conventions.	Using email, websites and FAQs to acquire and share information, attaching files to emails, uploading work, strategies for locating information quickly, evaluating information from the web.
7	Use email, websites and FAQs to acquire and share information. Attach email files and apply protocols, upload work, perform refined web searches, evaluate web information.	Use of software tools to plan and monitor collaborative projects, make websites editing information products.	Locating websites using keywords and filtering techniques, using appropriate formats and conventions when using interactive websites.

Levels	ICT for visualising thinking skills	ICT for creating skills	ICT for communicating skills
8	Select and apply tools and editing functions that support the filtering, classifying, representing, describing and organising of concepts, issues and ideas, retrieve and modify successful approaches to visualising thinking for use in new situations, explain why particular tools and techniques have been used, use a range of data types.	Using operating system to manage desktop and folders, designs and apply a range of processing skills, functions and equipment to solve problems, monitor project plans and record reasons why, apply criteria to evaluate products, use ICT in a safe, efficient and effective manner, keep their bank of digital evidence up-to-date.	Selecting appropriate search engines, using complex search strategies, judging integrity of information, sharing ideas on blogs, websites, forums, complying with conventions, organising email mailboxes, evaluating communication tools.
9	Use and select complex tools and techniques to test hypotheses; visually represent reasoning and solve problems.	Use consistent filenames, passwords, presentation conventions, design culturally respectful web-based information products.	Exchanging ideas and opinions through online that respect cultural differences, locate websites using proximity operators, use strategies that take into account legal responsibilities and ethical considerations.
10	Using visualising thinking tools and data types to solve problems, efficiently use tools to visualise thinking, and discriminate between tools.	Appraising strategies and managing resources, devise and annotate plans, apply efficient techniques, equipment and procedures, apply strategies that protect their files, products demonstrate purpose and respect for the audience, compare and justify own solutions with others.	Exchanging through online forums and websites, locating precise information from the web, communicate appropriately online with peers, experts, and others.

NB. Standards for assessing and reporting on student achievement are introduced at Level 1 and standards are not organised by dimension until Level 3.

Similar to the VELS, the emphasis in both the Australian National Curriculum and the AusVELS was on using ICT as a tool. The inclusion of the elements *Creating with ICT* (Australian National Curriculum) and *ICT for creating skills* (AusVELS), however, suggest that creating was considered as important as using tools.

In the Australian National Curriculum, programming was not mentioned at all until Level 5 (typically the end of Year 8) where programming games was mentioned. This was one level (and at least two school years) later than in the VELS. In the AusVELS, as can be seen in Table 1.2, simple programming, for example moving a robot, is also mentioned in Level 5 (typically Year 5).

The following example requirements of the highest level of the Australian National Curriculum, Level 6 (typically the end of Year 10), suggest a transition to more programming skills than Level 10 (typically Year 10) of the VELS:

> *…modelling solutions in spread sheets, creating movies, animations, websites and music; programming games; using databases; creating web pages for visually impaired users; using advanced functions to manage and edit digital products for desired effects (ACARA, 2013, p. 13).*

The Victorian Certificate of Education (VCE)

In the final two years of secondary school, Years 11 and 12, Victorian students can choose between the Victorian Certificate of Education (VCE), which is the certificate the majority of students in Victoria receive on satisfactory completion of their secondary education, or the Victorian Certificate of Applied Learning (VCAL) which is vocationally oriented. Students intending to enter University typically choose VCE while those intending to do a trade or enter the workforce often choose VCAL.

Subjects are divided into four study units that each consist of one semester of study. Units 1 and 2 are studied in Year 11 and Units 3 and 4 are studied in Year 12. In some subject areas Units 1 and 2 are prerequisites for Units 3 and 4. At the time of writing, there are six VCE ICT units on offer and their accreditation period is from 2011 - 31 December 2015. The units are:

- Unit 1: IT in action.
- Unit 2: IT pathways.
- Units 3 and 4: IT Applications.
- Units 3 and 4: Software Development (VCAA, 2014c).

VCE Unit 4 enrolment statistics are used to illustrate falling interest in ICT because, being the highest unit level in ICT, they give a conservative estimate of the number of students taking VCE ICT subjects. It should be noted that students may complete Unit 3 but not Unit 4 in a particular subject but they are usually taken together.

Within VCE ICT units the proportion of female enrolments was low. For Unit 4 *IT Applications*, females comprised 15.9% of the enrolments and in *Software Development* it was 5.5% in 2013 (VCAA, 2014d). Unit 4 VCE ICT unit enrolments for male and female students from 2001 to 2012 are illustrated in Figure 1.1. Note that in 2007 the names for the units *Information Processing and Management* (IPM) and *Information Systems* (IS) were changed to *IT Applications* (ITA) and *Software Development* (SD) respectively in 2007. This name change did little to halt declining interest in this discipline.

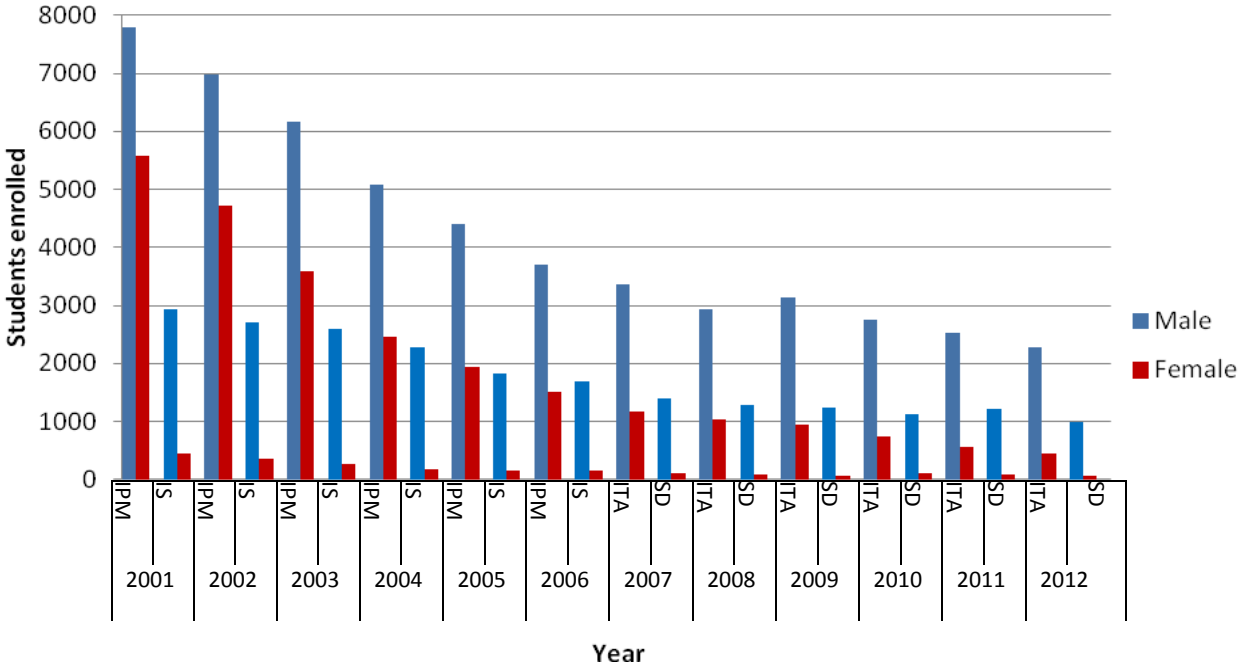


Figure 1.1. Male and female enrolments within Unit 4 VCE ICT subjects (based on VCAA, 2014d).

Figure 1.1 clearly illustrates the trend of declining interest for male, and particularly female, secondary students in ICT related subjects. While both decreased, proportionally the number of participating females diminished more rapidly than did males. In 2001, 5571 female students enrolled in IPM and 447 in IS. By 2012 those numbers had dropped to 452 for ITA and a mere 51 for SD.

Based on these statistics, it appears that gender differences in ICT interest and attitudes are well established by the time Victorian students reach VCE. Earlier UK research found that in primary school, males held more favourable attitudes towards computers than females, although there was no difference in level of attainment (Siann, McLeod, Glissov, & Durndell, 1990). Comparisons of primary and secondary students in the same country showed that older females were more negative about computers than younger females (Colley & Comber, 2003). Thus, many ICT intervention programs designed to encourage female students to have an interest in ICT have been aimed at the early secondary school years.

Further Education

Research has shown that exposure to computer science in secondary school is an important factor to one in three girls when making decisions about studying computer science at tertiary level (Margolis & Fisher, 2002). Indeed, the underrepresentation of females in ICT in the tertiary sector in Victoria follows a similar pattern to that of VCE ICT unit participation.

The process of gaining entry to University in Australia is now described. The Victorian Curriculum and Assessment Authority (VCAA) issue students with study scores out of 50 for Units 3 and 4 for

each VCE subject satisfactorily completed in the same year. The Victorian Tertiary Admissions Centre (VTAC) then uses the study scores to calculate an Equivalent National Tertiary Entrance Rank (ENTER) score, which in turn is used to gain entry to University courses.

When students have their ENTER scores they may apply for various courses through VTAC. In 2013 VTAC offered 2629 places in ICT related courses at University and Technical and Further Education (TAFE) Colleges in Victoria ranging from Certificate IV qualifications through to Masters Degrees. Of these, 385 offers were to females with only 251 taking up the offers and enrolling in ICT related courses in 2013 (VTAC, 2013). At the time of this study, there were no Universities in Victoria that required a VCE ICT subject as a prerequisite to an ICT related undergraduate degree. Figure 1.2, using data taken directly from VTAC for the years 2004-2013, shows the decrease in enrolments in Information Technology courses which have been applied for through VTAC over the past nine years.

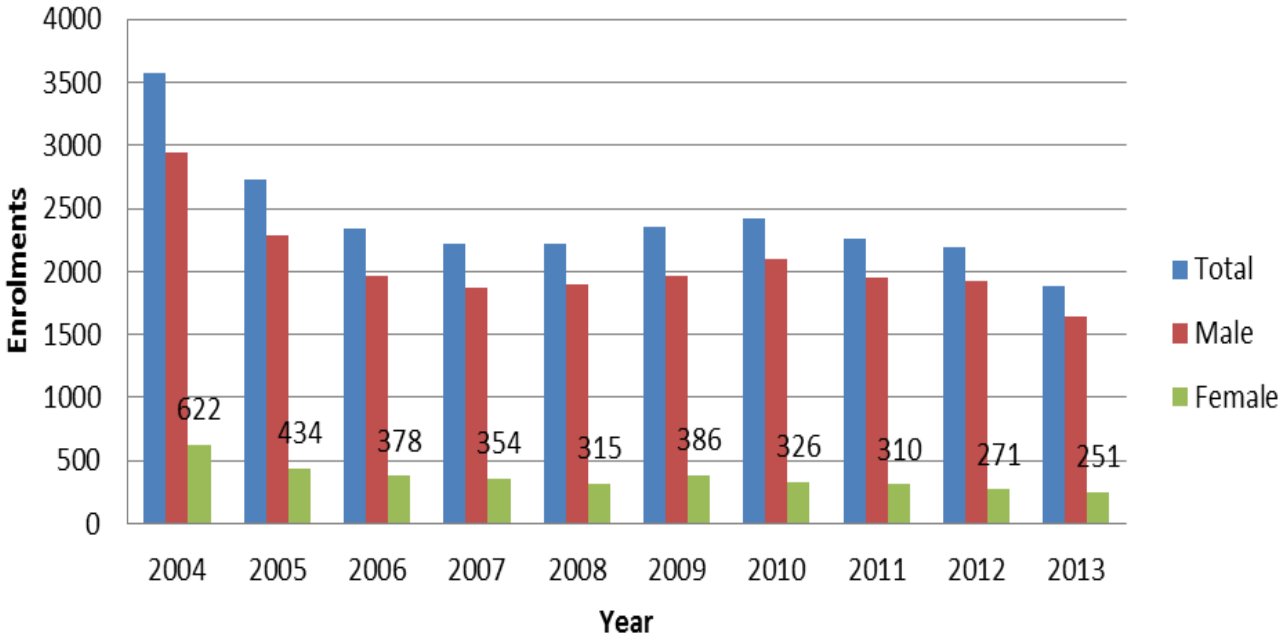


Figure 1.2. Information Technology enrolments in Victorian Institutions (based on VTAC, 2014).

Note that the enrolment numbers in Figure 1.2 relate to all applicants, not just those who completed Year 12 the previous year. As an example, in 2009 only 59% of enrolments were from those who had completed VCE in 2008 and had a current ENTER score. The other enrolments were made up of interstate and overseas Year 12 students, Year 12 students from recent years, those who had done previous tertiary study, and those who had no qualifications. Although the percentage of VCE graduates from the previous year has been as high as 74% (in 2007), in the last six years it has hovered around 60% (VTAC, 2013).

Although Figure 1.2 shows a pleasing slight increase in female and overall enrolments in 2009 in Victoria, the number of female applicants for tertiary ICT courses dropped from 386 in 2009 to a low of 251 in 2013.

Theoretical framework

The Digital Divas team used Eccles' 2005 version of the Eccles (Parsons), Adler, Futterman, Goff, Kaczala, Meece, and Midgley (1983) Expectancy Value Model of Achievement-Related Choices (J. Fisher, C. Lang, A. Craig, & H. Forgasz, personal communication, January 6, 2010) when formulating their research. Before the Expectancy Value Model of Achievement-Related Choices is explained, an investigation of its origins is required. To this end the following theories were visited:

- Sociocultural theory.
- Constructivist theory.
- Achievement motivation theories, in particular the expectancy value motivational theory.
- Social learning theory and self-efficacy theory.

Sociocultural theory suggests that human development is the product of our interaction with the social and cultural world around us (Cross, 2009). It emphasizes relationships, social participation, the setting of an activity, and historical change (Packer & Goicoechea, 2000). Vygotsky proposed the "zone of proximal development" which suggests that a child is able to do things in collaboration with others before they can do them independently (Vygotsky, 2012). Thus, children first learn on a social level through their interactions with others and participation in activities, where they acquire strategies and cultural knowledge, and these are later internalized so that they have learned on an individual level. This theory suggests that interaction with parents, peers, and the culture at large is responsible for what a child learns, including gender and activity stereotypes. For a sociocultural researcher, the context in which a phenomenon is set (for example, the DD program) must be explored in order to identify the reasons why an effect (for example, girls' attitudes about ICT) occurs (Schoen, 2011).

Constructivist theory emphasizes that through a learner's interaction with the world, their knowledge and ways of understanding are constructed (Packer & Goicoechea, 2000). Constructivist theory is similar to sociocultural theory in that both theories are concerned with the social activities in which children engage to learn. While sociocultural theory looks at the way children are enculturated through their interaction with society, constructivist theory suggests that through their interaction with others and their experiences and reflections, children actively construct their own understanding and knowledge of the world (Cobb, 1994). There is a growing consensus that these perspectives are at least partially complementary (Cobb, 1994; Packer & Goicoechea, 2000).

Achievement motivation theorists attempt to explain two things: the reason a person chooses to participate in an activity chosen from a variety of alternatives, and how much effort a person puts into something or why they persist with difficult activities (Atkinson, 1957). Atkinson described how the motive to achieve (and to avoid failure) is a combination of three variables: motive, described for example as pride in accomplishment or a sense of belonging; expectancy, anticipation of consequences of meeting a goal; and incentive, attractiveness of a goal or unattractiveness of lack of achievement of a goal. Constructivist achievement motivational theorists believe that because each individual has had different experiences, everyone is motivated differently.

Expectancy-value theory is an achievement motivation theory that explains and predicts attitudes towards activities, and grew out of research into achievement motivation. According to this theory, attitudes, and decisions about a task are based on an individual's belief in whether they can achieve success with a task and the value or cost associated with undertaking that task. The theoretical model of achievement-related choices (Eccles (Parsons) et al., 1983) was developed to add to an understanding of expectancy–value theory and was initially used to explain gendered participation in mathematics, but was expanded to include Science, Technology, Engineering, and Mathematics (STEM) fields (Eccles, 2005). The model, which has been modified over time, explains how choices, based on expectation of success and subjective task value, are shaped by the experiences and perceptions a person has had up until that point. According to the model, socializers' beliefs, behaviours, expectations, and attitudes about gender role and activity stereotypes directly influence a child's achievement-related choices and performance. A modified version of the figure found in Eccles (2005) is presented in Figure 1.3.

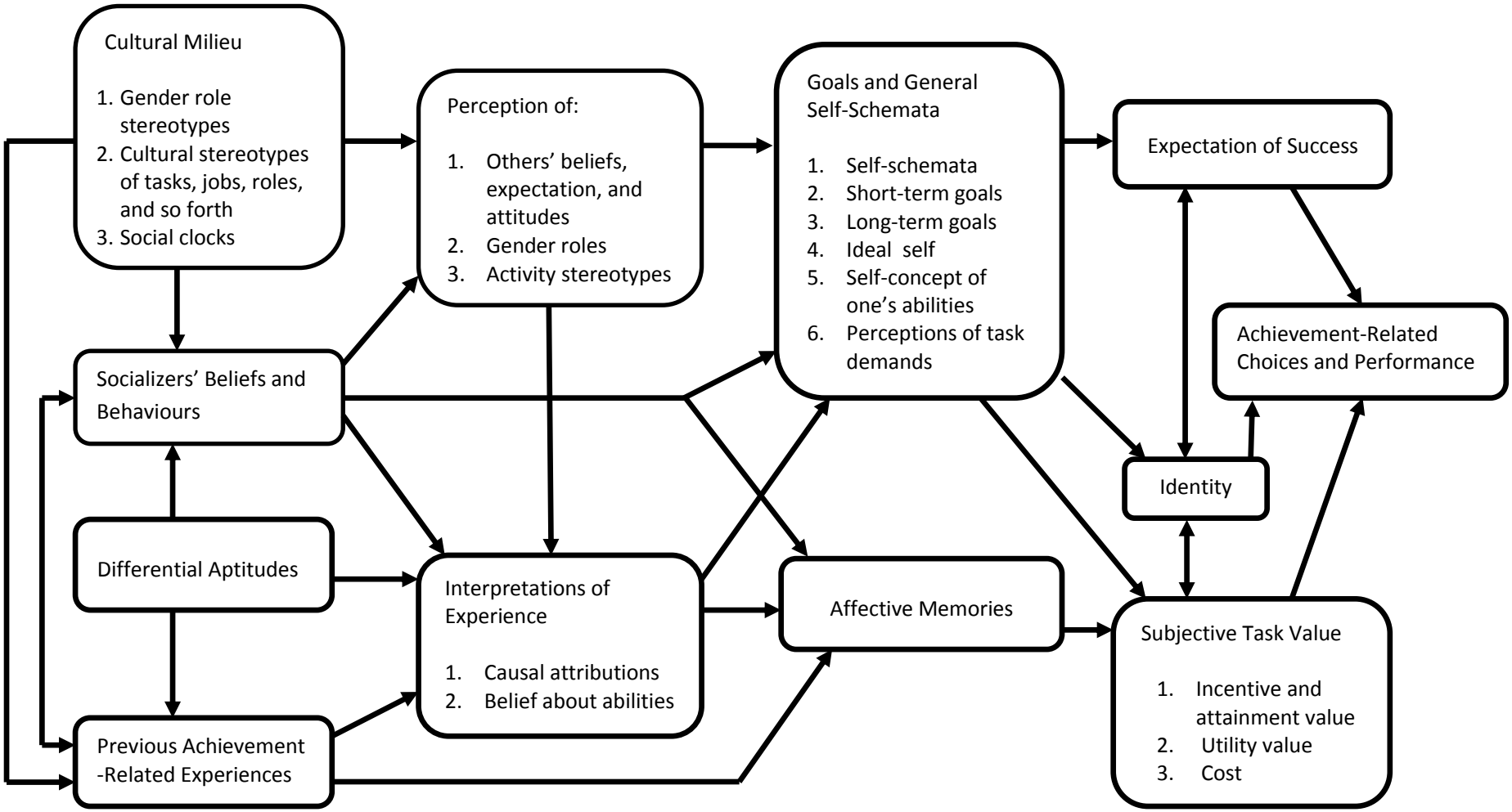


Figure 1.3. Expectancy Value Model of Achievement-Related Choices adapted from Eccles (2005, p. 8).

This thesis focused on the relationship between three elements of the model:

1. Cultural milieu - 1. Gender role stereotypes; 2. Cultural stereotypes of tasks, jobs, roles, and so forth with particular regard to ICT stereotypes (3. Social clocks were not included in this thesis).

2. Socializers' beliefs and behaviours - the socializers in this study were parents, teachers, peers, and the media. Their attitudes towards ICT and females were identified and explored.

3. Previous achievement-related experiences – in particular the focus was on ICT intervention programs, specifically, the DD program.

It is difficult to discuss gender and subject stereotypes and socializers' beliefs without also examining the children's perceptions of these. Therefore, the element in Figure 1.3, entitled the "Perception of: 1. Others' beliefs, expectations and attitudes; 2. Gender roles; and 3. Activity stereotypes" was also included throughout the contextual literature review as in many studies the stereotypes held by society and the attitudes of socializers were identified by surveying children.

Around the same time the Eccles et al. (1983) model was being developed, Bandura (1986) was expanding on social learning theory and suggesting that children learn through observation, imitation, modelling, and self-reflection. Bandura postulated a self-efficacy theory; self-efficacy is the belief in how capable a person is of doing something and is similar to self-confidence. Eccles (2006) later suggested that domain-specific self-efficacy (Bandura, 1997) was similar to the individuals' expectation of the success element of her model.

Bandura (1989) believed that self-efficacy was formed in four ways. First, through mastery experiences, that is, when a person succeeds in the achievement of a task; second, through vicarious experiences, that is, when a person observes someone else succeeding in the achievement of a task. Third, through encouragement, that is, when others express their belief that the individual is capable of achieving a task. Finally, physiological factors, including how comfortable, safe, or accepted people feel in a situation will impact on whether they believe they can achieve a task. It has been found that males generally form their self-efficacy in ICT through mastery experiences, while females generally gain their self-efficacy in ICT through vicarious experiences and encouragement (Zeldin & Pajares, 2000; Zeldin, Britner, & Pajares, 2008). In addition, physiological factors have been found to be more important to females than males (Zeldin & Pajares, 2000; Zeldin et al., 2008). These models and theories inform the

theoretical base of this study, which is that socializers and stereotypes play a strong part in females' decisions to participate in ICT.

Research aims and method

In order to further enhance understanding of why intervention programs have not succeeded in increasing the number of females in ICT, this study aimed to identify the attitudes towards ICT held in the community and determine how important these attitudes were to the success of the Digital Divas Intervention program. The primary research question for this study was:

> *Are the attitudes of the community towards ICT important in terms of a successful intervention program?*

As previously stated, the research focused on the case of the Digital Divas intervention program in two secondary school classes in Melbourne.

The primary research question was approached via six sub-questions:

> SQ 1: What are community attitudes about gender and ICT?
>
> SQ 2: What are community attitudes about ICT people and jobs?
>
> SQ 3: What are community attitudes about the importance and enjoyment of computing?
>
> SQ 4: To what extent was there a change in attitude among Digital Divas Intervention program participants?
>
> SQ 5: To what extent was the change in attitude consistent with or different from the goals of the Digital Divas Intervention program?
>
> SQ 6: To what extent was the change in attitude among the DD program participants related to community attitudes?

The genesis of the research questions and the relationship between them and the main DD program project are explained more fully in Chapter Four. In order to identify important themes and gaps in the field, and to provide a context for the study, a critical review of the literature related to socialization and stereotypes was undertaken and is presented in Chapter Three. Three issues were focussed on:

- The role of socialisers (the media, schools, parents, teachers and peers) in the interest, education, and career decision making processes of students.
- The specific ICT stereotypes and perceptions of ICT jobs and people.

- The recognition of socialization in the development of intervention programs.

A mixed methods approach was chosen for this PhD study and full justification is given for the approach in Chapter Four. A media review was conducted to investigate the way male and female ICT experts were portrayed on television. Data were collected from the school and Victorian communities using questionnaires and email and group interviews. In addition, permission was granted to use data collected through the DD program, including participant and teacher questionnaires and interviews, as well as DD research team observations of the two schools involved in this PhD research. In this way, various sections of the community surrounding the DD program participants at the two schools were sampled, as outlined in Figure 1.4.

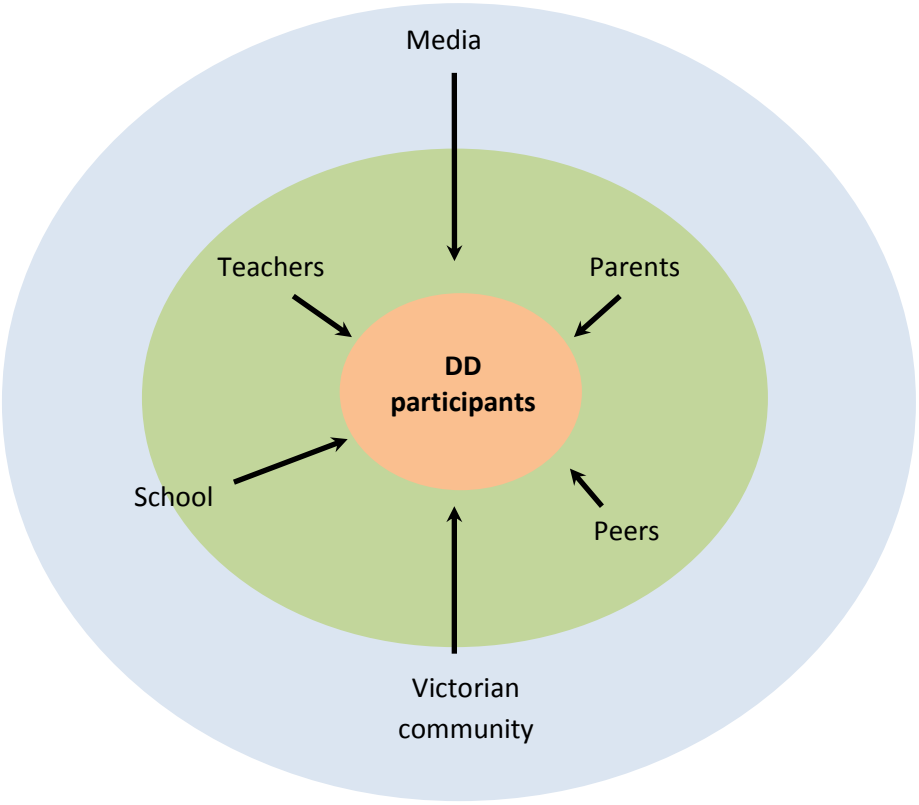


Figure 1.4. Community influences on DD participants.

The setting for this study was two Melbourne schools participating in the DD program. Both schools were coeducational, public (government) schools where the DD program had already run for at least one semester. Further information about the schools can be found in Chapter Two. All teachers at each school, and parents and students in the same year level as those participating in the DD program, were invited to participate in this study. In addition, in order to provide a comparison for the two school communities, Victorian parents with children attending Years 8 or 9 and not enrolled in the DD program were invited to participate in the study using the social networking website *Facebook*.

Contributions of this study

Intervention programs have thus far not, in general, succeeded in encouraging further female participation in ICT in Victoria. While each published report on ICT interventions adds to an understanding of this phenomenon, the lack of success has not yet been fully understood. This study contributes to understandings of the relationship between attitudes held in the community towards ICT and the success or otherwise of intervention programs. Information and insights gained could inform and improve future intervention programs, thereby encouraging more women into the industry.

In addition, while secondary and tertiary student and teacher attitudes towards ICT have previously been sought in a number of studies around the world, the Victorian community attitudes, in particular those held by parents, have not been well researched. This study endeavoured to garner these attitudes and provide a snapshot of the perception of ICT held by the community in 2011.

An overview of intervention programs from the past is presented next.

Intervention programs

Intervention programs are designed to foster change. In non-traditional fields, the goals are often to attract better representation of women and minorities in specific areas of education and the workforce (Leder et al., 1996). Intervention programs in the ICT area started in the mid-1980s, although in science and mathematics they started as early as the mid-1960s (Leder et al., 1996). One way of conceptualising intervention programs was outlined by Leder et al. (1996) who classified the programs in a number of ways – by time, by school calendar, by targeted population, and by educational institution. This classification can be applied to previous and on-going ICT intervention programs; examples are illustrated in Table 1.3.

Table 1.3

Classification of intervention programs

Classification	Examples	
Time	Short term	– Conferences such as *Explore IT* in Canada (http://www.explore-it.ca/). – Workshops such as *Go Girl Go For IT* run by Victorian ICT for women (http://www.vicictforwomen.com.au/www/html/264-about-go-girl.asp).
	Long term	– Classroom content and activities such as *Digital Divas* in Melbourne, Australia (http://www.digitaldivasclub.org).
School calendar	During the school year	– After school and Saturday classes. – Clubs such as *CC4G Connect, Create, Go....* run by e-skills the U.K. (http://www.cc4g.net/).
	Summer programs and camps	– *ExxonMobil Bernard Harris Summer Science Camp*
	Other	– Career fairs/recruiting programs. – Research apprenticeship programs. – Professional development programs for teachers.
Targeted population	Female students, parents, teachers, counsellors	– Professional Development for teachers run by the Victorian Information Technology Teachers Association (http://www.vitta.org.au/).
Educational institutions	Within	– University of Waterloo, Canada ran a 1 week Computer Science Seminar for Grade 9 and 10 females (Graham & Latulipe, 2003).
	Outside	– Run by professional associations or governments such as *GIDGITS Girls Into doing Great Information Technology Society* (http://www.gidgits.org/) organised by the Women in Technology (WiT) Association, Queensland, Australia (http://www.wit.org.au/).

The aims of ICT intervention programs are generally to make ICT more attractive to females by exposing them to creative computing activities which females find exciting, thereby debunking the myths and stereotypes about ICT, and highlighting the variety of careers in the industry (Crombie, Abarbanel, & Anderson, 2001). Areas that females may not have been exposed to previously, such as programming and robotics, may be contained in the curriculum of the intervention. These components are included so that females can experiment and gain more experience and confidence in their abilities in a non-threatening, often all female, environment (Graham & Latulipe, 2003).

Leder et al., (1996) suggested that the characteristics of successful intervention programs should reflect the needs and interests of the targeted population. Thus, they could include attainable goals, hands on experience, peer mentoring, introduction of role models and guest speakers, field trips, and regular evaluation.

Lewis, McKay, and Lang (2006) suggested that the percentage of females in the ICT industry has not increased, despite intervention programs, because of lack of curriculum reform in higher education and lack of action inside the industry. Weisgram and Bigler (2007) found that while making females aware of gender discrimination in science may cause them to consider science valuable and increase their self-efficacy, it does not increase their interest in science per se. Similar findings from Nott and Arnold (2011) indicated that interventions do not necessarily translate into more females in STEM school classes or related industries.

In their examination of 14 intervention programs, Craig, Dawson, and Fisher (2009) noted that perhaps an increase in the overall proportion of female students undertaking computing courses may not be the only way to measure the success of an intervention. They found that even when the positive impact of an intervention program was limited to specific areas or small groups, each of the intervention program advocates considered their program to have been a success. However, as far back as 2006, Bernhardt pointed out that despite these positive feelings about ICT interventions by participants and organisers, there had been "a massive failure of these intervention programs to positively impact on the overall picture and therefore a failure to accomplish [their] intended purpose" (2006, para. 10).

The Digital Divas Intervention (DD) program

This study is part of a larger project entitled *Digital Divas: Designing approaches to enthuse girls' interest in ICT studies and ICT careers* funded by the Australian Research Council. The research team behind the DD program gave permission for data to be drawn from their project for this study. The DD program is described in detail in Chapter Two.

Explanation of terms

The following clarifies the terminology used in this thesis:

ICT

A variety of terms including ICT, IT, and computing are used in the literature. ICT is the term that will be used in this thesis because it incorporates all the other terms and is most commonly used in the Victorian context where the study was carried out. For direct quotes, the term used by the author is included verbatim.

Nerd/Geek

People with a strong interest in ICT have often been described as "nerds" or "geeks". Dictionary definitions of "nerd" and "geek" are not specific enough to differentiate between these terms, although "geek" is more likely to be associated with computers (Moore, 2004). While many people have used these labels interchangeably (Kendall, 1999; Thomas & Allen, 2006) there has been some indication that "geek" is becoming more socially acceptable than "nerd" among some youth cultures (MMV, 2001) and this will be explored to some extent in this study. Among computer fanatics a "geek" is seen as more employable or wealthier, and does not have the negative connotations associated with a "nerd" (Kendall, 1999). In the British Computer Society magazine, *ITnow,* guests are regularly asked "Nerd or geek?" Their answers indicate that the terms are used interchangeably by some, while others think there is a difference. For example:

> *I use geek, but I'll answer to nerd* (Torvalds, 2007, p. 17).
>
> *Both* (Molyneux & Tucker, 2007, p. 18).
>
> *Probably a geek!* (Richards, 2007, p. 12).

In this thesis "nerd" and "geek" will be used interchangeably.

Outline of the thesis

This thesis has eight chapters. In Chapter One, the rationale for the study was introduced by presenting data on the current lack of females in ICT and the theoretical framework to be used in this study. The aims of the study, the research question, and the significance of the topic were explained. A description of intervention programs was provided and the DD program introduced. Finally, an explanation of terms used within this thesis and an outline of the thesis were presented.

In Chapter Two, the DD program is described. The concept and design of the program are explained along with the program aims. The assumptions of the program, the modules used in the delivery of the program, and the reasons for, and method of, data collection are outlined. A discussion of the schools, teachers, and students involved in the DD program follows. Finally, the elements of a successful intervention program are described and used to assess the elements present in the DD program.

In Chapter Three, the key concepts and contextual literature relevant to girls' attitudes towards ICT are examined. The chapter begins with a discussion of socialization and the way stereotypes are perpetuated, and those stereotypes specific to ICT are described. Girls' socialization away from ICT is reviewed with particular emphasis on the role of parents, teachers, peers, and the media. Finally, the ways in which ICT intervention programs allow for socialization in their design, delivery, and expectation of success are examined.

In Chapter Four, the research paradigms relevant to this study are presented along with a justification for implementing a mixed methods approach. This is followed by an explanation of the data collection procedure, instruments, and sources for the qualitative and quantitative phases of the study, and the methods of data analysis for each part. An overview of the three community groups participating in this study is given.

In Chapter Five, the first of three results chapters, the data collected from the community is presented. A media review is used to give an indication of what ICT stereotypes are present in Western society; the wider Victorian community is surveyed to establish ICT stereotypes commonly held in Victoria; and the communities surrounding the two schools in this study are surveyed to indicate the school community ICT attitudes. The data from the media review, community questionnaires and interviews are used to answer SQs 1-3. Thus community attitudes towards gender and ICT, ICT people and jobs, and the importance and enjoyment of computing are presented. The community group results are compared, and sub-groups within the two schools are examined to determine consistency of perception within each group.

In Chapter Six, an overview of the student cohorts involved in the DD program is presented. DD participant data are used to answer SQ 4 and determine whether there was any change in attitude among the DD participants following participation in the intervention. These changes are compared with DD program goals to determine whether they were consistent with or different from the goals of the DD program, thereby answering SQ 5.

In Chapter Seven, community attitudes towards gender and ICT, ICT people and jobs, and the importance and enjoyment of computing are compared with the changes in attitude among DD participants in these areas. The extent to which DD student attitude change relates to community attitudes is examined to answer SQ 6.

In Chapter Eight, a recap of the thesis is provided, including the reasons for this study, the approach taken, and the answer to the research question. The limitations of the study are described and recommendations related to the findings with regard to further intervention programs and research are presented.

Chapter summary

In this chapter an overview of the thesis was presented. The reasons for this study were described, including an outline of the current situation regarding females in ICT. In addition, the research aims, question, setting, and method, as well as the study's contribution to knowledge were introduced. In the next chapter, as further scene setting for the thesis, the DD program and the two schools used in this study are introduced.

Chapter Two: The Digital Divas Intervention Program

> *...early intervention is critical to reversing the decline of women in technology careers. Lack of K-12 computing courses and dull computing courses at the middle school level, lack of accurate career information about computer science and the absence of female mentors in the field all play a role in inadvertently turning young women away from the industry* (Schiavone, 2012, para. 2).

This PhD was part of a wider study entitled *Digital Divas: Designing approaches to enthuse girls' interest in ICT studies and ICT careers,* funded by an Australian Research Council (ARC) Linkage Grant. The partners in the project included three universities in Melbourne, the Department of Education and Early Childhood Development (DEECD), two professional organisations which promote women in ICT, a secondary school, and a service provider (Fisher, Lang, Craig, & Forgasz, 2012). The research team comprised Professor Julie Fisher (Monash University), Associate Professor Catherine Lang (Swinburne University of Technology/La Trobe University), Associate Professor Annemieke Craig (Deakin University), and Professor Helen Forgasz (Monash University).

The aims of the wider study were to develop an ICT intervention program (the DD program) to raise girls' awareness of careers in ICT and to gain an insight into what was required to change girls' attitudes towards ICT courses and careers (Lang, Craig, Fisher & Forgasz, 2010). The wider study focused on whether the DD program changed girls' attitudes towards ICT; what parts of the DD program the girls found interesting; and whether changes in policy and practice in schools supported girls' engagement with ICT and ICT careers.

As data gathered by the DD research team were used in this PhD study, in this chapter the DD program is explained in more detail. This includes the design, aims, assumptions, content, delivery, and method of data collection. Elements of the DD program are then assessed using the literature on successful intervention programs. The schools selected for this PhD study are described, and using the data from the DD program, the ICT culture and DD program teachers at each school are discussed. It should be noted that I was given permission to draw on hundreds of pages of unpublished data, and all quotes and related information referred to in this chapter were drawn from this source.

The DD program

The DD program was trialled and evaluated in 10 secondary schools in Australia from 2009 until 2012. It was a one semester, girls only, computing elective aimed at Years 8, 9, and 10. According to Craig, Fisher, Forgasz, & Lang (2011, p. 315), the goals of the DD program were to:

> [G1.] Design material that will engage the girls as part of the middle school curriculum.
>
> [G2.] Raise awareness and ignite girls' interest in IT and IT careers.
>
> [G3.] Increase girls' confidence and attitudes towards IT.
>
> [G4.] Identify what factors influence the programme's implementation.
>
> [G5.] Create sustainable programmes for school.
>
> [G6.] Increase the number of girls electing to undertake computing subjects in later years at Secondary school (and ultimately tertiary education) (Craig et al., 2011, p. 315, numbering added).

To this end, in order to counter the perceived stereotype of the computer professional, the DD program focused on:

- Computer-based experiences which were likely to be of interest to girls.
- Using classroom styles that appealed to females, such as group work and collaboration.
- Exposing the girls to role models from industry (women working in exciting jobs in ICT who talked to the classes).
- Placing female undergraduate ICT students ("Expert Divas") in classrooms to act as role models, informally mentor students, and normalize the perception that girls can do ICT.
- Including curriculum topics in which females are interested (Lang et al., 2010).

The concept of the DD Program came from many years of study by the DD research team into ICT interventions (Craig et al., 2008). The DD program design included material developed specifically to be of interest to girls in Years 8-10. Plans for nine modules were developed, from which teachers could choose, including:

- Programming skills using a storytelling package (*Alice*) that was specifically designed for females.

- Not teaching advanced skills in *Excel* specifically but introducing them through content.
- Image creation and manipulation.
- Investigation into ICT jobs.
- Making videos from concept to execution.
- Understanding web technologies and game making.

ICT career information was explored through the modules and talked about in class with the teachers, Expert Divas (the university students), and guest speakers. Materials provided by the DD research team included teacher instructions, assignments, student guides to aid teachers in their preparation for classes, and in some cases, assessment tools; these are explained later in the chapter.

Assumptions of the program

The explicit underlying assumptions of the DD program, in the words of Craig et al. (2011, p.316), were that:

[A1.] The curriculum modules will excite the participants and deliver positive messages about IT.

[A2.] By participating in Digital Divas the girls will learn skills based on curriculum topics that challenge the prevailing stereotypes/myths within society that computing is boring, technical and involves working alone.

[A3.] That the IT Career range presented involves the analysis, development, programming, designing, and the problem solving aspects of IT, not just the use of computers as tools.

[A4.] That the teacher delivering the program has brought to the attention of the girls (or make explicit) the links between the activities the girls are undertaking and their real world significance (e.g., Alice is not just a game but is an example of programming and why this is important).

[A5.] The role models present accessible choices of computing careers.

[A6.] That any increase in motivation/enthusiasm for IT is maintained from the time that the Digital Divas programme ends, to the time for the girls to make further subject selection.

> [A7.] The wider community (school, parent, other teachers, other students not participating in Digital Divas) are supportive.
>
> [A8.] Girls who undertake IT-based subjects in later years at high school will be more likely to consider a higher education course in IT (Craig et al., 2011, p. 316, numbering added).

This document did not make clear what "accessible choices" (A5) were or of what the wider community should be supportive (A7). An unstated assumption is implied in A8, that is, girls who participate in the DD program would be more likely to take ICT based subjects in later school years.

In addition, the DD program relied on a number of "inputs", referred to in this PhD study as "resourcing assumptions". To quote Craig et al. (2011, p.315), these were:

> [R1.] A Teacher who is motivated, committed, creative, skilled in IT and passionate.
>
> [R2.] A School that is supportive: Champion at the management level who is knowledgeable about IT, innovative/creative environment, flexible timetable, appropriate IT resources available (i.e. appropriate technology which is relatively up-to-date, works well, and there is good network access).
>
> [R3.] Expert Divas: Undergraduate female IT students, who are committed and motivated, have good IT skills, have empathy with the students, and are good role models.
>
> [R4.] Guest Speakers: who are appropriate female role models.
>
> [R5.] Appropriate Curriculum Modules which are engaging for the participants (Craig, Fisher, Forgasz, & Lang, 2011, p. 315, numbering added).

While the appointment of Expert Divas, the arrangement of guest speakers, and curriculum modules were organized by the DD research team, the support of the school and the choice of teacher were beyond the team's control.

The DD program content

Nine distinct teaching modules were available for teachers to use in their DD program classes. While the modules were designed to appeal to teenage girls, they were written with background knowledge of the software applications that were readily available to all Victorian government schools, or freely downloadable from the internet. The assumptions of the DD program were that the modules would excite the participants and deliver positive messages about ICT (A1) thus contributing to the potential for program goals to be met. The DD research team provided more modules than each class needed to allow teachers the benefit of choice. Teachers were encouraged to modify the modules to suit their classes and teaching style, and to discuss new ideas for modules with the DD research team and DD program teachers from other schools. The five modules described below are those run at the two schools used in the PhD study:

Shake the bottle, wake the brand - In this module, students created logos and slogans for "Digital Divas" using a vector based program. Funding was provided by the DD research team for key-rings and stickers to be produced using the resulting logos. As well as introducing the students to a new program, and thus increasing their confidence with ICT, this module was used to raise the students' awareness of the aims of the DD program and to create a sense of ownership. Schools were asked to run this as the first module in the DD program.

Chef's delight - This module capitalized on students' interest in healthy eating and the growth in television cooking shows. It introduced spreadsheets using advanced techniques in *Excel* to create an online restaurant menu. The module was included to increase student confidence in their abilities to manipulate existing spreadsheet software often used in mathematics and advanced accounting units. By using a software program commonly used at schools, and in the community, and introducing the class to advanced functions, students could gain a sense of competence and expertise.

Fab & Famous - Capitalising on student interest in appearance and body image, students looked at how photographs are modified in magazines and advertising, and the associated ethics. Students analysed the photographs and with software programs such as *Photoshop,* designed and created edited images to be used in creating their own artefacts, for example, their own magazine cover. While experience with new software may increase student confidence, this module was primarily included because of its intrinsic interest to teenage girls.

Alice Storytelling - This module introduced object-orientated programming through the application *Alice*. *Alice* is a free program developed by Carnegie Mellon University

(http://www.alice.org). It was written specifically for girls and uses the medium of storytelling to introduce object-oriented programming to the students in a fun and interesting way. While some schools readily adopted this module, it was under-utilized by the majority.

Mythbusters - The aim of this module was to break down stereotypes about ICT and broaden student views about ICT careers. The module required students to research aspects of ICT use in careers and was complemented by presentations from guest speakers from industry and in some cases a visit to an "ICT for Girls" themed open day at a local university. The module culminated in a presentation created by the students using software such as *PowerPoint* or *Prezi* where they were required to "bust" the myths around ICT. Schools were encouraged to run this as the final module of the program and presentations were showcased to parents in some schools.

Data collection

The DD research team used a mixed methods approach to data collection. The DD program teachers and students completed questionnaires before and after the DD program, and focus group interviews were also conducted by the DD research team. It was anticipated that the results from the questionnaires and interviews would indicate the extent to which the DD program had been successful and would provide ideas for improvements. In addition, Expert Divas were asked to reflect on classes in a weekly email to the DD research team, and observations made by the researchers were also collected. The DD student and teacher survey instruments are included in full in Appendix A and are summarised below.

The DD student pre- and post-program questionnaires were very similar so that comparisons could be made, particularly making use of 5-point Likert-type response formats.

The DD student pre-program questionnaire comprised four sections:

1. *About You*. This section included a range of demographic and background questions (e.g., Do you regularly speak a language other than English at home? How good are you at computing?).
2. *About You and Computers at home and at school*. This section focused on computer ownership and use of computers at school (e.g., How many hours do you use a computer at school?).

3. *Computers and YOU*. This section included a number of closed items with 5-point Likert-type response formats. The items were designed to determine beliefs about computers, focusing particularly on gender-related beliefs (e.g., Boys are better than girls at fixing a computer; A person who works in computing often makes a lot of money).

4. *Computing Careers and Jobs*. Questions about perceptions of the computer industry and the people who work in it were included in this section (e.g., What do you think you would like about a job in computing?).

The DD student post-program questionnaire comprised three sections:

1. *Thinking about Digital Divas.* This section asked about enjoyment of the DD program (e.g., What was the most interesting thing you learned during Digital Divas?).

2. *Computers and YOU*. This section was the same as the pre-program questionnaire.

3. *Computing Careers and Jobs*. This section was the same as the pre-program questionnaire.

The DD program teacher pre-program questionnaire comprised four sections:

1. *About You.* This section included demographic and background questions including questions about pre-service teacher education, experience, confidence and enjoyment with regard to ICT (e.g., Was ICT education a component of your teacher education program?).

2. *Computers in Your School.* In this section questions about the availability and arrangement of computers at the school, including questions about the ICT subjects offered at the school, were asked (e.g., How are computers organized in your school?).

3. *Your views: Girls, boys and ICT.* The focus of this section was to determine the DD program teachers' gendered attitudes about ICT. It included questions about differences in boys' and girls' behaviour, confidence and interest in computing (e.g., In ICT classes you have taught in the past, have you observed boys and girls behaving differently with respect to the ICT activities in which they engage?).

4. *The Digital Divas Program.* This section provided an opportunity for DD program teachers to explain why they were involved in the DD program and what successes they hoped to achieve through the program (e.g., What would success in the Digital Divas program look like to you?).

The DD program teacher post-program questionnaire included questions about the implementation and perceived success of the DD program: which topics the students found were the most enjoyable and difficult, how useful the Expert Diva had been, and whether the DD program teacher considered the DD program successful in changing student attitudes about ICT (e.g., Which topics did the students find most/least engaging? In your opinion will more students go on to study ICT as a result of Digital Divas?).

The DD student focus group interviews were held after participation in the DD program and included questions about which topics the students found the most interesting and accessible, whether student confidence with computers had improved, and whether they were now considering including ICT in their futures.

The DD program teacher pre-program interviews included questions about the typical ICT experience of a student, how ICT was promoted at the school, the perceived benefits of running the DD program, any problems the teacher could foresee with implementing the program, the teachers' opinions about ICT tasks that appeal to students, and the characteristics of students who engage in ICT.

The DD program teacher post-program interviews were mainly concerned with the success or otherwise of the DD program, how well activities worked, and what improvements could be made to the program.

Elements of a successful intervention program

In this section, the DD program is briefly compared with the literature on successful intervention programs to indicate its likely outcome. Leder et al. (1996) outlined elements of a successful intervention program based on a review of international intervention programs in the field of mathematics education aimed at addressing issues identified as disadvantaging girls. This is relevant to ICT interventions because there is a close association in the community between mathematics and ICT with respect to gender, that is, both fields are perceived as male domains.

Leder et al. (1996) suggested that to be effective, intervention programs should be tailored to the interests and needs of the participants and that they should feel they are participating in a useful activity. It has been suggested that dull computing courses, a lack of female ICT mentors and little career information is putting girls off ICT careers (Schiavone, 2012). The DD program aimed to incorporate female mentors, guest speakers from the industry, information about ICT careers, and a curriculum that girls would find interesting and useful while enhancing their self-

efficacy. Stereotypes, such as the lack of ICT job flexibility to incorporate a family, which Hayes and Bigler (2012), suggested was valued highly by females in their future career choices, were challenged. Ashcroft, Eger & Friend (2012) noted that increasing self-efficacy, challenging stereotypes and providing role models did not necessarily translate into a desire to enter a career, as children do not develop these perceptions and beliefs in a vacuum. Trauth (2012) cautions that interventions must be careful not to just look upon females as "broken" and aim to "fix" them by getting them interested in computer games, that is, not adopt a *deficit model* approach (Lang, McKay, & Lewis, 2007; Wallace, 2009).

Leder et al. (1996, p. 975) also suggested "targeted recruitment strategies, staff who empathise with the target population, parental involvement and a developed base of community and organizational support." Although the DD research team did not include parental or community awareness in their aims they did make an effort to get both the parents and the community involved. Although not all parents took up the opportunity, on the last day of class parents of DD students from Bartik SC were invited to presentations showcasing work the students had done during the DD program. The DD research team also had some success promoting awareness of the DD program in the community through strategies such as: a visit from the Victorian parliamentary secretary to the precursor of the DD program at one of the participating schools in 2008; a television piece in 2011 produced by the Australian Broadcasting Corporation; various university and industry media releases; features on the DD program web pages; and web news articles in 2011. The DD website (http://digitaldivasclub.org) also provided information on the intervention and detailed the media exposure achieved. Student recruitment strategies were left up to the participating schools, and while the DD research team did hope to have organizational support, in this case school support, and empathetic staff, in particular the DD program teachers, this was beyond the DD program research team's control.

Finally, "constant, regular evaluation…to adapt to the changing needs of groups" was also recommended by Leder et al. (1996, p. 793). The following examples demonstrate that the DD program had the potential to adapt according to changing needs and feedback. Some schools participating in the DD program had included neither the *Shake the bottle, wake the brand* module or the *Mythbusters* module, which were the only modules to give particular information about ICT careers and the aims of the intervention. In response to teacher and student feedback gathered in 2010, teachers were specifically requested to include the modules in future classes. In addition, the DD program teachers were encouraged to adapt the modules to suit their students.

In summary, the DD program appeared to have many of the elements of a successful intervention program suggesting a strong likelihood of positive outcomes. The curriculum was designed to interest and excite girls in Years 8-10. Also, while community awareness was not included as an explicit aim, some effort was nonetheless made to disseminate information about the DD program. In addition, the program was flexible in allowing for adaptations as required. An investigation of the support available at each participating school may have allowed the researchers to direct the intervention differently at different schools. As things stood, school support for the intervention was beyond the control of the DD research team.

The schools selected for the PhD study

The DD research team invited all schools in the state to participate through publicity on ICT teacher email lists, promotion at careers events, and through school contact lists obtained by the DD research team from their associated universities and the Linkage Grant partner DEECD. It was anticipated that schools would show active support for the program and that teachers would be enthusiastic.

Of the 10 schools that participated in the DD program, two secondary schools (SC) were chosen for detailed analysis in this PhD: Goldstine SC and Bartik SC. Goldstine SC and Bartik SC ran the DD program for the first time in 2010 while data for this PhD study were gathered in 2011. Goldstine SC is a newly established, medium sized, co-educational government school located in the South East of Melbourne for students in Years 7 to 12. The DD program was run as an elective for Year 9 girls. Bartik SC is a large, co-educational government school located in the East of Melbourne for students in Years 7 to 12. The DD program was run as an elective for Year 8 girls. Demographic information about the two schools provided by the school Principals and the 2010 (the year the DD program started in the two schools) “My School” website (ACARA, 2011a), is presented in Table 2.1.

Table 2.1

2010 Demographic information for Goldstine SC and Bartik SC

Item	Goldstine SC	Bartik SC
Year of establishment	2009	1969
Enrolment	933	1422
Male to female student ratio	488:445	698:724
Percentage NESB[1] students	51%	54%
Student to computer ratio	1.4:1	4.5:1
ICSEA[2] (Median 1000)	969	1074
NAPLAN[3] YEAR 7 (National mean, 548)	548	600
NAPLAN YEAR 9 (National mean, 585)	580	626

1. Non English Speaking Background.
2. Index of Community Socio-Educational Advantage.
3. National Assessment Program - Literacy and Numeracy – Numeracy results.

The differences between the schools are evident in Table 2.1 and further explained in the next few paragraphs. In 2010, Goldstine SC had a lower enrolment than Bartik SC, and slightly more male than female students, while Bartik SC had more females than males enrolled. The schools had similar percentages of Non English Speaking Background (NESB) students, and there was a marked difference in student to computer ratios with Goldstine SC students having much better access to computers than students at Bartik SC.

Each Australian school has an associated Index of Community Socio-Educational Advantage (ICSEA) score. Nationally, the median is 1000 with a standard deviation of 100, and ranging from 500 for schools with students from extremely educationally disadvantaged backgrounds, to 1300 for those with students from very educationally advantaged backgrounds (ACARA, 2012a; 2012b). Goldstine SC had an ICSEA score below the median of 1000 indicating it had students from lower socio-educational advantage than Bartik SC which had an ICSEA score above the median indicating that their students were from higher socio-educationally advantaged backgrounds.

The Australian Standing Council on School Education and Early Childhood (SCSEEC) directs a National Assessment Program – Literacy and Numeracy (NAPLAN) in order to measure whether Australian students meet the Council's desired educational outcomes (ACARA, 2011b). NAPLAN is conducted annually across Australia through a series of common literacy and numeracy tests for all students in Years 3, 5, 7 and 9. The 2010 NAPLAN scores for numeracy in Years 7 and 9 for Goldstine SC and Bartik SC were shown in Table 2.1. Year 7 and 9 results were used as they relate most closely to ICT at the year levels at which the DD program was aimed. Bartik SC NAPLAN scores for numeracy in both year levels indicated that it had above average achievement compared to the mean for Australian schools, while Goldstine SC numeracy at Year 7 level was equivalent to the average and at Year 9 level, was just below the national mean.

Data from the DD research team provided an insight into the environment in which the DD program was operating at each of the two schools in this study. Permission was given by the DD research team to make reference to the following data:

- Observations by the DD research team in 2010 and 2011.
- 2010 and 2011 Expert Diva reflections.
- 2010 and 2011 DD program teacher pre- and post-program questionnaires and interviews.
- 2010 and 2011 DD student pre- and post-program questionnaires and interviews.

It should be noted that Angela (pseudonym), the Bartik SC program teacher, while heavily invested in the DD program through teaching and writing modules for the DD program, was not the class teacher for the duration of the DD program. She was on maternity leave a few weeks before the end of the 2010 class and for the first half of the 2011 class. All questionnaires and interview data available, however, were from Angela; no data were collected from the replacement teachers. Angela's pre-program questionnaire and interview were only available for 2010, not 2011. In addition, the pre-program questionnaires and interviews for the DD program teachers from both Goldstine SC and Bartik SC in 2010, the first time the intervention was conducted, were more informative than in 2011, as the DD program teachers had already run the program once by then and, as such, the questionnaires and interviews were not really "pre-". For these reasons, the DD research program data from 2010 and 2011 are included in this thesis.

In the discussions that follow, only information about the two schools, Goldstine SC and Bartik SC, participating in this study (i.e., not all DD research project schools) are discussed.

School ICT culture

When exploring the ICT culture of each school, focus was placed on the following areas:

- Perceived ICT culture.
- The Principal's support for the DD program.
- Existing ICT subjects run at the school.
- Provisions for the DD program.
- The way in which students were recruited to the DD program.

Perceived ICT culture

In the pre-program questionnaire, the DD program teachers at Goldstine SC and Bartik SC were asked to indicate what they thought was the priority given to computer education within their schools. In 2010 the Goldstine DD program teacher, Jody (pseudonym), indicated that she believed the school gave moderate priority to computer education; in 2011, she reported that it was given moderate to low priority. The Bartik DD program teacher, Angela, believed Bartik SC gave a high priority to computer education in 2010; she did not fill out a pre-program questionnaire in 2011.

The Principals' support for the DD program

As discussed earlier, the DD research team anticipated a champion at management level (R2) in each participating school. The attitude of the Principal at each school sets the tone for the general culture of the school and for the ICT culture in particular.

*Goldstine SC***.** It was difficult to determine the level of support for the DD program from the Goldstine SC Principal because emails from the DD research team and from me went unanswered. After repeated attempts to contact her by email, in a telephone conversation she gave the impression that she was very clearly time-poor. I suggested distributing questionnaires to teachers, students and parents at the school and the Principal agreed. There were no questions posed by the Principal who appeared disconnected from the DD program. The DD research team and I communicated with the DD program teacher directly and had no contact with the Principal for the duration of the DD program.

Bartik SC. A member of the DD research team had worked with Bartik SC prior to the DD program on the forerunner (pilot) to the DD program. As the DD program was being developed, the team approached the Bartik SC Principal to enquire whether the DD program could be run at Bartik SC. The Principal agreed and subsequently the Bartik DD program teacher, Angela,

was employed to work with the DD research team to create teaching modules and materials for the DD program.

Upon receiving my email requesting permission to conduct this study, the Principal from Bartik SC initiated a meeting with me. When I met with her it was clear that she was both familiar with and interested in the study, asking questions and making suggestions. After the meeting the Principal indicated that the school would provide anything I needed and that we should keep in regular contact. Both the Bartik Principal and the Bartik DD program teacher were very enthusiastic about being involved in the DD program. The Bartik SC Principal appeared to value the program while the Goldstine SC Principal appeared to place less importance on it.

Existing ICT subjects run at the school

In the DD program teacher pre-program questionnaire, teachers were asked to indicate which senior ICT subjects were offered that year at their school as an indicator of how strongly ICT was represented in the whole school curriculum. The following Victorian Certificate of Education (VCE) ICT units were available at the time of this study:

Unit 1: IT in action.

Unit 2: IT pathways.

Unit 3 and 4: IT applications.

Unit 3 and 4: Software Development.

It should be noted that Units 1 and 2 are normally studied by students in Year 11, while Units 3 and 4 are undertaken in Year 12, the final year of secondary school.

Goldstine SC. In 2010, Jody, who had been teaching ICT "on and off" for four years at Goldstine SC, surprisingly, did not know whether the school ran Units 3 and 4: *Software Development*, but confirmed that the other available units were offered. The following year she indicated that Unit 1: *IT in action* and Units 3 and 4: *Software Development* were the only units offered at Goldstine SC in 2011. In the pre-program interview in 2010 Jody had commented that, "VCE IT seems to be decreasing". She noted that prior to VCE, students "don't get the opportunity really to do any IT 'til Year 9 and by then they've already decided it's pretty much just word processing and there's nothing to learn, which is a bit sad". The school had taught ICT in Year 7 in previous years. That, however, had been abandoned because "it's believed that they come in with enough skills already, which I don't believe they do, and you get such a variety of skills." Jody also mentioned that Goldstine SC had a "very, very tiny IT department". Jody anticipated Goldstine SC's participation in the DD program would "…build up IT in the school again…"

Bartik SC. In 2010, Angela indicated that the school ran all available VCE ICT subjects and that computing subjects were offered as a separate subject or elective in Years 8, 9, and 10. Angela believed that there was a big emphasis on ICT at the school, for example, there was an elective Year 8 unit for gifted students, and *IT Academy,* a new Year 10 unit Angela was advertising throughout the school. To promote ICT, the ICT teachers mounted student work on classroom walls so that students and teachers from other classes could see what was happening.

Provisions for the DD program

The ability to deliver ICT programs can be affected by a lack of resources, both financial and physical, at the school (Clayton & Beekhuyzen, 2004). Provisions for the DD program reviewed below included not only ICT hardware and software provided by the school, but also availability of classrooms, time allowance for the teacher to manage the DD program, and the method of student recruitment to the DD program.

Goldstine SC. In her 2010 pre-program interview Jody noted that the school had three computer rooms and would soon be getting laptop trolleys for the classroom. She mentioned that there had been major problems with the school's computer network and that she was worried that the software applications required for the DD program may not run properly. She was "not sure how our bandwidth's going to cope, but we're hoping". In addition, although Jody noted that it was unusual, in the first week of the DD program the class was to be held in a classroom with no computers, as the computer rooms were booked out for a special event at the school. In the following weeks the DD program class was timetabled into a computer room.

When the DD program ran at Goldstine SC in 2010, I observed a class. The computer room was large and students had individual access to computers. There was a data projector so that the teacher could demonstrate techniques to the class. In the observed class the teacher was to introduce a new application, *Flash*, to the students. Unfortunately, the teacher's computer and the students' computers had different versions of the application. Jody had not realised this prior to the class and so her demonstration of *Flash* was not useful for the students. She later explained that the school computers had been updated since the last time she had checked but she had not been made aware of this.

This was not an isolated incident, as in 2011, the Expert Diva assigned to Goldstine SC observed a lack of awareness of the DD program requirements, or communication between the school ICT team and the teacher, when she commented in her weekly reflections that, "unfortunately the IT team had done some upgrades over the holidays, and they forgot to include *Alice* on the image when reformatting the computers". This may have had an impact on the DD program

outcomes as the Expert Diva went on to note, “a couple of the girls couldn’t find the file they had been working on the previous week, so had to start again from scratch which would have been quite discouraging – to do all that work and then lose it”.

In the 2010 post-program interview Jody explained that she did not have a lot of time to prepare for or manage the DD program: “I’m also a Domain leader and I’m also in Management and also the head of the Union here. So it’s been a very hectic year.” In the 2011 post-program interview Jody commented that, “I just think I need to bring a bit more …” indicating that she did not think she had contributed enough to the DD program.

These observations and comments from the Goldstine DD program teacher indicate that resourcing assumption R2 (A school that is supportive, including a champion at the management level who is knowledgeable about ICT, innovative/creative environment, flexible timetable, appropriate ICT resources, that is, up-to-date, works well and there is good network access) may not have been the case at Goldstine SC. There were issues with the network, computer programs, communication between staff, and even classroom access, and the DD program teacher did not feel she was given enough time to manage the DD program well.

Bartik SC. In her 2010 pre-program interview, Angela noted that “on the whole I think the students are well catered for” with ample access to ICT: computer rooms, class sets of computers and interactive whiteboards. When asked if computers were used across all subjects, Angela responded that “there’s always a demand”. She explained that computers are always fully booked out and that the school was expecting two more trolleys of laptops that year. In addition, iPads had been distributed to Faculty Heads in the school in order to determine how educationally useful they might be. Angela explained that teachers at Bartik SC were given a lot of professional development (PD) in ICT. In 2010 they were receiving training for the school Ultranet which would enable students and parents to access from home attendance rolls, homework, and work the students had saved at school. The school had also recently run a PD workshop on Podcasts.

In her 2011 post-program interview Angela mentioned that the worst aspect of the DD program was “having a room that did not function for group work effectively”, indicating that perhaps some of the resources made available for the DD program by the school impacted negatively on the DD program outcomes.

The way in which students were recruited to the DD program

Ideally, and it was assumed by the DD research team, students should have been enthusiastic and willing participants in the program. This was not always the case as the method of recruitment was largely left up to the schools participating in the DD program.

*Goldstine SC***.** In 2010 and 2011 when asked how students were recruited to the DD program Jody indicated that while some students chose the DD program as an elective, others were placed in it because they were disengaged students and the school was hoping the DD program would help keep them at school. Jody explained that. "We've got a lot of disenfranchised girls, I think, in this group, which is (a) a bit worrying for obvious reasons, but (b) an opportunity - I hope to get them enthusiastic".

Bartik SC. In the 2010 pre-program interview, Angela had indicated that students would choose the unit "Digital Divas" as an elective, but that she could foresee a problem with recruitment. The school offered a wide range of subjects, and so the DD program would be competing with other subjects girls enjoy. The point was made that "... it's not that they don't like IT, it's just that they might prefer something better and they do have to make a choice at the end of the day".

After the DD program, in 2011, Angela explained that not every student could get into the electives they had chosen and had instead been allocated to other classes. She noted that one third of the students "did not select it [the DD program] and were put into the subject".

Summary of school ICT culture

One of the resourcing assumptions for the DD program (R2) was: a school that is supportive, including a champion at the management level who is knowledgeable about ICT, an innovative/creative environment, a flexible timetable, and appropriate ICT resources (up-to-date, works well and there is good network access).

Goldstine SC. Goldstine SC did not appear to have a champion at the management level. Provisions for the DD program at the school were basic and there appeared to be a lack of communication within the small ICT department. The school had also used the DD program to encourage some 'at risk' students to stay at school. Overall, the school did not seem to meet the requirements needed for a successful DD program.

Bartik SC. Bartik SC, on the other hand, appeared to embrace the DD program enthusiastically. The Principal was interested and supportive, ICT was well established within the school being used across the curriculum, ICT PD was regularly offered to staff, and everything required for

the DD program was offered. While students elected to participate in the DD program at Bartik SC, some students were placed in the class after missing out on their first choice of electives. Bartik SC was much closer to the ideal school envisaged by the DD research team.

The DD program teachers

The first resource assumed as a requirement for the DD program was R1: A teacher who is motivated, committed, creative, skilled in ICT, and passionate. When exploring the suitability of the DD program teachers at each school, focus was placed on the following areas:

- Support for the DD program.
- Teacher experience, confidence and enjoyment.
- Teacher beliefs about gender differences with regard to ICT.

Support for the program

Goldstine SC. Jody indicated that she was supportive of the DD program, as illustrated by this comment: "Look, I think it's a wonderful concept, I really love the idea". Jody believed that the DD program was on target to encourage girls' involvement and interest in ICT. In her mind, a successful program would mean girls being enthusiastic in the classroom and choosing ICT in the future.

Bartik SC. Angela indicated that she was "so pleased to be involved with this program" and wanted to continue her involvement. She saw a successful program as one which would result in more girls taking ICT units at VCE level.

Both Jody and Angela appeared to support the DD program goals and be willing to be involved. They were asked further questions about their experience, confidence and enjoyment of teaching ICT in the pre- and post-program questionnaires. In addition, their thoughts about gender differences with regard to ICT were explored and are described below.

Teacher experience, confidence and enjoyment

Goldstine SC. Jody had studied six semester length units of ICT in an ICT degree and in her teacher education program. She had worked in the ICT industry as an Analyst Programmer for six years. In her ten years of teaching experience she had only taught ICT subjects for four years. She had not undertaken any further study or PD prior to running the DD program for the first time in 2010, but afterwards undertook some training directly related to the *Shake the bottle, wake the brand* DD program unit. She had recognised that she needed professional development, commenting that her skills were "out of date".

Before teaching the DD program in 2010, Jody rated her computer skills as moderate and her enjoyment of teaching ICT as high. After teaching the DD program for one year her enjoyment of teaching ICT fell to 'high to moderately high' and she commented that she felt she was "not bringing enough to the classroom". This may have been as a result of her heavy workload as described earlier in this chapter. Despite this, Jody believed her computer skills had improved to moderately high and she was "much more confident" about the DD program in 2011 and felt that the modules she was teaching went well because she "directed it more". She was, however, still concerned about her level of knowledge, noting that it:

> *… still worries me a lot and the time to get those skills is another huge issue…. I really would love to be able to get out there and spend some time just learning things, because sometimes my knowledge level is only just above them [the students].*

In 2010 and 2011, Jody thought that the range of skills required for the DD program was unrealistic "for any ordinary IT teacher to have" and that she would have liked training or step by step instructions for the DD program "which would save me having to fossick around and try and figure it out myself." In addition, she commented that in 2010 she had "expected that the [Expert] Diva would know how to use all the modules and know exactly what to do and would do all that". This indicated that she thought she could take a passive role in the classroom, evidence of her incorrect interpretation of DD program expectations of the teacher and the Expert Diva.

During the first year of the DD program, the researchers recorded their observations of the teachers and their classes. Observations of Jody led to impressions of disorganization, lack of preparation given the materials that the DD program provided to teachers, and class control issues. The day before the first class in 2010, at a meeting with me, Jody revealed that she had not looked at the suggested lesson plans or any of the software applications that would be used in the DD program.

In an observed class, when Jody was unsure what to do next with a software program, some students tried to help her. Other students, however, were off task. The researcher observed, and Jody commented on, students watching movies and writing blogs during class time. Students, observed by the DD research team, became frustrated and comments heard in the class included:

> *This is making me cry.*
>
> *Mine doesn't work.*

When is the bell going? I want to get out of here.

Am I the only one who knows what I'm doing? – chorus: *yes!*

The Expert Diva commented, in her 2011 weekly reflections that: "Between myself and the teacher we don't have a large amount of knowledge of *Photoshop*... so the girls had to do some self-learning – and *Google* how to do certain things."

Comments from the 2010 post-program student questionnaires and focus groups reinforced this point. Three students indicated that the teacher was the thing they liked least about the DD program because "she failed to explain our tasks clearly to us" and "the teacher wasn't helpful". In addition, they were concerned that Jody "… was always putting us down..." and thought it was "quite insulting." They reported that the teacher made negative comments such as "You guys can't do anything, blah, blah, blah, blah" when "she could have helped". Apparently she was "too busy sitting down and yelling at us." Students believed that the DD program "… would have been better with a better teacher".

Comments by Jody in the pre-and post-program interviews appeared to indicate that she was not, perhaps, the role model the DD program had envisaged, as she seemed to have some stereotypically "nerdy" qualities. For example, when asked in 2010 if she anticipated any problems with the class, Jody prefaced her answer with "I mean it's an IT nerd class". She went on to reveal that "whenever I have a class I try and give them my experience in IT where I've worked selling Concrete Pipes", unlikely to be a topic that teenage girls would find very engaging. In addition she commented that, "...maybe, like me, they'll be thinking, 'Oh [I'm] not very creative so I wouldn't be able to do that'" and "I don't generally do the arty stuff. I'm more the mathematical, scientific rather than the beautiful layouts and doing that little picture thing" referring to DD program activities. In the 2011 post-program interview, when asked about the *Fab & Famous* module, one of the most popular modules with the DD students, Jody commented that "they loved manipulating the pictures, they loved talking about models and what's been done to them and they really, really did engage with that, which I found very surprising." That Jody was surprised that her students were so engaged with this module provides further evidence that Jody may have been out of touch with what the students found interesting.

These findings indicate that Jody may not have been as motivated, committed, creative or skilled in ICT as was initially assumed. While she became more confident in her skills in 2011, she was still not satisfied with her level of skill. Weisgram and Bigler (2007) suggested that a decrease in egalitarian views among a group of STEM intervention program participants may

have been due to "the physical appearance or mannerism of the female presenters [which] led some girls to endorse gender stereotypes about women in science" (p. 267). In a similar way, Jody may have unconsciously reinforced stereotypes about "nerdy" ICT people.

Bartik SC. Angela, the DD program teacher at Bartik SC, was heavily involved in the DD program. Angela was a curriculum coordinator and ICT teacher at the school. She had taught ICT for eight years, as long as she had been teaching, and was not teaching any non ICT subjects while involved in the DD program. While she had not worked in the ICT industry, Angela had studied six semester length units of ICT at tertiary level, then additional tertiary study, undertaken PD in ICT and ICT education since becoming a teacher, and she wanted to do more.

In 2010, Angela rated her computer skills as high and her enjoyment of teaching ICT as high. She commented that, "I always enjoy teaching DD." Angela was employed by the DD research team to write the modules for the DD program and was very enthusiastic. In the 2010 post-program interview she indicated that, "the best aspect of DD, from a teacher's point of view, is having flexibility with the curriculum and being able to experiment with ideas and finding out what works and what doesn't work with the girls." She had suggestions about improving the DD program in 2010 and 2011 such as arranging visits to companies where the students could "see IT in action". In particular, she had an interest in increasing collaboration between the DD program classes from other schools where students could meet in person, give presentations or have video conference lessons. Angela commented that, "I feel there is always more we can do... It is something that needs to grow and we need to continually improve and challenge our thinking on how to get the girls motivated and interested in this subject area."

Classroom observations in 2010 revealed Angela's enthusiasm, confidence and ability to run the class. In the field notes, the class was described as "Very orderly, calm environment, as expected, due to [Angela's] experience with DD and her technical expertise." On a separate occasion the researcher observed that Angela was "... confident and relaxed about the class." Angela was, however, on maternity leave a few weeks before the end of the 2010 class and for the first term of the 2011 class. While no data were gathered from the replacement teachers, student comments in the 2011 post-program interview indicated very different teaching styles. Students explained that while Angela "gives us more time if we don't get something done or she's very flexible", one replacement teacher (a male) was described as rigid, demanding, and strict.

Teacher beliefs about gender differences with regard to ICT

An expected outcome from the DD program was that students would understand that females and males are equally capable of participating in ICT. If the DD program teacher did not agree with this message, it would be difficult for the students to receive it. On the pre- and post-questionnaires, teachers were asked several questions related to this issue.

Goldstine SC. In 2010 and 2011 Jody indicated that she believed boys were more confident, competent, and interested or enthusiastic about ICT than were girls. She explained that this was because "on average boys [are] more proficient and ready to take risks/have a go" (2011) and "more likely to use it at home/online tutorials, etc.", and also "because boys picked ICT subjects and girls didn't" (2010).

Jody had observed differences in the way boys and girls behaved with respect to the hardware and the ICT activities in which they engaged. In 2010, she explained that girls "tend to take a more passive roll and seek help from the boys". In 2011, she observed that, "boys [are] rougher, more likely to try to fix it themselves, fiddle with connections, play tricks – unplug", whereas, "girls [are] more interested in making [things] look good, more careful following instructions/code".

Jody explained that girls' interest in ICT tasks used in classes at Goldstine SC depended on "what girls' interests are – e.g., Anime or what they think it is going to be about". She thought that pinpointing ICT tasks that appeal to secondary school girls was "a hard one". She suggested that they were probably those tasks involving creativity, but that it also depended on the girls. She was interested to see how the students would respond to *Alice*, the DD programming module, as "I would have thought they would think things like just the straight programming were boring".

Bartik SC. The Bartik DD program teacher, Angela, did not fill out a pre-program questionnaire in 2011, but in 2010, the first year of the DD program, she indicated, with no explanation, that while she believed boys were more interested or enthusiastic about ICT than girls, gender differences in confidence and competence "depends".

She had observed boys and girls behaving differently with respect to the ICT activities in which they engaged and sometimes observed gender differences with respect to the hardware but did not elaborate on this. She did not think that the ICT tasks used in classes at Bartik SC appealed more to girls or boys, rather that it "depends". Unfortunately this was not explained further.

When asked which types of ICT tasks are most appealing to secondary school girls, Angela, like Jody, thought this question was "really hard". She indicated that she could not pinpoint one particular thing as "some girls really like the designing element and some girls liked *Alice*, the DD programming" and that there was nothing specific that girls in general disliked.

Summary of teacher suitability for the DD program

Jody, the Goldstine DD program teacher, appeared to lack confidence in her abilities, only made minimum effort with regard to preparation for the DD program, was not held in high esteem by her students, and believed that boys were more suited to computers than girls. Jody did not seem to embody the teacher who is motivated, committed, creative, skilled in ICT, and passionate assumed as a prerequisite for the DD program to be successful (R1).

Angela, the Bartik DD program teacher, was enthusiastic, confident and well versed in the requirements of the DD program, not least because she wrote the teaching modules. While she believed boys were more enthusiastic than girls about computers, she thought that confidence and competence depended upon circumstances. Angela was closer to the teacher (R1) envisaged for the DD program.

Chapter summary

In this chapter, the design, aims, goals and assumptions of the intervention were described. In addition, the purpose and content of the DD program modules were expounded and the DD program data collection instruments were outlined. The elements of a successful intervention program were compared with those of the DD program and it was found that, with the important exceptions of school support and DD program teacher suitability, over which the DD research team had little control, the DD program appeared to address all elements.

The two schools focused upon in this PhD study, Goldstine SC and Bartik SC, were introduced and the school ICT culture and the DD program teachers at the schools were described. Goldstine SC did not appear to be as suited to the DD program as was expected, with little support from the Principal and a DD program teacher who appeared lacking in confidence, enthusiasm, and expertise. Conversely, Bartik SC was closer to the envisaged school with a very supportive Principal and an enthusiastic, experienced and skilled DD program teacher.

In the next chapter, the literature relevant to this study and the research question are reviewed and key concepts are highlighted.

Chapter Three: Key Concepts and Literature Review

In this chapter, key concepts and relevant literature on contextual factors impacting on girls' attitudes towards ICT are examined. The Expectancy Value Model of Achievement-Related Choices (Eccles, 2005), introduced in Chapter One, guided this literature review. The theoretical model suggests that gender roles and cultural stereotypes about ICT, socializers' beliefs and behaviours with regard to ICT, and previous ICT experiences form the basis of decisions about ICT achievement-related choices. This chapter begins with an overview of socialization and stereotypes held in society, followed by an exploration of literature on socializers' influence on girls' interest in ICT. Finally, literature related to the ways in which an appreciation of these factors have influenced the design, execution, and evaluation of previous ICT intervention programs is examined.

Socialization and stereotypes

Socialization is the process by which we learn the ways of a culture through our contact with other people (Giddens, Duneier, & Appelbaum, 2012). We are socialized initially by our parents, and later in life by others, such as our teachers, peers, and the media (Grusec & Davidov, 2006). The process of socialization involves observation, imitation, and seeking approval of those around us who reinforce our position in society through their reactions to us, whether negative or positive (Laible & Thompson, 2006; Grusec & Davidov, 2006).

The process of socialization and the introduction and perpetuation of stereotypes are intertwined. Stereotypes are a set of beliefs about the characteristics of a group of people which are formed within a culture over time (Ashmore & Del Boca, 1981). They help people process information about society and their place in it, and to identify with groups according to the way they perceive them (Mercier, Barron, & O'Connor, 2006). Currently, few women choose to have an interest in ICT in Australia, perhaps suggesting that they do not feel they belong or fit within this group. There are indications that this attitude has been engendered through socialization because, as illustrated below, the rejection of ICT by females is not consistent throughout the world.

The stereotypes people learn through socialization are culturally specific; it seems that nationality and ethnicity have a strong influence on participation in ICT (Adams, Bauer, & Biachoo, 2003; Gharibyan & Gunsaulus, 2006; Trauth, Quesenberry, & Huang, 2008; Trauth,

2012). Culture issues such as: who makes the decision about a woman's career (family or individual); what are considered "normal" gender roles (including carer responsibilities); personal safety; and social class and economic opportunity may have an influence on women's participation in ICT (Galpin, 2002; Trauth et al., 2008). In addition, when stereotypical gender roles are modelled, careers are gendered, and a culture expects lower achievement from women, they require a strong sense of efficacy to enter and attempt non-traditional jobs (Bandura, 1997). Consideration should be given to the stereotypes surrounding ICT in Australia which have contributed to the perception that women are unsuited to ICT careers. In order to understand this influence, an investigation of how stereotypes are formed and perpetuated follows, including the identification of the stereotypes surrounding ICT.

According to Zeldin et al. (2006), through socialization, stereotypes are absorbed from childhood and influence the decisions people make throughout their lives. Decisions about the appropriateness of an interest are based on gender stereotypes, that is, what is felt to be a gender appropriate activity, as well as occupational stereotypes, the characteristics of the people associated within that occupation. These stereotypes develop in similar ways, and clues to appropriate behaviour are modelled by parents, teachers, friends and other community members (Zeldin et al., 2006). This might include: the activities modelled, such as caring for babies or mowing the lawn; the direction of play activities for children, such as dolls for girls and building blocks for boys; and even the clothing worn, such as mechanics' overalls or a suit and tie for boys and nurses' uniforms for girls (Gottfredson, 1981; Miller & Budd, 1999). These examples are internalized by children and used to create rules for behaviour which can contribute to ability, self-concepts, and decisions about future careers and interests (Eccles, 2006). In addition, the exposure parents provide to various activities (for example, boys playing with mechanical reasoning toys such as construction toys, and toys based on character development and role playing such as prams for girls) send messages to children about what is appropriate (Cohoon, 2003; Margolis & Fisher, 2002). According to Eccles (2006), parents need to provide challenging but doable tasks and provide adequate scaffolding for children to succeed.

Two research studies found that errors in children's memories can be formed by strongly ingrained stereotypes, for example, it has been reported that when a child witnesses behaviour that conforms to a stereotype, that behaviour is remembered more frequently than behaviour inconsistent with the stereotype (Pettigrew, 1981; Susskind, 2003). In this way, stereotypes are perpetuated. Susskind (2003) found that when both male and female ICT professionals were involved with an intervention, the males, who fitted the ICT stereotype, were remembered

more accurately than the females, who did not, thereby reinforcing the stereotype that ICT is a male domain.

Research posits that gender role stereotypes are extremely powerful. While some argue that socio-economic status is the best predictor of educational outcomes and career choice (Bowden & Doughney, 2010; James, 2002), it has been suggested that around late adolescence, gender may have a stronger influence on educational choice than either socio-economic status or academic performance (Trusty, Robinson, Plata, & Ng, 2000). In addition, it has been found that often people would rather compromise on the field of work or the prestige of a job, than take a job that is considered inappropriate for their gender (Gottfredson, 1981).

According to Trusty et al. (2000), gender roles develop early in life, and Adya and Kaiser (2005) suggest that career "genderization" occurs around the early years of secondary school. The gendering of an occupation appears to be based on beliefs about the different qualities that each gender possesses and can thus bring to the job; this can lead to gender being considered more important than qualifications or abilities when gauging suitability for an occupation (Miller & Budd, 1999). There is some disagreement about whether occupational stereotypes get stronger with age. In a study of 592 eight, twelve, and sixteen year old students in the UK, Miller and Budd (1999) found that younger children held more stereotyped views about occupations than older children; however, both Fetherston (1999), who surveyed 25 ten and eleven year old students in Western Australia, and Barber & Mason (1994), who surveyed 5971 elementary and secondary school students in the USA, found that stereotypes about computing became stronger with age.

Stereotypes can be a negative or positive influence (Ashmore & Del Boca, 1981). 'Stereotype threat' is the term used when a stereotype causes a group to underperform. For example, Spencer, Steele, and Quinn (1999) showed how the stereotype that women are weaker than men at mathematics can cause women to underperform. Two groups of students took a mathematics test. Prior to sitting the test, the first group of students was told that the test results had indicated gender differences in the past, while the second group was told that the test results had never indicated gender differences. The results showed that women greatly underperformed in relation to men in the first group (when they had been reminded about the stereotype), but at the same level as men in the second group. This example of 'stereotype threat' may also be present in ICT where the stereotype that males are better at or more suited than females to ICT may have a negative influence on females.

Similarly, 'stereotype lift' occurs when people from the non-stereotyped group benefit from a stereotype (Walton & Cohen, 2003). Following Walton and Cohen's (2003) argument, in the above example, men improved their performance in the test when reminded of the stereotype, which is positive for men, because their self-efficacy was given a boost. In this thesis stereotypes were considered negative if they caused females to discount ICT as an interest or a career.

Objects and surroundings can also represent stereotypes and an individuals' decision to join a group can be based on the group's physical environment (Cheryan, Plaut, Davies, & Steele, 2009). This finding was evidenced in Cheryan et al.'s (2009) two part study conducted in the USA. In the first part of the research, results from a written questionnaire revealed that female undergraduate students' interest in ICT could be increased to the same level as male students by simply changing objects in an ICT classroom from stereotypical (e.g., *Star Trek* poster, video games) to non-stereotypical (e.g., nature poster, phone books). In the second part of the research, after interviews at two all-female ICT workplaces, surveyed women were much less likely than men to choose to work in an ICT company with a stereotypical environment than a non-stereotypical one (Cheryan et al., 2009).

The ICT stereotypes

Secondary school students have reported that when thinking about their ideal career, interesting and challenging work and working with other people are high on their list of priorities (Clayton & Beekhuyzen, 2004; von Hellens, Clayton, Beekhuyzen, & Nielsen, 2009). When these expectations were compared with the stereotypes about ICT a mismatch was found; ICT careers were not thought of as having these attributes.

The literature identifies a number of ICT stereotypes that may influence girls' decisions to participate in ICT related activities. For the purposes of this thesis, preconceptions about ICT identified from the literature have been organized into the following seven groups and will be explained in more detail below:

1. ICT is a male domain.
2. ICT professionals are geeks.
3. ICT jobs are socially isolating.
4. ICT jobs are bad for your health.
5. ICT jobs are difficult and boring.

6. ICT jobs are incompatible with a normal family life.
7. ICT professionals make a lot of money.

ICT is a male domain. This stereotype comprises two separate preconceptions: ICT professionals are men, and men are naturally suited to ICT. There is a general view that ICT professionals are male and the workplace situation has been likened to a male locker room (Margolis & Fisher, 2002). In fact, there are more males than females employed in the ICT industry (DEEWR, 2014). When asked to draw ICT professionals, both male and female students drew more male than female characters (Barba & Mason, 1994; Mercier et al., 2006). In addition, the characteristics of ICT appear masculine (e.g., "geekiness", social isolation, and incompatibility with family life, elaborated upon below) and are observed by children, who absorb them as behavioural norms and thereby perpetuate the stereotype (Kiesler, Sproull, & Eccles, 1985).

It has been suggested that the stereotypes about gender differences in attitude and in achievement in ICT have been extrapolated from those that existed in mathematics and technological disciplines (Markauskaite, 2006). There is a general feeling, identified not only among secondary school students but also within the wider society, that males are better with computers than females as they have technical brains, an innate fascination with technology, and are generally adventurous and obsessive; these characteristics are seen as advantageous in the pursuit of an ICT career (Leder & Forgasz, 2012; von Hellens et al., 2009). Males themselves have been found to concur, believing that they have a natural ability in ICT (Zeldin et al., 2008).

ICT professionals are geeks. The geek or nerd stereotype has been widely cited by girls as a reason why they were not interested in joining the ICT profession (Anderson, Lankshear, Timms, & Courtney, 2008; Lang, 2003; Margolis & Fisher, 2002). Primary and secondary students perceived those working in ICT as pale, wearing glasses, either grossly over- or underweight, with unfashionable hairstyles and clothing (Barba, 1991; Fetherston, 1999; Sheehan, 2003). ICT professionals have been associated with a strong interest in science fiction (Cheryan et al., 2009; Steele, 2010) and have often been considered to be indolent, have negative personality characteristics, and exhibit antisocial behaviour (Mercier et al., 2006). These traits are in keeping with the next ICT stereotype discussed, that is, that ICT is socially isolating.

ICT jobs are socially isolating. Another ICT stereotype is that not only do ICT professionals lack social skills, but that the job involves working in isolation rather than being part of a team (Bronson, 1999; Lang, 2003, Lang, 2007, MMV, 2001). Margolis and Fisher (2002) suggested that females are particularly sensitive to this stereotype. This perception could be related to the low percentage of females in this male dominated field, meaning there are fewer women to

socialize with. In one study, women who had dropped out of university ICT courses reported the lack of friendships as a major reason for their withdrawal (Miliszewska, Barker, Henderson, & Sztendur, 2006).

ICT jobs are bad for your health. It has been reported that students imagine that ICT professionals work indoors (Barba, 1991; Cheryan et al., 2009; Fetherston, 1999) in dark offices (Steele, 2010) often surrounded by junk food and science fiction paraphernalia (Cheryan et al., 2009; von Hellens et al., 2009; von Hellens, Nielsen, & Trauth, 2001). These images seem to portray an unhealthy environment. In addition, the perception that ICT professionals are pale, have abnormal weight, and wear glasses (Barba, 1991; Fetherston, 1999; Sheehan, 2003) adds strength to this stereotype.

ICT jobs are difficult and boring. There are many aspects of ICT jobs that are reported as off-putting to females. ICT jobs are not thought to involve activities that women consider part of their gender stereotype, such as working with, understanding, or helping people (Jewel & Maltby, 2001; von Hellens et. al, 2009). German secondary school students considered ICT professionals to be creative and hardworking (von Hellens at al., 2009). However, findings from other studies have suggested that ICT work is understood to be technical rather than creative (MMV, 2001; von Hellens et al., 2009), difficult (Miliszewska et al., 2006), boring and repetitive (Fisher, Lang, Craig, Forgasz, & Lazarenko, 2009; Miliszewska et al., 2006; von Hellens et al., 2009), and involve long hours and late nights (Johnson & Miller, 2002; van Oost, 2000). These perceived aspects of ICT jobs could impact on people's health and their ability to care for families, the next stereotype.

ICT jobs are incompatible with a normal family life. This stereotype is another consideration that has been reported as deterring females from entering the field. Concerns about family life have been cited as reasons for leaving ICT university courses (Miliszewska et al., 2006). This has been recognized, with Stanford University and Carnegie Mellon offering "family-friendly" curricula in Computer Science (Johnston, 2001). Women working in ICT have reported anxiety about needing to place work ahead of family commitments in order to succeed in their jobs (von Hellens & Neilsen, 2001). Indeed, Sheryl Sandberg, *Facebook's* chief operating officer, writes that women in ICT "won't discuss their children at work out of fear that their priorities will be questioned" (Sandberg, 2013, p. 90). The wide media coverage of the announcement of the pregnancy of Marissa Mayer, CEO of *Yahoo*, and the criticism of the way she chose to balance motherhood with her job reinforced the stereotype that ICT is not suitable work for women who have or want families (Miller, 2012). In addition, it has been suggested that

decisions by *Apple* and *Facebook* to pay for female staff to freeze their eggs is "loaded" and sends a subtle message that delaying having children would be a wise career move (Francis, 2014).

ICT professionals make a lot of money. It is widely recognized that ICT professionals can earn a great deal (von Hellens et al., 2009) although, unexpectedly, this has not always been seen as a positive, with some students describing those in the profession as "money-grubbing" (Jewel & Maltby, 2001). Students reported that although they were aware of how well paid ICT jobs were, and the opportunities available, they were more interested in pursuing careers that related to their personal interests (MMV, 2001).

In summary, from this research it appears that the prevalent stereotypes, that ICT is a male domain dominated by unhealthy, socially isolated geeks who spend all day inside doing difficult, boring jobs, are tacitly employed to socialize girls to believe that they are less suited to ICT than boys.

Socializers' influence on girls' interest in ICT

As suggested above, cultural groups can influence children's development of stereotypes. Girls can be socialized into their stereotypical attitudes about ICT when negative stereotypes and images are introduced and reinforced by the media (Clayton, von Hellens, & Nielsen, 2009; MMV, 2001), or by parents, teachers, schools, and peers (Ashmore & Del Boca, 1981; Roger & Duffield, 2000). Students themselves have reported that when making decisions about future studies or careers these same groups are the main influencers (Leder et al., 1996; Roger & Duffield, 2000).

Parents

According to Margolis and Fisher (2002), with few exceptions parents are the first and main socializing force in children's lives. In Australia, families have been found to play a significant role in influencing children's expectations and assumptions about interests and careers (Clayton & Beekhuyzen, 2004). Strong relationships have been suggested between parental encouragement with regard to ICT and interest (Bovee et al., 2007; Shashaani, 1993), subject choice (Gal-Ezer, Shahak, & Zur, 2009) and career pathways (Lang, 2007). Secondary school students have reported that their decisions about career choice are strongly influenced by parents (Rogers & Duffield, 2000), particularly mothers (Clayton & Beekhuyzen, 2004), who have sometimes actively discouraged them from being involved in computing (von Hellens et al., 2009).

Parental support is so influential that it can outweigh other factors. In terms of decisions, achievement, and motivation, it has been claimed that messages from parents about where a child fits in society are more powerful than demographic characteristics, positive computer experiences, or ability (Eccles, 2006; Vekiri & Chronaki, 2008).

Parents as socializers can influence their children through both routine and subtle means. For example, Gurer and Camp (2002) found that ICT can be modelled as unsuitable for females through a mother's fear of, or disinterest in, computing. Parents can also use encouragement, such as rewards or praise for participation in some activities rather than others, to socialize their children (Eccles, 2006). A parent's attitudes towards ICT can shape the encouragement they provide for their child in this area. Gal-Ezer et al.'s (2009) finding that parents supported their sons' involvement in ICT at school more than their daughters' involvement reinforced earlier findings that only 22% of parents believed computer science was important for their daughters (Shashaani, 1993), but contradicted Bovee et al., (2007) who found no difference in parental encouragement for sons and daughters.

Vekiri and Chronaki (2008) claimed that children were aware of their parents' stereotyped belief that ICT is a male domain and this possibly contributed to higher self-efficacy and more positive beliefs about the value of computers among boys than among girls (Vekiri & Chronaki, 2008). Similar findings in research on mathematics, a subject area often associated with ICT, revealed that children's academic self-concept, choices, and achievement reflected perceived parental beliefs that boys are better than girls at mathematics (Wigfield, Eccles, Yoon, Harold, Arbreton, Freedman-Doan, & Blumenfeld, 1997). Further to this, male university students have cited family encouragement as a reason to persist with an ICT course more often than have females, further substantiating possible gender bias within the family (Miliszewska et al., 2006).

Peers

When asked, secondary school students have suggested that their decisions about career choice or involvement in ICT were strongly influenced by peers (Clayton & Beekhuyzen, 2004; Roger & Duffield, 2000). In a list of influences on first year Australian university students' perceptions of ICT, both males and females reported that friends were second only to school ICT courses, ranking higher than media, career counsellors, university ICT courses, and family (Thomas & Allen, 2006). In their review of the literature, however, Adya and Kaiser (2005) reported there was mixed evidence that peers influence females in their decisions regarding interest in computers and ICT careers. Furthermore, in a study from Israel, secondary school students, whether taking an ICT subject or not, reported they were not influenced by their

friends' opinions (Gal-Ezer et al., 2009). Yet, in Australia, it has also been reported that friends discouraged students from involvement with computing (Clayton & Beekhuyzen, 2004; von Hellens et al., 2009).

In addition, women have indicated that, because they are often in the minority in ICT classes, there is a limited female network available for socializing and support, and that they felt uncomfortable approaching male students (Cohoon, 2003; Miliszewska et al., 2006). Male and female ICT professionals have both stated that supportive relationships with same sex colleagues helped to develop their confidence in ICT (Zeldin & Pajares, 2000).

The media

It has been suggested that the media has an influence on student decisions about ICT involvement (Clayton et al., 2009; Davis, Paullet, Houck, & Swan, 2010; White & Kinnick, 2000). Studies in other fields have shown that the media has an influence on career decisions (Byrne, 1994; Jackson, 2009). For example, an increase in the number of courses offered and enrolments in Forensic Science at university was credited to the increase in television programs such as *CSI* (Jackson, 2009). In addition, the television series *All Creatures Great and Small* and the female character of a vet in the Australian series *A Country Practice* have been credited with the perception of veterinary science as a gender neutral career for girls (Byrne, 1994).

First year students from the University of Melbourne have confirmed the strong influence of the media on students' ideas about computing, ranking it third in a list of influences on perceptions of ICT (Thomas & Allen, 2006). In the same study, however, it was also shown that the majority of students (56.1%) could not name a female ICT role model in the media and 8% chose cartoon characters, indicating that positive female ICT role models in the media are difficult to find (Thomas & Allen, 2006). Lang (2007) suggested that a lack of awareness of what ICT jobs involve, and therefore an inability to identify female ICT role models in the media, could explain why it is not viewed as a desirable employment area for women.

School

Shashaani (1993) suggested that the way students are socialized in their early years of education relates directly to women's low participation in ICT-related fields. Eccles (2006) maintained that students were more likely to succeed in settings that provide opportunities for them to develop their individual needs and will withdraw their engagement in learning settings that do not. Female university students studying ICT have reported that assumptions about the level of experience and knowledge of ICT prior to joining the class, aggressive or patronizing lecture styles, unwanted positive discrimination, and stereotypical attitudes held by fellow

students created negative classroom experiences which put females off ICT (Crump, 2001; Nielsen, von Hellens, & Wong, 2001).

These research findings suggest that the students' perspectives are influenced by: the ICT culture of a school (reflected in the resources available for ICT classes); the diversity of ICT classes available; the expertise of the teachers; and the ambience in the ICT classroom, whether it is alienating or supportive of female participation. When the ICT classroom does not provide a learning setting that develops female needs, they may withdraw their engagement. The classroom environment and the objects within it can also represent stereotypes as stated earlier in this chapter (Cheryan et al., 2009) which may further alienate females.

Teachers

The relationship between teachers and students, girls in particular, appears to influence future academic choices. Margolis & Fisher (2002) reported that a third of US undergraduate women in ICT surveyed made their decision to study ICT based on positive experiences in secondary school computer classes. In Israel, however, Gal-Ezer et al. (2009) found that when it came to subject choices, students reported that teachers had little influence.

Teachers, Margolis and Fisher (2002) claimed, affect the way students see themselves. Alban Metcalfe (1981) found that the importance females place on doing well in school can be predicted by the quality of their relationships with their teachers. Females, in particular, have been found to develop self-efficacy through vicarious modelling in their relationships with teachers (Zeldin et al., 2008). Encouraging, passionate teachers, and good student-teacher relationships have been reported as making students' sense of belonging to an ICT environment stronger (Furrer & Skinner, 2003, Zeldin & Pajares, 2000). Education research supports the importance of teachers, recognizing that a good teacher can significantly improve a child's school performance and emphasizing that pre-service teacher education is directly related to students' results (Department of Education and Early Childhood Development [DEECD], 2013).

Butler (2000) argued that teachers can give messages to girls, sometimes unconsciously, that they do not need to participate in computer technology. While male ICT professionals have reported witnessing teachers actively discouraging women from studying mathematics and science (Zeldin & Pajares, 2000), a teacher's influence can often be more indirect. Teachers' stereotypical beliefs and attitudes about appropriate behaviour and roles for boys and girls, and technology, have been found to distort their perception of actual student abilities (Eccles, 1994) and subtly steer girls away from ICT (Barker & Aspray, 2006). Similarly, researchers have

claimed that student performance can be predicted by examining teachers' expectations and beliefs about student ability (Eccles, 2006; Jussim, Eccles, & Madon, 1996; Lee & Smith, 2001).

In short, through socialization, parents, teachers, schools, peers, and the media appear to have a significant influence on students' decisions about study and career pathways. While teachers and schools have been discussed in this section as agents of socialization, they could equally be included in the next section in which previous achievement-related experiences are discussed.

The influence of socialization and stereotypes on ICT intervention programs

According to the Expectancy Value Model of Achievement-Related Choices (Eccles, 2005), previous achievement-related experiences, in this case those involving ICT, influence both subjective task value and expectation of success and are therefore influential in the decision to participate in ICT related activities. ICT intervention programs are intended as positive achievement-related experiences that increase the participation of females.

Craig (2008) noted that ICT intervention program reports were difficult to find and frequently highlighted successes rather than "failures". She also pointed out that often the assessment criteria and aims are amiss in final reports. When these details and experiences are not fully disseminated the same mistakes can be repeated in intervention programs and nothing new is learned (Bernhardt, 2006; Leder et al., 1996).

In Chapter One intervention programs were classified in terms of delivery, type, time, or institutions, and in Chapter Two, they were presented in terms of what the literature indicated made a successful intervention program. In this section the way interventions were planned, executed, and their results presented is examined with particular focus on the organisers' recognition that socialization and stereotypes play an important role in encouraging more females into ICT.

Aims of ICT intervention programs

The literature suggests that the social practices that lead to children's gendered expectations should be the focus of interventions (Vekiri & Chronaki, 2008). The stated aims of reviewed ICT intervention programs for girls give an indication of what the organizers considered to be the issues holding girls back from taking an interest in ICT. For example, phrases such as 'counter stereotypes' or 'dispel myths' (Christie & Healy, 2004; Clayton & Beekhuyzen, 2004) are evidence that the organizers recognized the significance of negative stereotypes and the role they can play in colouring girls' ideas about ICT (Fuller, Conner, Johnston, & Turbin, 2009).

Other interventions have been even more explicit in their aims, suggesting that the goal of the course was not only to understand the gender disparity in ICT, but to propose recommendations to improve the situation (Egan, 2007).

Target groups

When organizing an intervention, the selection of the group to be targeted requires careful consideration so the intervention can have maximum impact. When the aim of an ICT intervention program is to increase the number of females in ICT it would seem logical that the females themselves be the focus of attention. As discussed earlier in this chapter, while it is recognized that gender stereotypes are formed early in life, occupational or activity stereotypes are thought to develop around adolescence and become stronger with age (Zeldin et al., 2008). Keeping this in mind, many interventions are targeted at girls "before they reach a critical time of their lives, when peer pressure drives so many to lose self-confidence and 'swallow their voices'" (Lanzer, 2009, p. 7). This is generally in the early years of secondary school. Examples include:

- *Computer Club for Girls (CC4G*) aimed at Years 6, 7, and 8 girls in the U.K. (Fuller et al., 2009).
- *GIDGITS* aimed at Years 8, 9, and 10 girls in Queensland (Clayton & Beekhuyzen, 2004).
- *Go girl go for IT* aimed at Years 8, 9, and 10 girls in Victoria (http://gogirl.org.au/).

Recognition that female enrolments in ICT university courses are low has led to interventions aimed at higher year level school students. Interventions such as *Go for IT gURL* (Christie & Healy, 2004) or *Rural and Remote IT stars* (Anderson, 2003) were aimed at Year 10 girls in order to persuade them that it was not too late to change their study preferences. Clayton and Lynch (2002) described a University ICT department which ran an intervention aimed at: attracting female students from secondary schools with career information packs and bridging programs; maintaining female enrolments through gender and learner awareness sessions for university staff; and producing female ICT professionals, with support networks for female students, and interview and job seeking skills workshops. The authors reported that female enrolments in the ICT related courses at the university increased up until 2001, when two main changes occurred. First, computing was incorporated under the discipline of science at their university, which disguised the under-representation of women in ICT, and second, changes in Australian government policies redirected funding away from addressing the underrepresentation of women towards people with disabilities and NESB, which meant that funding for this project ended (Clayton & Lynch, 2002).

ICT interventions that target groups other than, or as well as, females illustrate an appreciation that the socializers themselves need to be influenced. Recognition of this has prompted organisers to include teachers in their interventions by involving them in the delivery of prescribed material to the students (e.g., Fuller et al., 2009) or encouraging them to be present during student intervention activities (e.g., Christie & Healy, 2004), thereby exposing teachers to the same educational material as the students. Separate interventions specifically for parents, teachers, and guidance officers (e.g., Christie & Healy, 2004; Clayton & Beekhuyzen, 2004), as well as mother-daughter events, (e.g., McCullough, 2002) have also been reported.

While not specifically targeted, some peripheral groups, such as male and female peers who were not participating in the particular intervention programs, have been included in data collection phases, as it was recognized that their attitudes might have an impact on the success of the program. An indicative example is from Fuller et al. (2009), who explained that in the data collection phase of *CC4G*, female peers from the same school who had not been members of *CC4G* were surveyed in order to understand the particular effects that participation in the clubs had on its participants. Male peers' views of ICT were also collected in order to highlight any differences in ICT knowledge and attitude between males and females of a similar age (Fuller et al., 2009).

In some cases whole communities have been targeted for participation in an intervention. In one example, in the remote New Hebrides off Scotland, community resource centres recruited volunteers to teach ICT skills to the whole community (Faulkner & Kleif, 2005). The volunteers were mainly female and they successfully built networks of expertise among other women, although this was not the specific target group of the intervention. In this case, computer ownership and usage increased in the area, old computers were recycled for new users, and there was a "snowball effect on general levels of technical knowledge" (Faulkner & Kleif, 2005, p.12). The authors suggested that men were not as involved because male role models were not present, and that males were less comfortable with female-dominated learning environments. In addition they found that age, lack of interest in ICT, unwillingness to reveal a deficit of ICT knowledge, and types of occupations also contributed to the low participation by males (Faulkner & Kleif, 2005). This example highlights the importance of community attitudes in changing perceptions of ICT, although in this case, unusually, it was the females who benefitted.

In the Netherlands, in a national initiative to bridge the digital divide, the government funded ICT courses, taught by volunteers, for the whole community (Rommes, 2003). The courses

were not aimed at women specifically, but attracted nearly three times as many women as men. While overall, the intervention was not thought to have been very successful at addressing the digital divide in the whole community, lessons were learned from the high female participation rate (Rommes, 2003). The authors suggest that efforts to include people from diverse cultural backgrounds with varying gender expectations (such as female only courses, childcare, language teachers, and specific explanations about the relevance of ICT to women and girls) may have been responsible for the high numbers of females who participated.

Delivery of ICT interventions targeting females

Rather than fighting against socializing forces, some interventions have attempted to utilize the socialization process as a tool. While activities in ICT interventions are often hands on, interacting and socializing with ICT university students and professionals is also considered important (e.g., Christie & Healy, 2004; Clayton & Beekhuyzen, 2004). Female role models can be used to help dispel the stereotypes that ICT is a male domain, and that ICT professionals are nerdy and socially awkward. They are not only included as speakers, but are encouraged to mingle with students to illustrate their normality (e.g., Clayton & Beekhuyzen, 2004).

Recognition that males are often the experts in ICT prompted a delivery method where females were repositioned as the experts. Jenson, de Castell, and Bryson (2003) report on *GenTech*, an intervention in which female students and teachers were taught ICT skills and then returned to the school to train male teachers and students, thus positioning them as ICT leaders. A similar model was used in the *SYSTEM* intervention in which Girl Scout leaders were trained in ICT skills which they then used to interest girls at Girl Scout meetings (McCullough, 2002).

In another strategy, the media has been used to deliver messages about ICT in the hope that widespread exposure to positive images would challenge existing negative stereotypes. Eric Kaplan, co-executive producer of *The Big Bang Theory*, a popular television show including characters who are experts in various scientific disciplines (related fields to ICT), has suggested that the show plays a role in science education by making "people feel that scientists are real people and that science is something that real people, like themselves, could do" (Vance, 2013, p. 13). While the producers of *The Big Bang Theory* draw upon the knowledge of an actual particle physicist (Heyman, 2008), the comedy show plays upon negative STEM stereotypes with quirky, exaggerated, nerdy characters; this may be more likely to alienate viewers from a STEM career than draw them to it. In an earlier intervention, using television and print advertisements, the *Maths multiplies your choices* advertising campaign (run in the 1980s in Victoria) successfully raised parents' awareness of the importance of mathematics for their

daughters' future career options and encouraged girls into mathematics (Department of Labour & Mattingly Advertising, 1989). The positive results from this intervention, however, were not long lasting and negative stereotypes about mathematics persist (Leder & Forgasz, 2012).

Music has also been used to try to involve more girls in ICT. *will-i-am,* a popular musician, has appeared on television talk shows promoting female participation in STEM (Magnusson & Smith, 2012). In addition, *ITBeat* (Pitt, 2003) was a competition run in the UK where girls designed a website for their favourite pop star and the winner got to meet her idol. Female role models were used along the way to show the glamour and excitement of ICT with the aim of improving its image (Pitt, 2003).

Impact of interventions

Some organizers of the ICT interventions targeting females reveal that they were aware that, due to the nature of socialization, the impact of an intervention may be minimal. Fuller et al., (2009, p. viii) recognized that *CC4G* was "not implemented in a vacuum. The girls (and boys) in our study were subject to an array of influences – educational, social, financial, emotional and cultural – on their attitudes to and abilities in IT". They realized that the complex mix of influences made the impact of *CC4G* difficult to determine and that the "voluntary and individual character of the club raises an important question about what can realistically be expected, in terms of behavioural outcomes and attitudinal change in relation to IT, from the relatively brief exposure members … have had to the initiative" (Fuller et al., 2009, p. 9).

The power of socialization is also in evidence when the short term successes of interventions do not last. Jenson et al. (2003) described the results of *GenTech* (the delivery of which was discussed previously) where girls and female teachers were positioned as technology leaders. Initially there were successes with marked improvements in girls' enthusiasm, competence, and confidence with ICT. Unfortunately, the gender inequalities at the school returned within a year. The authors suggested this was due to "a specifically gendered ordering of female students' lives … by themselves, their peers and adults" (Jenson et al., 2003, p. 568). The authors suggested that the school community had failed to address the underlying issue of gender inequality, in particular, it seems that the principal was not prepared to defend the program against accusations from parents, teachers, and school administrators who had accused the program of discrimination in favour of girls.

Accepting that negative results of interventions are often unreported, in those for which results were discussed, girls' initial reactions were often quite positive, indicating an interest in the activities included in the intervention, admiration for the role models , improved self

confidence in ICT and enjoyment of the content. In some of these studies, however, apparently contradictory results were found when girls were much less positive about future involvement in ICT subjects or careers, even more negative than prior to the interventions, as the following examples indicate.

Weisgram and Bigler (2006), for instance, reported on a computer science intervention program where pre- and post- program questionnaires revealed that female participants' beliefs that computer science was a worthwhile subject and appropriate for men and women became more positive after participation in the intervention program. The questionnaires, administered straight after the event also showed, however, that the female participants' interest in participating in computer science significantly decreased.

Similarly, Nott and Arnold (2011) reported on the findings from a summer science camp (including computer science) in the US for Years 6, 7, and 8 male and female students. The results of the intervention (for two years running) showed that although skills and interest in the areas explored increased after the intervention, desire for future participation at school and as a career decreased. The authors suggested that the students perceived the science at the camp differently to the school based science. They also proposed that the age of the students was such that they may have had only limited understanding of the job options available in science and were, probably, not even thinking about careers.

Results from *CC4G* also revealed that while participants were more aware of a wider range of uses and applications for ICT, there was little evidence that it had increased their desire to pursue ICT as a career (Fuller et al., 2009). In their report the authors also suggested that the students were too young to be thinking about careers and may not have known what ICT careers entailed.

In a final example, Anderson (2003) reported on the evaluation of *Rural and Remote IT Stars*, a three day intervention for Year 10 students in Queensland. It was revealed that while there were successes, with an increase in enthusiasm towards, and enjoyment of, computers among the participants, the question "Are you more likely to choose a job involving computers?" recorded the lowest positive response of all questions. Interestingly the author described the program as "a decidedly 'un-school like' experience" (Anderson, 2003, p. 46) for the students; this echoes Nott and Arnold's (2011) suggestion above that students perceive school based learning differently from intervention based learning. However, Anderson explained this lack of interest in terms of the role socialization plays in a students' decision making with regard to ICT

and suggested that “the total school and home and social environment needs to support and encourage female students in their use and interest in ICT” (Anderson, 2003, p. 47).

These examples are further evidence that ICT intervention programs do not operate in isolation and that the girls themselves recognise this. While participation in ICT is acceptable in the artificial, supportive environment of an intervention, they are less inclined to indicate an interest in ICT in terms of a career. Recognition that socialization and ICT stereotypes are important factors in ICT related decisions can be seen in the aims, target groups, delivery, and expectations of impact of ICT intervention programs.

Chapter summary

Learning is a social process and in order to learn people need to engage with those around them. A belief that the decision to participate in an activity is based on our interaction with others led Eccles and her colleagues to develop their Expectancy Value Model of Achievement-Related Choices (Eccles, 2005). The model reveals that it is the interaction between cultural milieu, socializers’ beliefs and behaviours, and achievement-related experiences that shape our achievement-related choices and performance.

Australian society, including parents, teachers, peers, and the media, seem to be perpetuating stereotypes that indicate ICT is not suitable for females, reflected in the low numbers of females participating in ICT. Not only do the stereotypes suggest ICT is uninteresting, difficult, and boring, but *ICT* stereotypes have evolved that are directly opposite to female *gender* stereotypes. The idea that males are naturally more suited to ICT than females, and the perceived lack of social contact and unsuitability for family life associated with ICT careers in particular, are incompatible with the gender messages females receive.

Intervention programs have taken socialization and stereotypes into account in their design, including socializers as targets, and specifically countering stereotypes they believe deter females from an interest in ICT. There is also some recognition that ICT intervention programs can only have limited success, as they exist within the overwhelming, ICT negative socialization experiences that children encounter. Given this understanding, it seems sensible to investigate the relationship between community attitudes towards ICT and the outcomes of an ICT intervention program further, which is the aim of this PhD. In the following chapter the research design used to answer the research question is explained.

Chapter Four: Research Design

In this chapter the research design used to answer the research question is explained. First, the purpose of the study is restated and the development of the research question is described. Then, the implementation of a mixed methods approach is justified. Next, the practical aspects of data collection, including the recruitment process and the adoption and modification of the main DD program data collection instruments, are elaborated upon. Finally, the methods employed for data analysis for the qualitative and quantitative phases of the study are presented.

Purpose of study

When the purpose of a study is clear, consistency can be maintained when developing research questions and methods of enquiry which, in turn, strengthen the validity of the study (Newman, Ridenour, Newman, & DeMarco, 2003). As this thesis was part of a wider study, the DD program, the range of topics that could be researched was limited to those related to the DD program. Thus, the purpose of this study had already been partially determined: to investigate an aspect of the DD program. The DD students were not isolated in the classroom; they were part of a community. One of the underlying assumptions of the DD program was that "The wider community (school, parents, other teachers, other students not participating in DD) will be supportive" (Craig et al., 2011, p.316); however, there was no part of the main study aimed at investigating whether this was, in fact, the case. If the community was not supportive of the intervention program, then it was possible that the DD program would be less effective. As explained in Chapter Two, the goals of the DD program were to:

[G1.] Design material that will engage the girls as part of the middle school curriculum.

[G2.] Raise awareness and ignite girls' interest in ICT and ICT careers.

[G3.] Increase girls' confidence and improve their attitudes towards ICT.

[G4.] Identify what factors influence the programme's implementation.

[G5.] Create sustainable programmes for schools.

[G6.] Increase the number of girls electing to undertake computing subjects in later years at secondary school (and ultimately tertiary education) (Craig et al., 2011, p.315).

Community attitudes may have impacted on all goals, and were considered most likely to be related to G3: Increase girls' confidence and improve their attitudes towards ICT. In order to establish how important the community attitudes were to the success of the DD program a range of data was required. First, the attitudes of the community towards ICT needed to be established. Second, it was necessary to determine whether the DD program participants' attitudes changed after completing the DD program. Finally, to ascertain whether the community attitudes were important to the success of the DD program, the extent and direction of attitude change among DD program participants needed to be compared with the community attitudes. These three investigations were undertaken in the present study.

The community

Before research questions could be developed, it was necessary to define "the community". For the purposes of this study, the community was defined as:

- The two selected schools.
- Teachers at the two schools who were participating in the DD program.
- Teachers at the two schools who were not participating in the DD program.
- Parents of students in the year level the DD program was run at the two schools.
- Parents of students in Years 8 and 9 at Victorian schools.
- Students in the year level the DD program was run who were not participating in the DD program at the two schools.
- The media – Melbourne free to air television programs.

Research Questions

Insights gained from investigating the impact of community attitudes on the DD program's goals could be used to guide modifications to the DD program and to inform any future programs. The overarching research question investigated in this study was:

> *Are the attitudes of the community towards ICT important in terms of a successful intervention program?*

As previously signalled, to address this question and outline its relationship to the goals of the main DD research study, the following set of subsidiary research questions (SQs) were developed:

SQ1. What are community attitudes about gender and ICT?

SQ2. What are community attitudes about ICT people and jobs?

SQ3. What are community attitudes about the importance and enjoyment of computing?

SQ4. To what extent was there a change in attitude among the DD program participants?

SQ5. To what extent was the change in attitude consistent with or different from the goals of the DD program?

SQ6. To what extent was the change in attitude among the DD program participants related to community attitudes?

Research approach

It is generally recommended that studies in education be approached by starting with theoretical perspectives and moving on to investigation techniques (Crotty, 1998). The theoretical perspective of a researcher determines the methodology and research methods used. Thus, before a method of answering the research questions could be formed, an understanding of the beliefs and assumptions held by the researcher, or the paradigm chosen, required exploration.

Paradigms

Morgan (2007) points out that paradigms are "the consensual set of beliefs and practices that guide a field" (p. 49), and can be understood in different ways: as world views, as epistemological stances, as shared beliefs in a research field, or as model examples. Choice of paradigm, therefore, not only signals to other researchers the ontological assumptions of the research, which, in this thesis will be discussed through justification of the theoretical framework used, but also of the research methods employed, which are discussed in the next chapter. Before a decision was reached on how the research would be conducted the positivist, constructivist, post-positivist, and pragmatic paradigms were investigated.

The positivist paradigm suggests that meaning exists regardless of context, and waits to be discovered by the researcher (Crotty, 1998; Guba, 1990). It is most closely associated with quantitative methods, where a hypothesis or theory is tested (Johnson & Christensen, 2000) and generalizations are made based upon statistical analysis of data collected for specific questions (Creswell, 2008). The researcher and the subject should have distance between them so that they do not influence each other (Crotty, 1998). Researchers should remain objective and try to leave behind their biases (Clough & Nutbrown, 2002; Johnson & Onwuegbuzie, 2004).

The constructivist paradigm holds that meaning only exists from our engagement with the world: meaning is constructed, not discovered (Crotty, 1998). In this type of research the

subject and the object work together to construct reality. As not everyone will see things in the same way, multiple realities are constructed. Constructivists believe meanings only makes sense in context and that generalizations free from time and context cannot be made (Johnson & Onwuegbuzie, 2004). Constructivist studies value subjectivity and seek to understand actions and meanings rather than simply causes. Qualitative methods such as interviews, case studies, and observation are often employed (Clough & Nutbrown, 2002). Qualitative methods can also be used to generate new hypotheses and theories (Johnson & Christensen, 2000).

Teddlie and Tashakkori (2009) point out that mixing paradigms, in particular positivist and constructivist, and therefore methods, qualitative and quantitative, has been argued against. Morgan (2007) explains how "different assumptions about the nature of reality imposed limits on assumptions about the nature of knowledge and what could be known" (p. 58). Positivist and constructivist paradigms produce types of knowledge that were thought to be difficult to compare and so attempts to modify paradigms were made. Post-positivism, or critical realism, is a modified version of positivism that recognizes that there is no such thing as absolutely secure foundations on which to base knowledge (Phillips & Burbules, 2000). It is not possible for researchers to remain completely objective and so human objectivity cannot be relied upon. To counter this, findings should be based on as many sources as possible (Guba, 1990). Unlike positivism, post-positivism recognizes that generalizations can only be made within a context (Morgan, 2007). Morgan (2007) submits that post-positivism is "little more than a few minor changes in any attempt to repair a hopelessly broken paradigm" (p. 61).

Morgan (2007) suggests that the belief system of paradigms are disconnected from the practicalities of the actual research and so there should be a shift in the definition of paradigms so that they are looked at not so much as epistemological stances, but as the belief systems and practices within a field. Pragmatism, the proponents of which were described by Tashakkori and Teddlie as "pacifists in the paradigm wars" (1998, p. 9), was a new paradigm introduced in education research, suggested as providing the best foundation for using both the quantitative and qualitative approaches. This mixed methods approach seems most suitable for those researchers who do not "dwell on epistemological and ontological issues" (Bryman, 2007, p. 17). A pragmatic approach should emphasize shared meanings, joint actions, and the utility of research (Morgan, 2007). As this thesis is part of the wider DD program, a pragmatic approach has been taken in that the theoretical framework and methods used by the DD program were adopted for this study.

Mixed methods approach

Interaction between community members, those with and those without an immediate interest in ICT, gave rise to the stereotypes discussed in Chapter Three, and interaction between the younger community members and the more established members of the community perpetuates the stereotypes. Only through direct interaction with the members of the community can the strength and distribution of these stereotypes be known. Consideration of the research questions required not only the identification of the attitudes held within society and how widespread they were, which can be analysed statistically, but also an interpretive understanding of 'reality' from the point of view of the participants which could be analysed qualitatively.

Research should be undertaken using the most appropriate methodological tools to answer the research question (Teddlie & Tashakkori, 2009). Therefore, this study was conducted as a single study comprised of different data gathering techniques where qualitative and quantitative methods were interwoven in a mixed methods approach. The weaknesses in each data collection approach could be minimized by a mixed methods approach which would provide "a better understanding of the research problem and questions than either method by itself" (Creswell, 2008, p.552). By collecting data from multiple sources the two methods complement each other making the product better than if only one method were used (Johnson & Onwuegbuzie, 2004). In addition, when more than one method is used to collect data, reliability is increased (Urquhart, 2013).

For this study, quantitative methods would allow for the gathering of data from a large number of participants, however, the data would lack depth for a full understanding of the attitudes held in the community towards females and ICT; attitudes are more complex than can be deduced from a simple data set. Alternatively, qualitative data and appropriate analysis methods would provide detailed information about the attitudes held, but from only a small number of community members; alone they would not provide adequate data for the study. Therefore a combination of large scale quantitative data from the community and in-depth qualitative data from a smaller sample would allow not only the identification of a broad picture of the attitudes of the community, but also the emergence of a deeper understanding of those attitudes.

In addition, the data collection in the main study, the DD program, included both qualitative and quantitative methods. As data for this thesis were to be compared with data from the wider DD program it made sense to modify the DD program instruments and employ the same

methods. As noted by Schoen (2011), the pragmatic approach suggests that researchers allow the question and situation to dictate the methods of inquiry; thus a pragmatic, mixed methods approach was used for this study.

Data collection and analysis outline

As briefly mentioned in Chapter One, the data sources in this study were:

- Questionnaires, used to identify general trends among participants.
- A media review, which contributed to an understanding of the attitudes held within the community.
- Group interviews and email interviews, used to further explain the trends and attitudes found.
- Access to data from the DD program, which provided data for comparison with the wider community data.

The data collection and analyses for this study are outlined below in Figure 4.1. As illustrated in Figure 4.1, in the initial phase community attitudes were established. Questionnaires were administered to parents, teachers, and non-DD students (those not participating in the DD program) and a media review was conducted. The data from the questionnaires and the media review were then used to inform the questions for the group and email interviews. Since the community surrounding the DD students does not only exist outside the school, data from inside the school, collected through the DD program, were accessed to establish school community attitudes towards ICT. In this way, sub-questions 1-3 could be answered.

In the next phase, student data from the DD program were analysed to determine the extent and direction of attitude change among participants. Data from the community (parent, teacher, and non-DD student questionnaires, and parent and non-DD student group and email interviews) were compared with the outcomes of the DD program at the two schools. The data analysed was used to answer sub-questions 4-6, and ultimately, the research question.

A summary of how the individual research sub-questions (SQs) were addressed is set out in Table 4.1.

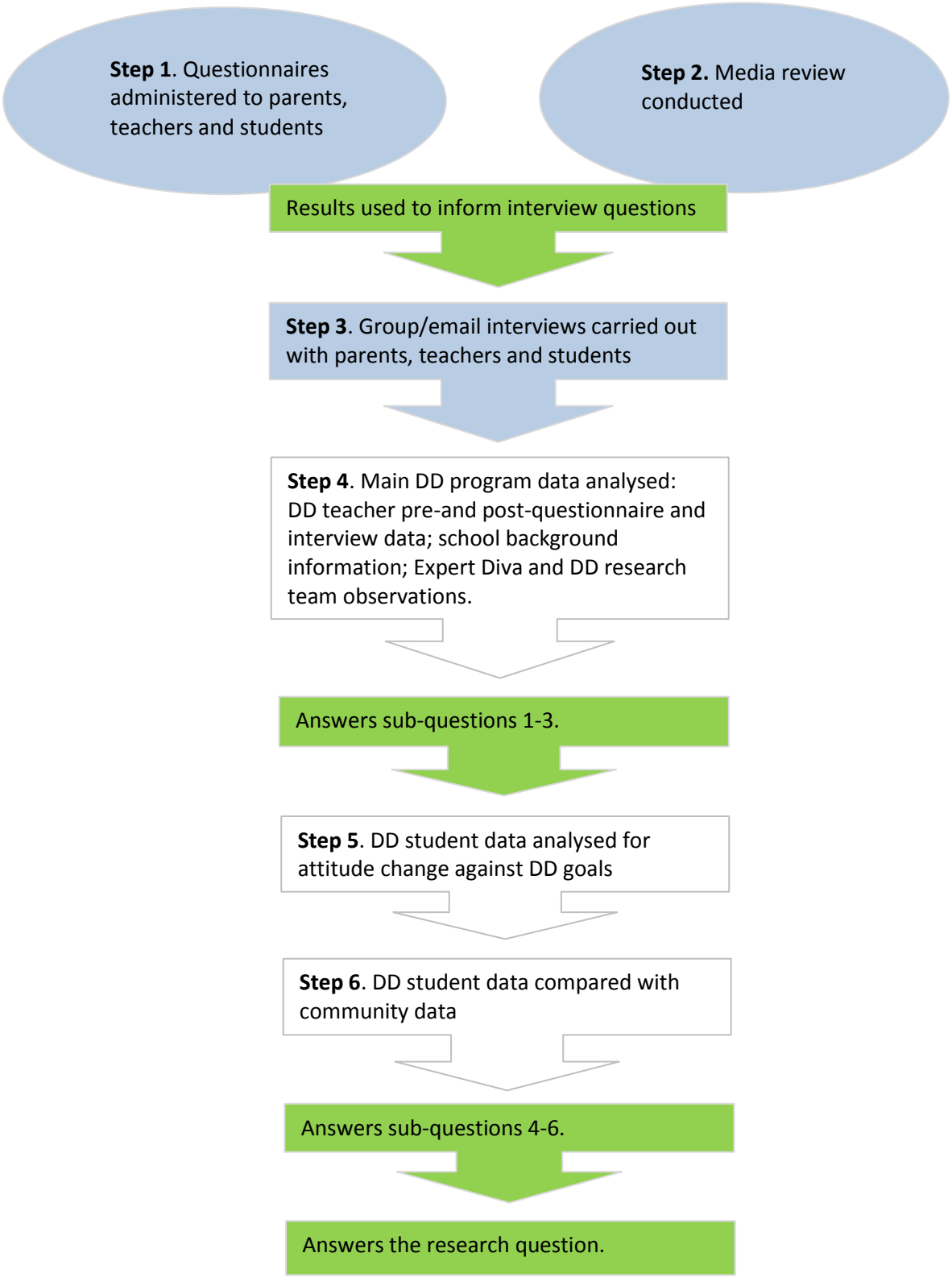


Figure 4.1. The data collection and analysis flow chart.

Table 4.1

The way in which research sub-questions were addressed

Sub-questions	Data used to address sub - questions	Concepts and sample items
SQ 1: What are community attitudes about gender and ICT? **SQ 2: What are community attitudes about ICT people and jobs?** **SQ 3: What are community attitudes about the importance and enjoyment of computing?**		Concepts: Stereotypes, attitudes and beliefs.
	Community questionnaires:	2.13 Boys are more suited than girls to work in the computer industry (parent questionnaire).
	Group and email interviews:	9. How do you think a job in ICT would impact on your child's life? (parent interviews).
	Media Review:	The characteristics of male and female ICT experts in the TV shows, including stereotypes were observed.
	DD program:	Pre- and post- teacher questionnaires.
SQ 4: To what extent was there a change in attitude among the DD program participants? **SQ 5: To what extent was the change in attitude consistent with or different from the goals of the DD program?**		Concepts: Stereotypes, attitudes and beliefs.
	DD student pre- and post-surveys:	3.3 People who work in computing work alone (pre-questionnaire).
		6.3 People who work in computing work alone (post-questionnaire).
	DD program goals :	DD program goals. G3. Increase girls' confidence and improve their attitudes towards ICT.
SQ 6: To what extent was the change in attitude among the DD program participants related to community attitudes?		Concept : Socialization.
	Community questionnaires :	Comparison of Digital Divas participants' and non participants' responses.
	DD student pre- and post-surveys:	3.29 People who are really good at computing are popular (pre- and post-student survey).
	The theoretical model of achievement-related choices (Eccles et al., 1983):	A combination of all data collected and examined using the theoretical model was used to examine the relationship.

The resources described in Table 4.1 can be found in the following places:

- The parent, teacher, and non-DD student (community) questionnaires can be found in Appendix B. Interview and email questions are found later in this chapter.
- The DD program pre- and post- teacher and student surveys can be found in Appendix A.
- The DD goals can be found in Craig et al., (2011) and were discussed earlier in this chapter.
- A description of the theoretical model of achievement-related choices (Eccles, 2005) can be found in Chapter One.
- The media review is discussed in more detail later in this chapter.

Recruitment for community questionnaires and participant profiles

A description of the two schools focused on in this study was provided in Chapter Two. The schools, Goldstine SC and Bartik SC, already had students participating in the DD program. As there was an existing relationship between the DD research team and these schools, a simple email to obtain permission to conduct data collection for the present study was sent to the principals. Permission was obtained from Goldstine SC and, after a meeting was arranged where the purpose and conduct of the research was discussed, permission was also obtained from Bartik SC.

As some statistical tests required a minimum number of responses to allow valid analysis, the goal was to have at least 50 completed questionnaires from each group (Muijs, 2004).

The community groups recruited were:

- Parents of students in the year level at which the DD program was run at the two schools; later, a wider sample of Victorian parents of Year 8 and 9 students was surveyed, as explained below.
- Teachers at the two schools who were not participating in the DD program.
- Students in the year level at which the DD program was run who were not participating in the DD program at each of the two schools.

Parents

Not all parents had given email addresses to the schools and so hard copies of parent questionnaires, explanatory statements, and consent forms were mailed to parents of all students in the year level that the DD program was running in 2011 (copies of these

documents can be found in Appendix B). The reasons why parents had not given email addresses to the school may have included privacy, computer literacy, and computer access issues. Surveying only those parents who had given their email addresses to the school, therefore, may have resulted in response bias as parents who had not given their email addresses to the school would not have been recruited (Sue & Ritter, 2007).

There was a low response rate from both schools. This prompted an additional recruitment effort. An online version of the parent questionnaire, targeted at parents in Victoria, Australia, aged between 20 and 40, who had a child attending Years 8 or 9, was advertised on *Facebook*. These parents were not directly associated with the DD program. As these recruits lived in Victoria, however, and had children in the same year levels as those in which the DD program was run, Years 8 and 9, they were considered to be part of the wider community.

The break-down of responses from parents was as follows: 14 Goldstine parents, 31 Bartik parents, and 119 Victorian (*Facebook* respondent) parents. With 164 responses, parents constituted the largest group in this study. Males comprised 29% of Goldstine parents, 15% of Bartik parents, and 11% of Victorian parents. Parents in all groups were aged between 30 and 59 with 71% aged in their 40s. Overall, 78% (129) of parents in this study had children attending government schools (which included Goldstine SC and Bartik SC); 12% (16) had children attending independent schools; and 10% (16) at Catholic schools. Parents categorized as language background other than English were: 31% of Goldstine parents, 35% of Bartik parents, and only 3.5% of Victorian parents.

Non-DD program teachers

As all teachers already had email accounts and internet access at their schools, it was decided that an online questionnaire, the link to which was distributed via email, would be the most efficient and least time consuming method to administer the questionnaire for both the researcher and the non-DD program teachers. *Qualtrics* (www.qualtrics.com), a web-based questionnaire creator, was used to publish the questionnaire online. An added advantage of the online questionnaire was that data collected were automatically coded and could be exported to *Statistical Package for the Social Sciences (SPSS) 20.0 for Windows* for further analysis. This method ensured fewer errors when compared to manual coding and data entry. The schools sent emails to all teachers at their schools who were not participating in the DD program explaining the study, with a link to the online questionnaire. On the first page of the questionnaire the purpose of the study was stated and the contact details of the researchers were provided. Explanatory statements were made available, and it was explained that consent to participate in the study was implicit in completing the questionnaire. Copies of these documents can be found in Appendix B.

In total 32 non-DD program participating teachers completed the online questionnaire, 17 from Goldstine SC and 15 from Bartik SC. Around a quarter of the respondents at each school were male. Teachers' ages were spread fairly evenly between 20 and 59 years of age with two teachers over 60, both at Bartik SC.

Non-DD students

Hard copies of student questionnaires, explanatory statements and consent forms for parents and students were posted to all students not participating in the DD program in the year level in which it was run in 2011. The student questionnaire was paper based rather than online for two reasons: First, as the students were under 18, parental permission was required before they could participate in the study and this would be difficult to obtain online; second, as previously mentioned, the schools did not have the email addresses for all parents.

Forty-one students responded - 14 Year 9 students from Goldstine SC and 27 Year 8 students from Bartik SC. Of the respondents, 57% of Goldstine SC students and 40% of Bartik SC students were male. Students were aged between 13 and 15. Goldstine SC students appeared to be more linguistically diverse than Bartik SC students with 41% of Goldstine SC students and 29% of Bartik SC students having a language background other than English.

Recruitment for group and email interviews

Group interviews were to be used in order to obtain first hand opinions and to clarify and explore reasons for the answers collected in the questionnaires and the findings of the media review. In the final question of each questionnaire, non-DD program parents, teachers, and students were invited to leave their contact details if they were interested in attending a group interview.

No teachers were willing to participate in a group interview. A few students responded with their email addresses; however, when contacted via email, none replied. A number of parents initially indicated they were interested in participating in a group interview. After being contacted, however, only five were able to attend the group interviews in person. Six of the remaining parents indicated they would be happy to respond to an email interview. Those students who had left email addresses were also sent email versions of the group interview questions and three responded.

Two group interviews were held at the researcher's university on a Saturday, one group of two mothers and the other of two mothers and one father. A digital voice recorder was used. Audio-taping the group interviews improved the accuracy of data gathered and

reported as the recordings could be listened to a number of times during the transcription process. A transcript of one of the interviews is included as Appendix C.

Community groups for analysis

The parents, teachers, and students recruited from the community and described above were divided into three groups for analysis in this study:

1) **The Goldstine community (Group A):** Group A (*N*=45) was made up of the community surrounding the girls participating in the DD program at Goldstine SC and comprised three sub-groups:

   Goldstine parents: 14 parents of male and female Year 9 students at the school.

   Goldstine teachers: 17 teachers from the school (not including the DD program teacher).

   Goldstine non-DD students: 14 Year 9 students who had not participated in the DD program. This sample included both boys and girls.

2) **The Bartik community (Group B):** Group B (*N*=73) was made up of the community surrounding the girls participating in the DD program at Bartik SC and comprised three sub-groups:

   Bartik parents: 31 parents of male and female Year 8 students at the school.

   Bartik teachers: 15 teachers from the school (not including the DD program teacher).

   Bartik non-DD students: 27 Year 8 students who had not participated in the DD program. This sample included both boys and girls.

3) **Victorian parents (Group C):** Parents (*N*=119) recruited through *Facebook* who lived across the state of Victoria. They were aged between 30 and 50, and each had a child in Years 8 or 9 attending schools in each of the educational sectors (independent, Catholic, and government) in the state. Results from Group C reflected wider community attitudes and provided a comparison for Groups A and B.

The term “combined community” is used throughout the thesis to describe the combination of Groups A, B and C.

The instruments and data analysis

As previously outlined, the data collection instruments used in this study were: community questionnaires (see Appendix B), a media review (discussed in detail later in this chapter), and group and email interviews (also discussed later in this chapter). The use of three types

of data collection instruments enhanced the reliability of this study. The interview questions were informed by the initial results of the questionnaires and the media review. The instruments and methods of data analysis are now described.

Community questionnaires

Questionnaires are a form of survey study suitable for both descriptive and analytical research so that not only the spread of a phenomenon in a population, but also an explanation for it, can be investigated (Buckingham & Saunders, 2004). They can be used to measure characteristics such as attitudes (Alreck & Settle, 2004). The three community questionnaires used in this study (parent, teacher, and non-DD student) were developed to broadly identify the attitudes towards ICT held in the community. Adaptations of the DD program instruments were used so that comparisons between community data collected in this study and data collected in the DD program could be made. Copies of the full DD program instruments can be found in Appendix A, and a summary of the development of the DD program surveys can be found in Craig et al. (2011).

The community questionnaires included:

- Multiple choice answers (e.g., Boys / Girls / No difference).
- Open ended questions (e.g., What do you think you would like about a job in computing?).
- Items with 5-point Likert-type response formats (e.g., Strongly agree – Strongly disagree).

Each community questionnaire included five areas (described in more detail below): demographic questions, computer use questions, attitudes towards females and ICT, ICT stereotypes, and media questions.

Demographic data. Demographic questions were included in the questionnaires to provide a profile of each group. In addition, it was anticipated comparisons of attitudes based on demographic data could be made. As explained in the analysis section, however, this was not possible due to the low number of responses to each questionnaire.

Computer use. In order to gauge the level of comfort and expertise among respondents, items about computer competence and enjoyment, and how often computers were used, were included in all three community questionnaires.

Attitudes towards females and ICT. Questions about attitudes towards females and ICT were based on the stereotype from the literature that males are better at computing than females. In all community questionnaires, respondents were asked whether they believed,

or had noticed, there was any difference between boys and girls in their competence, confidence, and interest in computers. They were also asked to what extent they agreed with statements about either boys or girls being more competent with various aspects of computing using 5-point Likert-type response formats where 5 = Strongly agree and 1 = Strongly disagree.

Attitudes towards ICT. In all community questionnaires, participants were asked to respond to a number of statements related to stereotypes about ICT (other than gender) using 5-point Likert-type responses where 5 = Strongly agree and 1 = Strongly disagree. The statements were about: the people who work in ICT (e.g., sociability, geekiness); ICT jobs (e. g., enjoyment, interest, pay); desire to study or work in the ICT industry; community support for student computer use; and how enjoyable or interesting computing is considered.

Media questions. Media questions which related directly to the media review were included in each community questionnaire and provided data on the amount of television respondents watched, which ICT related shows were watched and which ICT characters were remembered.

The parent, teacher and non-DD student community questionnaires drew on items from the "Computers and you: Digital Divas Student Commencement Survey" and the "Pre Digital Divas: Teacher Survey" (Appendix A). In Table 4.2, 30 items taken from the DD surveys and common to all community questionnaires are described. For more information, the complete community questionnaires (parent, teacher, and non-DD student) can be found in Appendix B.

Table 4.2

Questions common to all community questionnaires (parent, teacher, and non-DD student)

Unmodified items	**Source**	**Modification**
1. Girls find it easier to work with a new program than boys.	Pre DD student*	
2. Girls are better than boys at setting up a new computer.	Pre DD student	
3. Boys are better than girls at fixing a computer.	Pre DD student	
4. Boys are more suited than girls to work in the computer industry.	Pre DD student	
5. Boys are better than girls at working with computers.	Pre DD student	
6. Using a computer makes learning more enjoyable.	Pre DD student	
7. People who work in computing work alone.	Pre DD student	
8. I would like it if people thought of me as a computer geek.	Pre DD student	
9. A person who works in computing makes a lot of money.	Pre DD student	
10. People who are really good at computing are popular.	Pre DD student	
11. How many hours per week do you use a computer at home?	Pre DD student	
Modified for relevance to parents, teachers, and non-DD students	**Source**	**Modification**
12. My school is enthusiastic about students using computers.	Pre DD student	Parent survey: “My child’s school”.
13. The name of your school:	Pre DD student	Parent survey: “your child’s school”.
14. How many hours per week do you use a computer at school?	Pre DD student	Parent & teacher surveys: “at work” replaced “at school”.
15. I have to work hard to do well in computing.	Pre DD student	All surveys: “People have to be very hard working if they want to work in the computer industry”.
16. I think computing subjects are very interesting.	Pre DD student	Parent & student surveys: “is” replaced “subjects are”.
Modified to fit onto A4 page	**Source**	**Modification**
17. Girls are more likely than boys to ask for help when they are not sure what to do next when working on the computer.	Pre DD student	All surveys: “with computers” replaced “when they are not sure what to do next when working on the computer”.
18. Who is more confident using ICT? Please explain your answer.	Pre DD teacher*	All surveys: “Why” replaced “Please explain your answer”.
19. Who is more competent using ICT? Please explain your answer.	Pre DD teacher	All surveys: “Why” replaced “Please explain your answer”.

Modified to fit onto A4 page continued	Source	Modification
20. Who is more interested/enthusiastic about ICT? Please explain your answer.	Pre DD teacher	All surveys: "Why" replaced "Please explain your answer".
21. How good are you at computing?	Pre DD student	Parent survey: "Computer skills" (child), "Your computer skills"; teacher survey: "How would you rate your computer skills?"; student survey: "How good are you at computing?"
22. Your gender.	Pre DD teacher	Parent survey: "Gender" (child), "Your gender"; teacher survey: "What is your gender?"; students survey: "Gender?"
New items	**Source**	**Justification**
23. What is your age?	New question	To allow for comparisons of attitudes based on age.
24. If you are interested in participating in a 30 minute focus group about girls and computing careers with other parents/students/teachers from your (child's) school, please write your name and email address or phone number and you will be contacted shortly.	New question	To recruit participants for the group interviews.
25. Computing professionals have a lot of outside interests.	New question	Included based on studies from: Anderson, Lankshear, Timms, & Courney,2008; Cheryan, Plaut, Davies, & Steele, 2009; Lang,2003; Margolis & Fisher, 2002; Steele,2010.
26. Computing jobs are good for people with families.	New question	Included based on studies from: Johnston, 2001; Miliszewska et al., 2006; von Hellens & Neilson, 2001.
27. Computing professionals work in teams.	New question	Included based on studies from: Bronson, 1999; Lange, 2003, 2007; MMV, 2001.
28. Which TV shows do you watch that involve computer experts?	New question	To gather information for the media review.
29. Can you name any females on TV who are computer experts or need computers for their jobs?	New question	
30. How many hours per week do you watch TV?	New question	

**Computers and you: Digital Divas Student Commencement Survey* is abbreviated to *Pre DD student*; and *Pre Digital Divas: Teacher* Survey is abbreviated to *Pre DD teacher*.

Each community questionnaire is now described in more detail below. For more information, the complete community questionnaires (parent, teacher, and non-DD student) can be found in Appendix B.

Parent questionnaire

There was no parent questionnaire in the DD program, however, in preparing the parent community questionnaire for this study the "Computers and you: Digital Divas Student Commencement Survey" and the "Pre Digital Divas: Teacher Survey" were drawn upon. This questionnaire included 44 questions. Thirty questions were common to all questionnaires (as described above), parents were asked four of the common questions for both themselves and their child. Ten additional questions were included as outlined in Table 4.3.

Table 4.3

Additional questions for parent questionnaires

Modified for relevance to parents	Source	Modification
1. Year level (child).	Pre DD student*	Added: "child's".
2. Do you regularly speak a language other than English at home? No Yes - which language?	Pre DD student	Added: "if yes, which language".
3. I would like my daughter to have a job in the computer industry.	Pre DD student	Modified from "I would like a job specifically in the computing industry after I finish studying".
4. I would like my son to have a job in the computer industry.	Pre DD student	Modified from "I would like a job specifically in the computing industry after I finish studying".
5. Your highest level of education.	Pre DD teacher*	Modified from "Including this year, how many years have you been teaching".
6. Have you ever studied computers? If yes, please describe If no, would you like to?	Pre DD teacher	Modified from "Since completing your initial education program have you taken any subsequent tertiary study in ICT/ education/ any short courses or professional development in teaching ICT".
7. Enjoyment of computers (child).	Pre DD teacher	Modified from "How would you rate your enjoyment of teaching ICT?"
8. It is generally believed that girls are less likely than boys to consider computing as a career. What do you believe can be done to encourage girls' involvement and interest in computing?	Pre DD teacher	Replaced "ICT" with "computing".
New items	**Source**	**Justification**
9. Your occupation: multiple choice options taken from Australian and New Zealand Standard Classification of Occupations (Australian Bureau of Statistics [ABS], 2013).	New question	To allow for comparisons based on occupation.

New items continued	Source	Justification
10. Industry in which you are employed: multiple choice options taken from Australian and New Zealand Standard Industrial Classification (ABS, 1993).	New question	To allow for comparisons based on industry.

**Computers and you: Digital Divas Student Commencement Survey* is abbreviated to *Pre DD student;* and *Pre Digital Divas: Teacher Survey* is abbreviated to *Pre DD teacher.*

While the parents from Goldstine SC and Bartik SC completed this questionnaire with pen and paper, the same questionnaire was posted online and completed electronically by Group C (Victorian parents).

Teacher questionnaire

In addition to the 30 common questions, 20 additional questions were used for the community teacher questionnaire, which drew heavily on the "Pre Digital Divas: Teacher Survey" as outlined in Table 4.4.

Table 4.4

Additional questions for teacher questionnaires

Unmodified items	Source	Modification
1. Please list the positions of responsibility you currently hold at your school.	Pre DD teacher*	-
2. Please indicate what you think is the priority given to computer education within your school?	Pre DD teacher	-
Modified for relevance to teachers	**Source**	**Modification**
3. In classes you have taught in the past, have you observed boys and girls behaving differently with respect to the computer hardware? Please explain your response.	Pre DD teacher	Removed "ICT" added "computer".
4. In classes you have taught in the past, have you observed boys and girls behaving differently with respect to the computing activities in which they engage? Please explain your response.	Pre DD teacher	Removed "ICT" added "computer".
5. In classes you have taught in the past, have you observed boys and girls behaving differently with respect to any other aspect of computing? Please explain your response.	Pre DD teacher	Modified from In classes you have taught in the past, have you observed boys and girls behaving differently with respect to the computing activities in which they engage? Please explain your response.
6. To whom are the computing tasks used in your classes more likely to appeal? Please explain your response.	Pre DD teacher	Changed "ICT" to computers and removed "in your school".

Modified for relevance to teachers cont..	Source	Modification
7. My female students' parents want them to use computers.	Pre DD student*	Modified from "My parents encourage me to use computers".
8. My males students' parents want them to use computers.	Pre DD student	Modified from "My parents encourage me to use computers".
9. It is generally believed that girls are less likely than boys to consider computing as a career. What do you believe can be done to encourage girls' involvement and interest in computing?	Pre DD teacher	Replaced "ICT" with "computing".
10. Anything Else? Please write about any facet of your experience of using computers in your classes that you would like to tell us about or to expand upon.	Pre DD teacher	Modified from "Is there anything else" from pre DD teacher and Post DD teacher survey"Please write about any facet of your experience with Digital Divas that you would like to tell us about or to expand upon.
Modified for relevance to teachers	**Source**	**Modification**
11. How many years have you been teaching (at any school?)	Pre DD teacher	Removed "Including this year" and added "at any school".
12. Please indicate all the year levels in which you have ever taught.	Pre DD teacher	Removed "ICT".
13. Please list your methods from your teaching qualification.	Pre DD teacher	Modified from "Was ICT education a component of your teacher education program?"
14. Please list the subjects you have ever taught.	Pre DD teacher	Modified from "What subjects other than ICT do you teach this year?"
15. Have you ever studied Information Technology at a tertiary level? If yes, please describe.	Pre DD teacher	Modified from "Since completing your initial education program, have you taken any subsequent tertiary study in ICT?"
16. Have you ever taken any short courses or professional development (in-house or external) in computing? If yes, please describe.	Pre DD teacher	Modified from "Since completing your initial education program, have you taken any short courses or professional development (in-house or external) in teaching ICT?"
17. Would you like some (more) professional development in computing? If yes, please describe.	Pre DD teacher	Modified from "Even though you have had some professional development in teaching ICT, would you like further professional development?"
18. How would you rate your enjoyment of using computers in the classroom?	Pre DD teacher	Modified from "How would you rate your enjoyment of teaching ICT?"
19. How many hours per week do you use a computer in class?	Pre DD student	Replaced "at school" with "in class".
New items	**Source**	**Justification**
20. Have you been encouraged to use computers in your classes? By whom?	New question	To gather information on ICT school culture.

**Computers and you: Digital Divas Student Commencement Survey* is abbreviated to *Pre DD student;* and *Pre Digital Divas: Teacher Survey* is abbreviated to *Pre DD teacher.*

Non-DD student questionnaire

The non-DD student community questionnaire had 50 items, 30 were common to all community questionnaires, 16 were drawn from the "Digital Divas Student Commencement Survey" and four new questions were added, as shown in Table 4.5.

Table 4.5

Additional questions for non-DD student questionnaires

Unmodified items	Source	Modification
1. Year level?	Pre DD student*	-
2. How good would you like to be at computing?	Pre DD student	
3. My parents encourage me to use computers.	Pre DD student	-
4. Please describe the person and explain what is happening in the picture.	Pre DD student	-
5. What do you think you would like about a job in computing?	Pre DD student	-
6. What do you think you would NOT like about a job in computing?	Pre DD student	-
Modified for relevance to students	**Source**	**Modification**
7. Do you regularly speak a language other than English at home? If yes, which language?	Pre DD student	Added: "If yes, which language?"
8. Where would your teachers put you on this scale?	Pre DD student	Deleted "computing".
9. How competent is your mother with computers?	Pre DD student	Modified from "Where would your mother put you on this scale?"
10. How competent is your father with computers?	Pre DD student	Modified from "Where would your father put you on this scale?"
11. List the main programs you use.	Pre DD student	Modification of list of computer activities.
12. In future, where would you like to learn more about computers?	Pre DD student	Modification of "I want to study computing as part of my VCE".
13. Teachers think it is important to use computers.	Pre DD student	Deleted "for learning".
14. I would like a job specifically in the computing industry.	Pre DD student	Deleted "after I finish studying".
15. Please draw a picture of someone who works in the computing industry. Draw them doing something.	Pre DD student	Reworded "and what they are doing".
New items	**Source**	**Justification**
16. How competent are your teachers with computers?	New question	To gather information on student opinions of teacher expertise.

New items continued	Source	Justification
17. How many hours per week do you use the internet on your mobile phone?	New question	Added after DD students were heard to comment that they did not use the internet on computers.
18. Do you use computers for homework?	New question	To gather information about how students use computers.
19. List the classes in which you use computers.	New question	To gather information about how students use computers.
20. Do you think your teachers or parents treat you differently when it comes to computers because of your sex? If yes, in what way?	New question	To determine whether students were aware of gender discrimination.

**Computers and you: Digital Divas Student Commencement Survey* is abbreviated to *Pre DD student.*

Data analyses

The data collected from the parent, teacher, and non-DD student questionnaires provided an insight into community attitudes with respect to the ICT stereotypes described in Chapter Three. Along with the data from the media review, these results were used to inform the group interview questions. As similar techniques were used to analyse the data from the questionnaires, data from the DD pre- and post-student surveys (providing evidence as to whether the DD program changed attitudes among participating students) and for the comparison of community attitudes with changes in attitude among DD students, these techniques are explained together in this section. In the following section, the media review will be described.

The community questionnaires and DD program surveys generated two types of data: quantitative and qualitative. In this study, the independent variables were: the community as a whole; Groups A, B and C; the sub-groups: parents, teachers, and non-DD students; and DD students before and after participation in the DD program. The dependent variables were various measures of attitudes towards ICT.

The null hypothesis for the community data gathered in this study was that there were no differences in attitude between groups (Groups A, B, and C) or within groups (e.g., parents, teachers, and non-DD students by school). The null hypothesis for the DD program student data was that there was no change in attitude after participation in the DD program. Statistical tests were used to determine whether these null hypotheses could be confirmed or rejected (Tabachnick & Fidell, 2013). The methods of analysis adopted for each type of data are now described.

Quantitative analysis

As Tabachnick and Fidell (2013) have explained, “Inferences are made about populations based on data from samples that contain incomplete information” (p. 35). In this study,

quantitative data were extracted from the community questionnaires and DD program surveys. Data from the online questionnaires were automatically coded (data was converted into variables using numbers) by *Qualtrics*, the online questionnaire creator, and exported directly into *SPSS*. Using the same coding system, data from the paper questionnaires were entered manually into *SPSS*.

Descriptive statistics - The majority of demographic and computer use questions were multiple choice. When developing the community questionnaires it was anticipated that comparisons of attitudes based on demographic data could be made, however, this was not possible due to the low number of responses to each questionnaire. Descriptive statistics, frequencies and means, were employed to analyse the demographic and computer use questions in order to show characteristics of the samples and to build up a profile of each group.

Comparison of means - In this study, 5-point Likert-type response formats were used for a number of attitude questions. The responses were coded as 1= Strongly disagree, 2 = Disagree, 3 = Not sure, 4 = Agree and 5 = Strongly agree. Comparison of means can only be performed when equal interval data are used. There is a logical ordering of the response categories in an item with a Likert-type response format. It can be assumed that the degree of difference between each point on the Likert-type response format is equal and the data can therefore be treated as equal interval. While some argue that Likert-type response formats can only be considered ordinal (e.g., Carifio & Perla, 2007) there are many precedents in the social sciences (Blaikie, 2003) for considering the data as equal interval. In this study, the data have been treated as equal interval. This means that parametric tests can be performed to identify statistically significant differences in the mean scores of the various groups. The *p*-value was set at .05 for significance as "tradition and journal editors decree that it is .05 or smaller, meaning the null hypothesis is rejected no more than 5% of the time when it is true" (Tabachnick & Fidell, 2013, p.37). As the number of respondents in the study was low, a trend was identified if a *p*-value between .1 and .05 was found.

"If a research goal is to distinguish among subgroups in a sample … on the basis of a variety of attitudinal variables, we could use several univariate *t*-tests (or analysis of variance) to examine group differences on each variable separately" (Tabachnick & Fidel, 2013, p.3). The *t*-test is a robust statistical test that is appropriate to use with small sample sizes (Tabachnick & Fidell, 2013). In this study three types of t-tests were used. One sample t-tests were used to determine whether attitudes were statistically significantly different to the middle value, "Not sure". Paired t-tests were used to compare DD students' attitudes before and after participation in the DD program and determine whether any statistically significant change in attitude occurred. Independent samples t-tests were used to

determine whether there was any statistically significant difference in attitudes between the groups (e.g., between groups A and B, B and C, teachers and students, etc.).

One sample *t*-tests: Hill and Lewicki (2007) suggest that the *t*-test is the most common method for evaluating differences in means between two groups. In the one-sample *t*-test, "the observed mean (from a single sample) is compared to an expected (or reference) mean of the population... and the variation in the population is estimated based on the variation in the observed sample" (Hill & Lewicki, 2007, p.745). In this study, the one-sample *t*-test was used to indicate whether the mean score for each statement was significantly different from 3, the "not sure" value in the score range. Mean scores that were significantly different from 3 could then be used to indicate whether the group of interest agreed or disagreed with pertinent statements.

Paired samples *t*-tests: According to Warner (2013), "When we have repeated measures or matched or paired samples, we will use the paired samples *t*-test to evaluate whether means differ across scores collected under two different treatment conditions or between scores obtained at two different points in time" (p. 954). This test was used to compare the mean scores for students completing both the pre-and post-DD program surveys to determine whether their responses to each statement, and therefore their attitudes, had changed significantly after participation in the program.

Independent samples *t*-tests: This test "involves comparison of mean scores on a quantitative Y outcome [e.g., extent of agreement with statements] between two groups: membership in each of the two groups is identified by each person's score on a categorical X variable that identifies membership in one of just two groups [e.g., Group A and Group B, or parents and students]" (Warner, 2013, p. 185). Independent samples *t*-tests were used in this study to compare the means, or extent of agreement with a statement, of two groups to determine whether they were significantly different.

Analysis of variance (ANOVA): ANOVAs were "used to compare two or more means to see if there [were] any statistically significant differences among them" (Tabachnick & Fidell, 2013, p.37). When there was a significant difference, Scheffé Post Hoc tests, designed to compare each group to every other group, determined which pairs of groups had significantly different mean scores. The ANOVA is not as robust or powerful as a *t*-test because it reduces the number of cases by excluding all missing data, therefore, it is not ideal when there are a low number of responses. For a study with three groups, an alpha level of .05 and a desired level of power of .80, the minimum number of participants required per group would be 19 (Warner, 2013, p.239). In this study ANOVA was used to compare the means of Groups A, B and C and to compare the means of the sub-groups of Groups A and B (parents, teachers, and non-DD students). As Groups A, B and C had sample sizes in excess of 19 the ANOVA

had high statistical power. Among the sub-groups of Groups A and B, however, the smallest sample sizes were 14 so the statistical power of the ANOVA was between .50 and .70.

Unfortunately, statistical comparisons between male and female teachers' and between mothers' and fathers' responses, and comparisons based on the parents' educational backgrounds and occupations could not be conducted due to the low number of responses in some categories.

Frequency distribution comparisons. The Pearson chi-square test of independence is used to examine the relationship between two discrete variables by comparing observed and expected values to see if they are discrepant (Tabachnick & Fidell, 2013; Warner, 2013). On each questionnaire, participants were asked to indicate whether they thought boys or girls were more confident, competent and interested in computers or whether they believed there was no difference between males and females (e.g., Boys are better than girls at fixing a computer).

Questions with this type of response format provide only categorical data and mean scores cannot be found. Chi square tests were used to investigate whether the response distributions of two groups to items of this kind differed significantly. Chi-square tests are not very robust as the number of responses is compared, rather than the means; when one or more cells in a 2x2 table have expected cell frequencies less than five, the test cannot be conducted (Warner, 2013).

Qualitative Analysis

Qualitative analyses were required for open-ended questionnaire items and for questions which required pictures to be drawn. A number of qualitative methods of data analysis, including grounded theory methodology (GTM) and content analysis, were investigated for this study. While GTM was developed as a method to discover theory from data, Urquhart (2013) pointed out that today it is more commonly used as a method of qualitative data analysis. Qualitative content analysis employs techniques whereby data are classified into "an effective number of categories that represent similar meanings" (Moretti, van Vliet, Bensing, Deledda, Mazzi, Rimondini, Zimmermann, & Fletcher, 2011, p. 420). GTM analysis techniques involve open coding where categories are identified followed by selective coding (Urquhart, 2013). Qualitative content analysis techniques, not GTM approaches, were used in this study.

Initially the data from the open-ended items and the drawings from the questionnaires were examined for similarities and differences through a process whereby key words in the answers were highlighted and compared (Miles & Huberman, 1994). Data were classified into categories identified from the literature on ICT stereotypes. The frequency of answers

in each category was used to report which stereotypes were present in the data, and examples were extracted from the data to illustrate the stereotypes and attitudes towards ICT found in the responses.

Media review

In addition to the questionnaires, a review of shows on Australian television was conducted. As discussed in Chapter Three, the media is an effective socializer and plays an important role in the development of an interest in ICT and ICT careers. The aim of the media review was to observe whether the media portrayal of ICT was stereotypical. The influence of the stereotypes presented on television on the community was further investigated in the group and email interviews in which participants were asked their opinions about ICT experts on television.

Data gathering sources

The television shows to be included in the study were initially defined as those screening on free to air television stations in 2011 in Melbourne, Victoria. In order to be selected for the media review, the shows had to be screened in prime time, rank highly with audiences, use ICT as a story component, and had to have an ICT expert as one of the main characters. As computers are used in a wide variety of jobs, to be considered an ICT expert, the main character had to be on screen, speak, and meet one of the following criteria:

- Be employed in an ICT job.
- Be referred to in the show or promotional material as an ICT expert.
- Perform at least two of the following ICT activities – hack into a database, recover data from destroyed hard drives, debug or write a computer program, or repair or develop hardware.

Using these criteria, three television shows were chosen. These shows provided three female ICT experts and one male ICT expert. As a comparison of male and female ICT experts was desired, more male ICT experts were required. Unfortunately, other shows including male ICT experts that fitted the above criteria were not available during the survey period, so it was decided that shows known to depict male ICT experts that were shown on pay television in 2011 were included.

A total of five television shows was used for the media review. The television shows included in this review and the corresponding ICT experts are shown in Table 4.6. The third column (Ranking) indicates where the show was positioned out of the top 10 shows for 2011 by Australians aged 14 and over (Roy Morgan Research, 2011).

Table 4.6

ICT shows and experts included in media review and ranking among viewers

Television show	ICT expert characters	Ranking
NCIS – drama	Abby Scuito (Female) and Tim McGee (Male)	5
Criminal Minds – drama	Penelope Garcia (Female)	8
Bones – drama	Angela Montenegro (Female)	9
The IT crowd – comedy	Roy Trenneman (Male) and Maurice Moss (Male)	Not ranked
Leverage – drama	Alec Hardison (Male)	Not ranked

Analysis

At least one season of each show was viewed in its entirety, and fan blogs and official websites were scanned to gather more information about the characters (CBS Broadcasting Incorporated, 2012a; 2012b; Channel4, 2012; Fox Broadcasting Company, 2012; Turner Entertainment Digital 2012; Wetpaint Entertainment, 2012). The shows and official websites provided visual data as well as background data on the characters' personalities and employment roles. The fan blogs provided data on how the characters were perceived by the public, for example, whether the characters were considered attractive. A profile of each ICT expert character was developed from watching the shows, and from entries on blogs and websites. Using content analysis techniques, data were classified into categories identified from the literature on ICT stereotypes (see Chapter Three). The categories were appearance, background, personality, and employment role.

The literature on these four categories was used to define the stereotypes within each category; these could then be compared to the character profiles developed:

1. Appearance – The stereotype is of a young unattractive Caucasian male who wears glasses and may be weak and thin, or overweight, usually with poor dress sense.

2. Background – The qualifications, if any, that each character had and any other pertinent background information about the character, such as family background.

3. Personality – The stereotype of ICT professionals as nerds or geeks is often cited by students as a reason for not wanting to be an ICT professional (Anderson et al., 2008; Margolis & Fisher, 2002). The characteristics of nerds or geeks include being: boring, unhealthy, messy, obsessively neat, socially awkward, unable to form relationships, and interested in science fiction or comics.

4. Employment Role – The stereotypical ICT job is seen as requiring someone to be stuck in a dark office all day in front of a computer with paraphernalia such as Sci-Fi posters or junk food littered around the room.

After the categories were defined, the data were explored to determine how closely the portrayal of each ICT expert was to the ICT stereotypes. In addition, the males and females were compared to determine whether there was any difference in the way they were portrayed in the television shows with ICT expert characters.

In order to provide data on the potential influence of media portrayals of ICT, questions about the community's television viewing habits and recognition of ICT experts on television were included in the community questionnaires. In the group interviews, participants were shown an excerpt from *NCIS* and asked to comment on the ICT experts in the show.

Group and email interviews

The purpose of the interviews was to gain a greater depth of understanding of the attitudes identified through the questionnaires and observed in the media review. It was anticipated that first hand opinions, clarification, and exploration of the responses collected from the questionnaires would assist in answering the research question. The attitudes towards ICT initially identified from the community questionnaires and the media review and those identified from the literature (as described in Chapter Three) were categorized to help develop the interview questions. According to Downe-Wamboldt, "how narrow or broad the categories should be depends on the purpose of the investigator" (1992, p. 316). Here the categories were quite broad because the stereotypes found in the questionnaire and media review data were not clearly defined and often overlapped. A description of the categories is presented here:

1. Perception of an ICT professional – this included descriptions of the appearance and character of ICT professionals, but also the attitudes held towards them, whether the things they described were positive or negative and whether the type of person described was desirable or not.

2. Perception of an ICT job – this included knowledge of the types of ICT jobs available and the tasks ICT professionals perform in their roles – not only the technical, but also the social aspects of their work. In addition, the kinds of jobs students wanted or that parents desired for their offspring and the reasons why. Whether ICT was included in this list and if not, why not? In some ways this theme overlapped with perceptions of an ICT professional.

3. Socialization – how influential did parents believe they were on their child's decisions about the future? What other influences on their child's decisions

about the future did parents perceive? Also, had the parents encouraged ICT use among their children?

4. Support for the DD program.

Group interview questions. The questions for the group interviews (five parents) and questions to be emailed (six parents and three students) were based on these themes. The group interviews were semi-structured to allow free flowing discussion but were based around the questions shown in Table 4.7.

Table 4.7

Group interview questions

Group Interview question	**Theme**
1. Look at the list below. Please indicate, with an 'x' next to the word, which adjectives apply to ICT professionals. The following list of words was provided (Gough, 1979): Capable, Honest, Artificial, Intelligent, Clever, Well-mannered, Cautious, Wide interests, Confident, Inventive, Egotistical, Original, Commonplace, Narrow interests, Humorous, Reflective, Conservative, Sincere, Individualistic, Resourceful, Conventional, Self-confident, Informal, Sexy, Dissatisfied, Submissive, Insightful, Snobbish, Suspicious, Unconventional .	1. Perception of an ICT professional. 2. Perception of an ICT job.
2. What additional adjectives describe an ICT professional?	1. Perception of an ICT professional. 2. Perception of an ICT job.
3. What influence do parents have on a child's interest in ICT?	3. Socialization.
4. What do you think about an all-girl computer class?	4. Support for the DD program.
5. What do you think about the ICT characters in this clip (Bellisario, McGill, Binder, Kriozere, & Wharmby, 2011, 20:35 – 24:40).	1. Perception of an ICT professional.
6. Do you know any ICT experts? – description of job and person.	1. Perception of an ICT professional. 2. Perception of an ICT job.

Email interview questions. Those who responded to email interviews (six parents and three students) were asked a greater number of questions around the same themes as no interviewer was available to prompt discussion. In the instructions respondents were encouraged to write as much as they liked. The parent and student email interview questions and the categories they relate to are set out in Tables 4.8 and 4.9.

Table 4.8

Email Interview questions for parents

Parent questions	**Category**
1. What kind of job would you like your child to have? Why?	1. Perception of an ICT professional. 2. Perception of an ICT job.
2. What factors do you think will influence/have influenced your child's subject/career/interest decisions?	3. Socialization.
3. In your opinion is there any advantage for your child to study ICT (at VCE level, uni, TAFE, etc.)? Why?	1. Perception of an ICT professional. 2. Perception of an ICT job.
4. Do you ever do anything on the computer with your child that has nothing to do with homework? If so, what kinds of things?	3. Socialization.
5. In your opinion, how important are ICT skills in society today?	1. Perception of an ICT professional. 2. Perception of an ICT job.
6. Can you give specific examples of ICT jobs? Please list.	1. Perception of an ICT professional. 2. Perception of an ICT job.
7. Computers are USED in many industries, but what makes someone an ICT expert?	1. Perception of an ICT professional. 2. Perception of an ICT job.
8. What would my day be like if I were an ICT person? What kinds of tasks would I perform? What would my work environment be like?	1. Perception of an ICT professional. 2. Perception of an ICT job.
9. How do you think a job in ICT would impact on your child's life (benefits, problems, socially, etc.)?	1. Perception of an ICT professional. 2. Perception of an ICT job. 3. Socialization.
10. What is a geek? Is it the same as a nerd?	1. Perception of an ICT professional.
11. The majority of students surveyed said they wanted to have high computer skills, but they did not want to be thought of as geeks. Why do you think this is?	1. Perception of an ICT professional. 2. Perception of an ICT job. 3. Socialization.
12. Look at the list below. Please indicate, with an 'x' next to the word, which adjectives apply to ICT professionals.	1. Perception of an ICT professional. 2. Perception of an ICT job.
The following list of words was provided (Gough, 1979): Capable, Honest, Artificial, Intelligent, Clever, Well-mannered, Cautious, Wide interests, Confident, Inventive, Egotistical, Original, Commonplace, Narrow interests, Humorous, Reflective, Conservative, Sincere, Individualistic, Resourceful, Conventional, Self-confident, Informal, Sexy, Dissatisfied, Submissive, Insightful, Snobbish, Suspicious, Unconventional.	

Table 4.9

Email Interview questions for students

Student questions	**Category**
1. What job would you like to have in the future?	1. Perception of an ICT professional. 2. Perception of an ICT job.
2. Is there any benefit for you in being good at computers?	1. Perception of an ICT professional. 2. Perception of an ICT job.
3. Why would/wouldn't you like to do ICT for VCE?	1. Perception of an ICT professional. 2. Perception of an ICT job. 3. Socialization.
4. How do you know what an ICT career is? (my mum told me, I saw it on TV, etc., try to think of all the things that have helped you understand what an ICT job is).	3. Socialization.
5. Computers are USED in many jobs, but what makes someone a computer expert?	1. Perception of an ICT professional. 2. Perception of an ICT job.
6. Do you know anyone who is an ICT expert? Who? Are they male or female? What do you think of them?	1. Perception of an ICT professional. 2. Perception of an ICT job.
7. Do you think ICT experts have any special traits or characteristics? What are they?	1. Perception of an ICT professional. 2. Perception of an ICT job.
8. Please describe my day if I were an ICT expert? (What kinds of tasks would I perform?, What would my work environment be like?, etc.)	1. Perception of an ICT professional. 2. Perception of an ICT job.
9. Do you think that more boys than girls study ICT subjects at school? Why do you think this is the case?	1. Perception of an ICT professional. 2. Perception of an ICT job. 3. Socialization.
10. What is a geek? Is it the same as a nerd?	1. Perception of an ICT professional.
11. Many students at your school said people who were good with computers were popular, but that they would not like to be thought of as a geek – why do you think this is?	1. Perception of an ICT professional. 2. Perception of an ICT job. 3. Socialization.
12. Look at the list below. Please indicate, with an 'x' next to the word, which adjectives apply to ICT professionals.	1. Perception of an ICT professional. 2. Perception of an ICT job.

The following list of words was provided (Gough, 1979): Capable, Honest, Artificial, Intelligent, Clever, Well-mannered, Cautious, Wide interests, Confident, Inventive, Egotistical, Original, Commonplace, Narrow interests, Humorous, Reflective, Conservative, Sincere, Individualistic, Resourceful, Conventional, Self-confident, Informal, Sexy, Dissatisfied, Submissive, Insightful, Snobbish, Suspicious, Unconventional.

Analysis of group and email interviews

As explained earlier in this chapter, the purpose of the group and email interviews was to clarify the results of the questionnaires and media review. Participants were asked to discuss themes that had previously been identified as significant. Each utterance was coded according to the categories listed previously. Complying with a clear systematic coding process that can be replicated increases the validity of the findings (Hsieh & Shannon, 2005). While the email interviews were fairly structured, the face to face group interviews were semi-structured so that conversation could flow freely. This resulted in discussion of topics that had not been anticipated before the data were obtained and analysed. It was important to include these topics as "imposing … constraints on the data could impede the validity of the results" (Downe-Wamboldt, 1992, p. 316). The categories were revised to include an "other" category and the full transcripts of the group interviews, as well as the email interviews, were coded according to the revised categories. For intra-rater reliability (Weber, 1985) the data were re-coded by the researcher a month later and intra-rater reliability was 94%. The following table gives examples of typical comments for each theme from the group and email interviews:

Table 4.10

Examples of themes

Theme	Examples from group interview (parents)	Examples from email interviews
1. Perception of an ICT professional	… very quiet, introverted type person. I actually know quite a few very humorous IT people.	I know a few people who are good with IT, most are females, a few are males. They're the people I go to when I need help with anything to do with IT – student. Not being very physical and slightly isolated. However for a person who has Asperger's it might be an ideal working environment. – parent.
2. Perception of an ICT job	It's always growing and they can continue to learn – it's not something that's stagnant and they can, um, there's so many different areas in IT that they can go into that there's always opportunities.	IT support help desk, data entry – parent. An IT job is a big range of jobs. My dad uses formulas and programs for his job and my mum is basically one of the IT people at her work. –student.
3. Socialization	It's what you've exposed your children to. So if they're not exposed to something they don't know they've got an interest.	Both of our children have always had encouragement from me and my husband. We would take an interest in their achievements and encourage them with their hobbies – parent.
4. Support for the DD program	Yes [I support an intervention], probably because I am very aware that boys in the class will umm, that boys usually have more knowledge.	
5. Other	Just for an example, … a Catholic school up in Belgrave, they insist that at VCE you still do really just religious subjects.	I have been studying Library Services Certificate off campus for the past few years and have found the majority of people who are involved in the library industry are women - parent.

Ethics approval

Ethics approval for the main DD study had already been obtained from the Monash University Human Research Ethics Committee (MUHREC), along with permission from the schools involved, before this PhD research had begun. The project number was CF09/2617 – 2009001507; its title was "Digital Divas: Designing approaches to enthuse girls' interest in ICT studies and ICT careers". The ethics application for this PhD study was submitted as an amendment to the wider study and approved on 10th December 2010. A copy of the MUHREC approval can be found in Appendix D. Permission from the schools specifically for this PhD study was also obtained before approaching participants.

Chapter summary

In this chapter the purpose of this study and the development of the research questions were described. The research approach was justified, followed by an overview of the data collection and analysis design. An overview of how data were sourced was given and participant profiles are provided. Finally, the development of the instruments was explained and the methods of data analysis were presented.

In the next chapter the results of the media review, community questionnaires and interviews are examined and discussed.

Chapter Five: Results and Discussion - Community Attitudes

Over the next three chapters, the results and discussion of the findings in this thesis are presented. In this chapter community attitudes are described. In the next chapter the DD program outcomes will be examined and the results and discussion section of the thesis is completed in Chapter Seven with a comparison of the community attitudes and the DD program outcomes.

This chapter begins with an overview of the statistical analysis techniques used in this chapter and a reminder of the community groups. This is followed by a presentation of the data from the media review which will be referred to throughout the chapter. Finally, the community results are presented in three sections which relate directly to sub-questions 1-3 and are entitled:

> Perceptions 1: Gender and ICT - answers SQ 1: What are community attitudes about gender and ICT?
>
> Perceptions 2: ICT people and jobs – answers SQ 2: What are community attitudes about ICT people and jobs?
>
> Perceptions 3: Importance and enjoyment of computing – answers SQ 3: What are community attitudes about the importance and enjoyment of computing?

Each of these sections is introduced with a discussion of relevant data from the media review and followed by results from the community questionnaires and interviews. This chapter concludes with a summary of the findings of the community attitudes towards ICT and a discussion of how this data informs the main research question:

> *Are the attitudes of the community towards ICT important in terms of a successful intervention program?*

Statistical analyses

As described in Chapter Four, descriptive statistics and statistical analyses using *SPSS 20.0 for Windows* were used to analyse the data from the community questionnaires as follows:

- Chi-square tests were used to investigate whether the frequency distributions of categorical data response categories differed significantly from each other.
- Independent samples *t*-tests were used to test whether the mean scores on particular variables differed for two groups.

- When there were more than two groups, one way between subjects analysis of variance tests (ANOVAs) were used to test whether mean scores on particular variables differed. When a statistically significant difference in the mean scores was found, Scheffé Post-Hoc tests were used to identify which pairs of mean scores were different.

- For the interpretation of mean scores of items close to 3, the middle value in the score range of relevant items, one sample *t*-tests were used to indicate whether mean scores were significantly different from 3. An asterisk in the tables in which data are presented indicates that the mean is not significantly different from 3, indicating an interpretation of "Not sure".

Following convention in the social sciences (Tabachnick & Fidell, 2013) the p-value was set at .05 for statistical significance, that is, 95% confidence levels were adopted. A p-value between .05 and .1 was considered a trend.

Please note that when there was no statistically significant difference in mean scores for the groups compared the results are not displayed. Discussion about the findings is presented with the results.

Numbering of items

Items were numbered differently on each community questionnaire (parent, teacher, and non-DD student). In this chapter the identical questions were used but have been renumbered sequentially for clarity.

Community groups

The attitudes of the following three groups (described in more detail in the previous chapter) were sought with regard to ICT:

1) **Group A (the Goldstine Community):** Group A (*N*=45) was made up of members of the school community surrounding the girls participating in the DD program at Goldstine SC and comprised three sub-groups:

Group A parents: 14 parents of male and female Year 9 students at the school.

Group A teachers: 17 teachers from the school (not including the DD program teacher).

Group A non-DD students: 14 Year 9 students who did not participate in the DD program. This sample includes both boys and girls.

2) **Group B (the Bartik community):** Group B (*N*=73) was made up of members of the school community surrounding the girls participating in the DD program at Bartik SC and comprised three sub-groups:

Group B parents: 31 parents of male and female Year 8 students at the school.

Group B teachers: 15 teachers from the school (not including the DD program teacher).

Group B non-DD students: 27 Year 8 students who did not participate in the DD program. This sample includes both boys and girls.

3) **Group C (Victorian parents):** Parents (*N*=119) were recruited through *Facebook* and lived throughout the state of Victoria.

The term "combined community" is used to describe the combination of Groups A, B and C.

Biographical data

Questions were included in the community questionnaires in order to compare attitudes based on computer confidence and demographic data. In many cases, comparisons were not possible, however, due to the low number of responses to the questionnaires. A summary of the computer use and confidence and demographic data for each group and sub-group are presented below.

Computer confidence

All community participants (parents, teachers, and non-DD students) were asked, responding on a 5-point scale, how competent they believed they were at computing, where 1 = Weak and 5 = Excellent. The results indicated that the most frequent response was "Average" with many in each group responding they were "Good" and "Excellent" and very few describing themselves as "Below average". The mean scores for each group (Group A, 3.43; Group B, 3.39; and Group C, 3.53) indicated above average competence with computers. A one way ANOVA revealed no statistically significant difference in mean scores for perceived competence among parents from each group (Group A, 3.39; Group B, 3.45 Group C, 3.53). Independent samples *t*-tests revealed no statistically significant difference in mean scores for perceived competence between teachers from Group A (3.39) and Group B (3.47) or between non-DD students from Group A (3.57) and Group B (3.85)

Teachers' enjoyment and use of computers

Group A and B teachers were asked to rate their enjoyment of using computers on a 5-point scale where 1 = Very low and 5 = Very high. Group A and B teachers described similar levels of enjoyment, both Group A (3.78) and Group B (3.71) indicated that their enjoyment of using computers was high.

In order to gauge exposure to, and confidence with, ICT, questions were included about the number of hours per week teachers used a computer at home and at school. The median value for computer use per week among Group A teachers was 1-5 hours for home use and 6-10 hours at school. The median value for hours of computer use at home among Group B teachers was 1-5 hours, however, five teachers admitted they did not use computers at home at all. Four Group B teachers indicated that they did not use the computer at school at all, although the median value for school computer among use Group B teachers was 6-10 hours per week.

Teachers' experience and qualifications

Group A and B teachers were asked about their experience and qualifications, particularly with regard to ICT. The years of teaching experience among the teachers at the two schools were similar, ranging from 1 to 33 years in Group A and 1 to 38 years in Group B. In Group A, only two teachers indicated that they had studied ICT at tertiary level, and in both cases it was as a component of another unit they had studied. In Group B, on the other hand, one teacher had a degree, and another a diploma, specifically in ICT. Furthermore, one Group B teacher had studied ICT teaching as part of a pre-service teacher education program at tertiary level and another mentioned studying ICT as a component of another unit. Teachers were also much more likely to have undertaken a short course in ICT in Group B (73% of respondents) than in Group A (47%). Teachers at both schools, however, would have liked to do more ICT related study (Group A, 68%; Group B, 60%). At both schools the ratio of teachers who had studied humanities subjects as part of their teaching qualifications to those who had studied any mathematics, science or ICT was in favour of the humanities (Group A, 10:8; Group B, 10:5).

Parents' levels of education

Parents were asked about their education background, particularly with regard to ICT education. The educational level of the Group B parents was generally higher than the Group A parents or Group C parents. Amongst Group B parents, the highest proportion had degrees (27.6%) and 17.2% had completed post-graduate studies. The highest proportion of parents in Group A had diplomas (35.7%) and the highest proportion of parents in Group C had completed VCE (23.7%).

With regard to ICT related education, 36% of Group A parents, 48% of Group B parents, and 59% of Victorian parents indicated some ICT training, ranging from an Advanced Diploma in Information Technology to basic short courses. When asked whether they would like to undertake further ICT study, 66% of Group A parents, 25% of Group B parents and 34% of Victorian parents responded positively.

Parents' employment details

Parents were asked about their occupation and the industry in which they worked. Those who listed their occupation or industry as home duties, mother or unpaid carer were classified as "Not currently in paid employment" and in each community group this represented a sizeable proportion of parents (Group A, 14.2%, Group B, 22.6%, Group C, 29.4%). Of those who responded to these questions, the highest proportion of Group A parents (21.4%) was employed in education and training, while in Groups B and C parents were mainly employed in the health care and social assistance industry (Group B, 22.6%; Group C, 29.4%). In each group 'Professional' was the most common occupation (Group A, 28.6%; Group B, 30.0%; Group C, 24.8%), followed by 'Clerical and administrative worker' (Group A, 21.4%; Group B, 30.0%; Group C, 19.7%). This similarity in the three groups in terms of their professional profiles indicates a representative sample of people in the community.

Media review

As discussed in the previous chapter, in order to determine how closely ICT characters shown on television conformed to the societal stereotypes identified from the literature (see Chapter Three), a review of five television shows broadcast in 2011 on Victorian television was undertaken. The shows were:

- *NCIS* (ICT expert characters: Abby Scuito and Tim McGee).
- *Criminal Minds* (Penelope Garcia).
- *Bones* (Angela Montenegro).
- *The IT Crowd* (Roy Trenneman and Maurice Moss).
- *Leverage* (Alec Hardison).

Data were classified into categories identified from the literature on ICT stereotypes: appearance, background, personality and employment role. The results are presented in Table 5.1 which can be referred to when the media review results are discussed in terms of gender and ICT in Perceptions 1; ICT people and jobs in Perceptions 2; and the importance and enjoyment of computing in Perceptions 3. Characteristics are highlighted in yellow if they correspond directly with the identified ICT stereotypes. In each cell of the table, an *S* is included to indicate whether the appearance, background, personality, or employment role was considered consistent with the stereotype; an *N* is used when it was not considered stereotypical.

Table 5.1

Media review results

Character	Appearance	Background	Personality	Employment Role
Abby Scuito (*NCIS*) Drama	Female, Caucasian, late 30s, slim, Goth with tattoos, long black hair worn in pigtails, wears a lab coat – *N*	Degree in sociology, criminology and psychology, masters in criminology and forensic science. Deaf parents, knows American sign language – *N*	Quirky, fun, hyperactive, loyal, single, likes junk food, can be too technical, childish Hobbies: Online games, music, the occult – *S*	Forensic scientist who also has IT expertise. Works in a forensics lab, in the basement full of scientific paraphernalia and equipment. Blown up pictures of blood and viruses on the walls, stuffed toys around the lab – *S* (partial)
Penelope Garcia (*Criminal Minds*) Drama	Female, mid 30s, Caucasian, glasses, overweight, wears frilly, fluffy clothes and accessories, feminine - *N*	Hippy parents died in car crash when 18, on FBI's hackers list which is how she got recruited – *N*	Flamboyant, fun, emotional, feminine, single. Hobbies: Acting, online games - *S*	Computer technician. Works in a very dark lab, rarely leaves, surrounded by computer screens, lots of fluffy pens and toys - *S*
Angela Montenegro (*Bones*) Drama	Female, mid 30s, Chinese mother, Caucasian father, attractive - *N*	Degree in visual arts with a minor in computer science – *S*	Very good social skills, father is rock guitarist, party girl background, married with one child, best friend of 'Bones', too technical. Hobbies: Painting, sculpting - *N*	Forensic artist. Uses computer programs to reconstruct victim's faces or simulations of their deaths, computer room very dark and has no furniture, one very large screen on a wall, doesn't go out into the field - *S*
Tim McGee (*NCIS*) Drama	Male, Early 30s Caucasian, chubby in earlier series but has slimmed down, wears suit and tie – *S* (partial)	Bachelor of science in biomedical engineering from John Hopkins, Master of science in computer forensics from MIT – *S*	Fair social skills, detail oriented, focussed, single, too technical, teased by other members of the team -"McGeek" Hobbies: Computer games, writing, the outdoors - *S*	NCIS special agent. Works in open office. Hacking, information gathering, tracking mobile phones, fixes boss's computer and helps in the forensics lab, goes out in the field – *S* (partial)

Character	Appearance	Background	Personality	Employment Role
Roy Trenneman (*The IT Crowd*) Comedy	Male, early 30s, Caucasian, a slob, usually unshaven and wearing geeky T-shirts - *S*	Went to university – course unknown Not known	Lazy, laid back, pessimistic, selfish junk food, "not a real man", bullied by colleagues, Single, Limited social skills Hobbies: Building gadgets, computer games - *S*	Roy and Maurice: ICT technicians. Provide computer support for large company. Answer questions over the phone. Install and update new software. Fix computer problems. A routine job that characters did not enjoy. Located in basement covered in *Sci-Fi* and comic paraphernalia and junk food wrappers - *S*
Maurice Moss (*The IT Crowd*) Comedy	Male, early 30s, non-Caucasian background, wears short sleeved checked shirt with clip on tie – *S*	Was academically bright at school and bullied by other kids - *S*	Up tight, control freak, emotional, asthmatic, scared, childish bullied as a child & by colleagues, lives with mother Hobbies: Computer games, inventing – *S*	
Alec Hardison (*Leverage*) Drama	Male, mid 20s, African American, the least stereotyped of the males in appearance, appears cool and casual -*N*	Foster child, no formal training, criminal – computer hacker - *N*	Very good social skills, single, self-proclaimed geek, science fiction fan, computer games, teased, retained cultural identity as African American Hobbies: Dog, plays the violin – *S*	Computer specialist and hacker. Communications, special effects, hacking, and information gathering, lounge room office, also works from a van, also gets to impersonate various people as part of the teams' plans - *N*

In addition to the media review, questions about television viewing habits and computer experts in television shows were included in all the community questionnaires (parent, teacher, and non-DD student), and in the group interviews (but not the email interviews). In this way, the potential influence that media portrayals of ICT expert characters in popular, contemporary television programs may have on community members could be gauged. The data collected from these sources is now presented.

Survey results for media review

Questionnaires

The following questions related to the media review were asked of Group A and B parents, teachers, and non-DD students:

Q1. How many hours per week do you watch TV?

Q2. Which TV show/s do you watch that involve computer experts?

Q3. Can you name any females in TV shows who are computer experts or need computers for their jobs?

Findings -The combined community (Groups A, B and C) were asked how many hours per week they watched television. The responses from adults (parents and teachers) and students and the numbers of hours of television they reported watching per week and the percentage for each category are presented in Figure 5.1.

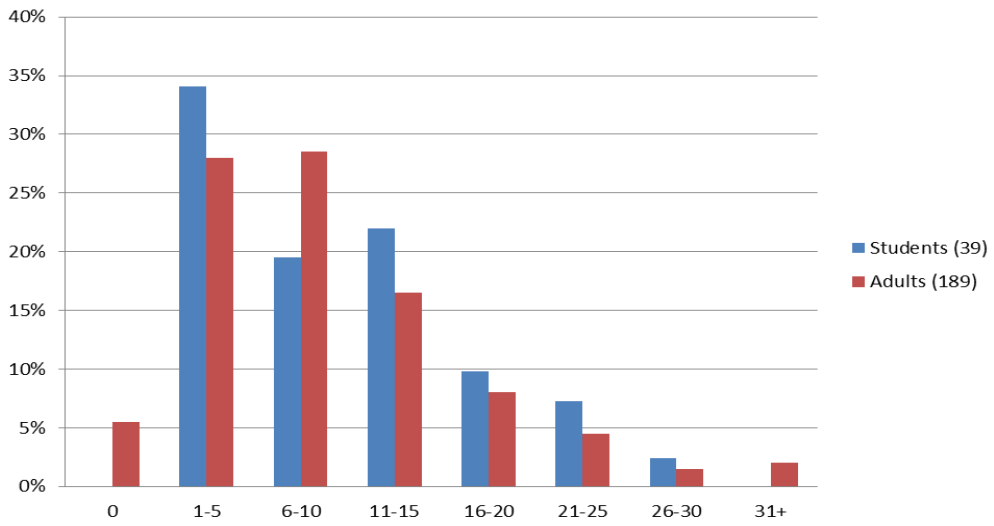


Figure 5.1. Percentage of responses by number of hours watching television per week.

It can be seen in Figure 5.1 that the most frequent response for students was “1-5” hours per week and the most frequent response for adults was “6-10” hours per week. This is

contrary to findings from the literature that Australians aged 14 and over spend over 21 hours per week watching television, more time than any other form of media (Roy Morgan Research, 2010).

The results for Q2 (Which TV shows do you watch that involve computer experts?) are shown in Figure 5.2 for adults (parents and teachers) and non-DD students. (NB. Only percentage responses greater than 2% are included). Please note that percentages do not add to 100% because respondents were able to nominate more than one show.

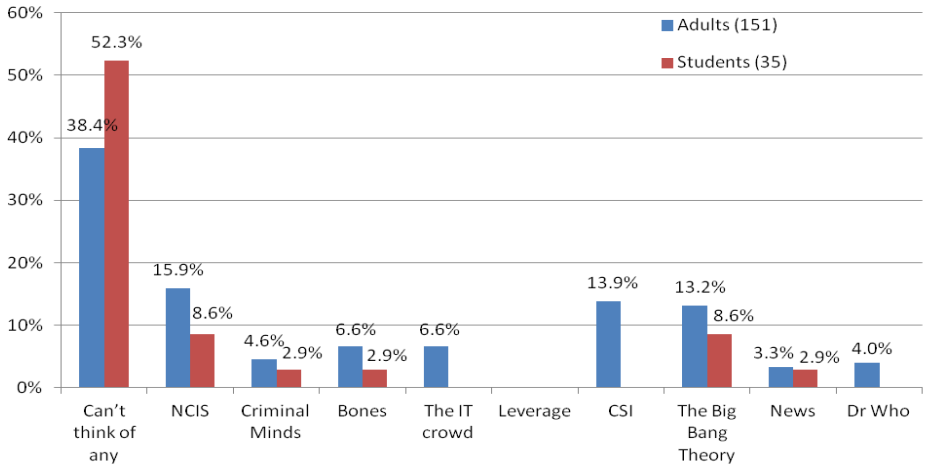


Figure 5.2. Percentage of respondents who named a television show that involved computer experts.

It can be seen from Figure 5.2 that of the responses from the combined community (Groups A, B, and C), 38% of adults and 52% of students could not name any television shows that involved computer experts. *NCIS* was the most familiar television show indicating that it may have the strongest influence on community attitudes. While *Criminal Minds* and *Bones* were mentioned by adults and students, of the two reviewed shows that were not on free-to-air television, *The IT Crowd* was known by adults but not students, and *Leverage* was not mentioned by any participants. *CSI (Crime Scene Investigation)*, a drama involving forensic investigators who examine evidence to solve crimes, and *Dr Who*, a science fiction series, were only mentioned by adults, and *The Big Bang Theory,* a comedy about two brilliant "socially challenged" physicists and their "street smart" neighbour, along with news broadcasts were mentioned by adults and students.

The results for Q3 (Can you name any females on TV who are computer experts or need computers for their jobs?) are shown in Figures 5.3 for adults (parents and teachers) and non-DD students. (NB. Only percentage responses greater than 2% are included,

percentages do not add to 100% because respondents were able to nominate more than one character.)

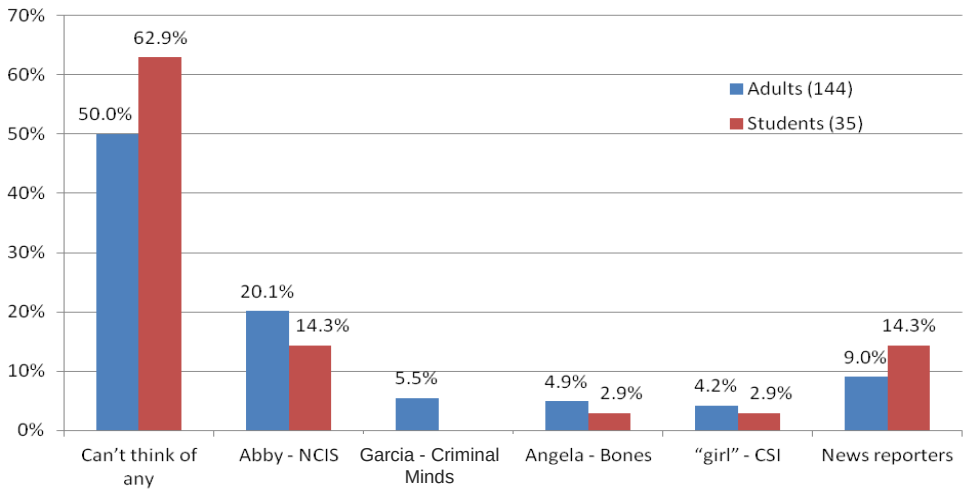


Figure 5.3. Percentage of respondents who named a female on television who uses ICT.

It can be seen from Figure 5.3 that 50% of adults and 63% of students could not think of a female ICT expert character in any television program. *Abby* from *NCIS* was the most recognised female (adults, 20.1%; students, 14.3%). *Garcia* from *Criminal Minds* was recognised by a small percentage of adults (5.5%), but not by students. *Angela* from *Bones* was named by adults (4.9%) and students (2.9%). A non-specific "girl" from *CSI* (adults, 4.2%; students, 2.9%) and non-specific female news reporters or journalists were also mentioned by some respondents (adults, 9.0%; students, 14.3%).

This general lack of recognition of television shows that involve computer experts, and the relative absence of respondents' ability to identify female ICT characters on television in 2011 suggest that the influence of television shows on community beliefs about ICT people and jobs is likely to be limited.

Although *NCIS, Criminal Minds* and *Bones* were ranked in the top ten shows with Victorian audiences (Roy Morgan Research, 2011), people did not recognise that ICT experts were involved in these shows. Surprisingly, more adults identified *The IT Crowd* than *Criminal Minds*, even though it was not shown on free to air television in 2011, perhaps because of the clearly recognisable (indeed, stereotyped) ICT characters, reinforced by the name of the show.

While Abby Scuito from *NCIS* was the most often mentioned female ICT character, the second most common response was "journalist" or "news reporter". Computers have

become so common in the contemporary workplace (and reflected in contemporary TV programs) that it is, perhaps, difficult for the public to distinguish between expert and user.

The questionnaires yielded another interesting result. In response to the question about television shows involving computer experts, a number of people listed *The Big Bang Theory* or *CSI*. In *CSI,* computers were used by all characters, but there was no specific ICT expert character (which excluded the show from analysis in this study). Some confusion between *NCIS* and *CSI* may account for the high percentage of responses of *CSI* with answers such as:

> *The girl from CSI with the black hair and ridiculous clothes - Abby?*
>
> *Characters on NCSI* [sic]*, etc.*

In *The Big Bang Theory*, Australia's most popular TV show in 2011 (Roy Morgan Research, 2011), the characters often used computers in their spare time. This show, however, was not included for analysis in this study because none of the characters' jobs were in ICT. Amy Farrah Fowler from the show, a neurobiologist, was mentioned by one adult in response to Q3 (Can you name any females in TV shows who are computer experts or need computers for their jobs?).

The Big Bang Theory and *CSI* both involve science, indicating respondents may have been confused between science and ICT. For shows like *NCIS* and *Bones* it was difficult to distinguish between science and ICT, as computers were used for scientific tests and monitors were used to display the scientists' findings.

Interviews

In the face to face group interviews, participants were shown an excerpt from *NCIS* showing the two ICT expert characters (Abby Scuito and Tim McGee) talking in Abby's lab and were asked their impression of the characters. *NCIS* was chosen rather than other television shows as questionnaire responses indicated *NCIS* was the most recognised show. Their responses are discussed in the next section, Perceptions 1: Gender and ICT.

Perceptions 1: Gender and ICT

This section begins with a discussion of perceptions of gender and ICT found in the media review. This is followed by an exploration of the attitudes held by all three community groups (Groups A, B and C), expressed through questionnaires and interviews, with regard to:

- Whether they believe there is a gender difference in a person's confidence, competence, and interest or enthusiasm towards computers.

- The extent of agreement with a number of items concerning whether males or females are better at certain aspects of ICT.

Next, Group A and B teachers' observations of boys' and girls' behaviours with regard to ICT in the classroom are presented. The section concludes with a summary of the findings in answer to the following sub-question:

SQ 1: What are community attitudes about gender and ICT?

Media review

When assessing the data from the media review in terms of portrayals of gender and ICT, it was found that while all expert characters displayed some of the ICT stereotypes, the media did not portray the traditional ICT stereotype among female characters as strongly as for males. The results of the media review were presented in Table 5.1 (above). The least stereotyped character was a female, Angela Montenegro, from *Bones*. Angela was an attractive, lively artist who was married with a child. Her best friend, Dr. Temperance "Bones" Brennan, however, a female forensic anthropologist and the main character of the show, displayed many stereotypes common to science and ICT. Dr. Brennan was already the female geek in the show, which may be the reason why Angela did not display many stereotypical characteristics.

Penelope Garcia *(Criminal Minds)* was the most stereotypical female ICT expert. She wore glasses, was overweight, enjoyed online games and rarely left her dark basement office. Penelope was, however, less stereotyped than Alec Hardison (*Leverage*) who was also the least stereotypical male. Hardison was a young African American criminal turned good guy who dressed in a fashionable way and was proud of being a geek.

The most stereotyped characters were two males, Roy Trenneman and Maurice Moss, from the comedy *The IT Crowd*. Stereotypes attributed to Roy and Moss included geekiness, social isolation, health problems, and the boredom of their jobs. While it is understood that extremes of behaviour, dress, and attitude were emphasized because of the genre of the show, males from the dramas were also portrayed in a more stereotypical way than the females.

Female characters were not referred to by other characters in the show as nerdy as frequently as male characters were, and there was more evidence of bullying with male characters. Some male experts, however, were shown working outside their offices more often than females were; thus the males' employment roles were less stereotyped. This issue will be discussed further in Perceptions 2: ICT people and jobs.

It should be noted that while female ICT experts were portrayed in a less stereotyped way than male ICT experts, they were still unusual when compared with other female characters on the shows. Responses to Q3 (Can you name any females on TV who are computer experts or need computers for their jobs?) included in the community questionnaires reinforced this finding. For example, one parent wrote, "The goth one from NCIS and the 'zany' one from Criminal Minds." This finding was further strengthened by the responses of interviewed parents who watched a clip from *NCIS* and were asked to comment on the two ICT expert characters from the show, Abby Sciuto and Tim McGee. Abby is a "Goth" with numerous tattoos and an interest in the occult. She wears her hair in two pigtails which is quite childish, and is fun and quirky. Tim McGee is a detail oriented special agent at *NCIS.* He wears a suit and tie and is called "McGeek" by his colleagues. Typical comments from parents in the Group interviews about Tim McGee were:

> *Well, he's a dork, McGeek, ha! (Gender of participant: female).*
>
> *He's very much focused on finding things through electronic methods and he has difficulty relating to people on the same sort of level (female).*
>
> *The geek "Tim" is the computer programmer, he does the hacking, he goes in and finds out where things are coming from (male).*

Typical comments about Abby Sciuto were:

> *Well, she's a Goth isn't she, she's very individualistic and, you know, out there (female).*
>
> *She's a great character, but it is kind of going [sic], if you're going to be a girl and that geeky, then you have to be pretty wacky too (female).*
>
> *All the women on television are usually quite glamorous – she's kind of made out to be a bit different than the norm (female).*
>
> *She's smart and it's obvious that she's smart and she doesn't care that everyone knows that she's smart and that's cool (female).*

These comments illustrate that Tim McGee was thought of as a stereotypical geek while Abby Sciuto was described as individual, intelligent, and even cool, although it was recognized that she was somehow different from other females in the show.

In summary, while all ICT expert characters in the television shows reviewed displayed some ICT stereotypes, females were not portrayed as stereotypically as males. The least stereotyped character was Angela Montenegro from *Bones*. The most stereotyped

characters were Roy and Moss from the comedy, *The IT crowd*. The jobs of the male ICT expert characters were more varied than those of the females.

Confident, competent, and interested?

In each of the questionnaires completed by Groups A, B and C the following questions were asked with the response formats "Boys", "Girls" or "No difference" (respondents were also provided with the option of giving an explanation):

Q4. Who is more confident using computers?

Q5. Who is more competent using computers?

Q6. Who is more interested/enthusiastic about computers?

The answers for Q4, 5, and 6 for the combined community (Groups A, B and C combined) were analysed descriptively (frequency distributions) and are shown in Figure 5.4.

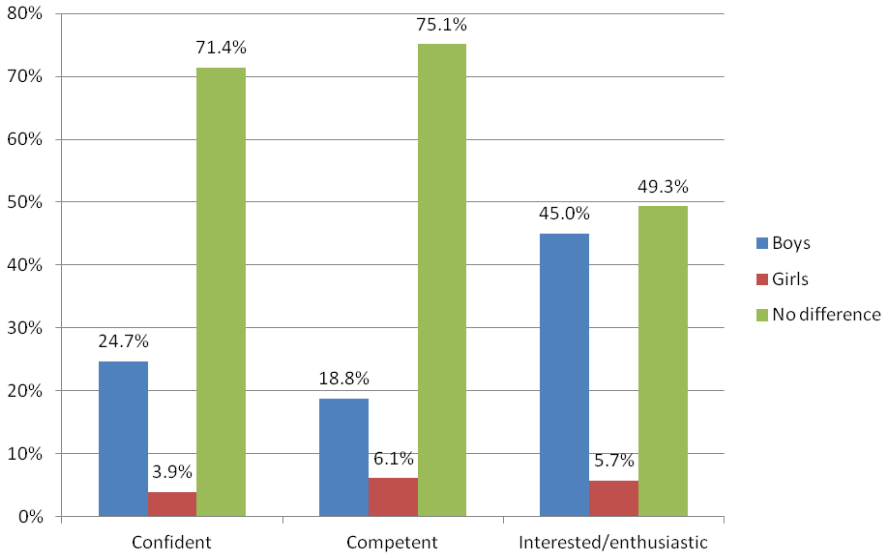


Figure 5.4. Percentage responses for: confident, competent, & interested.

As can be seen in Figure 5.4, there was a similar pattern of responses for Q4 (confidence) and Q5 (competence). The majority of the combined community considered there was no gender difference (Confidence: 71.4%, Competence: 75.1%). If people considered there to be a difference in confidence or competence it was in favour of boys (Confidence: Boys - 24.7%, Girls – 3.9%; Competence: Boys 18.8%, Girls 6.1%).

The pattern for Q6 (interest/enthusiasm) was different. There were almost as many people who believed boys (45.0%) to be more interested or enthusiastic towards ICT as those who indicated that there was no gender difference (49.3%). Only 5.7% believed girls were more interested or enthusiastic.

Comparison of group results

Responses from Groups A, B and C were compared with each other and, as described earlier in this chapter, chi-square tests were performed. For each chi-square test, however, there was a cell with fewer than five entries which contravened the assumption of the test. Results, therefore, could only be reported in percentage frequencies (see Table 5.2) and trends in the data described.

Table 5.2

Percentage responses to Items 4-6 for Groups A, B, and C

Item	Answer	Group A *(N)*	Group B	Group C
Q4. Who is more confident using computers?	Boys	26.7% (12)[1]	29.2% (21)	21.1%(24)
	Girls	2.2% (1)	1.4% (1)	6.1%(7)
	No difference	71.1% (32)	69.4% (50)	72.8%(83)
Q5. Who is more competent using computers?	Boys	17.8% (8)	23.9% (17)	15.9% (18)
	Girls	4.4% (2)	4.2% (3)	8.0% (9)
	No difference	77.8% (35)	71.8% (51)	76.1% (86)
Q6. Who is more interested/ enthusiastic about computers?	Boys	35.6% (16)	57.1% (40)	41.2% (47)
	Girls	2.2% (1)	2.9% (2)	8.8% (10)
	No difference	62.2% (28)	40.0% (28)	50.0% (57)

[1]Number of responses are shown in parentheses.

As seen in Table 5.2, the pattern of results for each of the groups was very similar for Q4 (confidence) and Q5 (competence). The most frequent response in all three groups was "no difference" and, if a gendered view was held, a much higher proportion responded "boys" than responded "girls". Although the same pattern was seen for Q4 and Q5, compared to Groups A and C, a higher percentage from Group B responded "boys" to both questions (Q4 – 29.2%, Q5 – 23.9%) and fewer responded "no difference" (Q4 – 69.4%, Q5 – 71.8%).

The pattern of results for Q6 (interest/enthusiasm) was also similar for Groups A, B and C. In each group the percentage of respondents answering "boys" was higher than in Q4 (confidence) and Q5 (competence). For Q6, Group B participants were more likely to respond "boys" (57.1%) than those from Group A (35.6%) or Group C (41.2%); and less likely

to respond “No difference” (40.0%) than those from Group A (62.2%) or Group C (50.0%) indicating that Group B held the most stereotyped views.

While a majority in each group believed there was no difference between girls and boys with respect to ICT, these results suggest that the views of Group B were more traditionally stereotyped than Groups A or C, that is, Group B held the strongest views that ICT was a male domain.

A closer examination of the responses from each of the two school communities is shown in Tables 5.3 (Group A – the Goldstine community) and 5.4 (Group B – the Bartik community). The responses have been disaggregated and the results shown separately for each sub-group (parents, teachers, and non-DD students). While numbers of respondents are small, the trends in the patterns observed are, nonetheless, of interest. No statistical testing was possible.

Table 5.3

Group A (Goldstine community) sub-group responses to Items 4-6

Item	Answer	Group A parents *(N)*	Group A teachers	Group A Non-DD students
Q4. Who is more confident using computers?	Boys	21.4% (3)	35.3% (6)	21.4% (3)
	Girls	7.1% (1)	0.0% (0)	0.0% (0)
	No difference	71.4% (10)	64.7% (11)	78.6% (11)
Q5. Who is more competent using computers?	Boys	7.1% (1)	11.8% (2)	35.7% (5)
	Girls	0.0% (0)	11.8% (2)	0.0% (0)
	No difference	92.9% (13)	76.5% (13)	64.3% (9)
Q6. Who is more interested/ enthusiastic about computers?	Boys	14.3% (2)	47.1% (8)	42.9% (6)
	Girls	7.1% (1)	0.0% (0)	0.0% (0)
	No difference	78.6% (11)	52.9% (9)	57.1% (8)

Table 5.4

Group B (Bartik community) sub-group responses to Items 4-6

Item	Answer	Group B parents (*N*)	Group B teachers	Group B non-DD students
Q4. Who is more confident using computers?	Boys	26.7%(8)	40.0% (6)	25.9% (7)
	Girls	3.3% (1)	0.0% (0)	0.0% (0)
	No difference	70.0% (21)	60.0% (9)	74.1% (20)
Q5. Who is more competent using computers?	Boys	13.3% (4)	33.3% (5)	30.8% (8)
	Girls	3.3% (1)	6.7% (1)	3.8% (1)
	No difference	83.3% (25)	60.0% (9)	65.4% (17)
Q6. Who is more interested/ enthusiastic about computers?	Boys	62.1% (18)	46.7% (7)	57.7% (15)
	Girls	6.9% (2)	0.0% (0)	0.0% (0)
	No difference	31.0% (9)	53.3% (8)	42.3% (11)

From Tables 5.3 and 5.4 the following similarities between the two groups can be seen:

- For Q4 (confidence): Group A teachers and Group B teachers were less likely to respond “no difference” and more likely to respond “boys” than non-DD students or parents in their school communities.
- For Q5 (competence): Group A and Group B parents were more likely to respond that there was “no difference” between girls and boys than non-DD students or teachers in their school communities.
- There were differences in responses to Q6 (interested/enthusiastic) for the Group A and B parents. For Group A, 78.6% of parents responded “no difference”, 14.3% said “boys” and 7.1% said “girls”, while in Group B only 31.0% of parents responded “no difference”, 62.1% said “boys”, and 6.9% and “girls”.

The stereotype that boys are better at, or more interested in, ICT than girls was supported more strongly by members of Group B. Teachers at both schools believed that boys were more confident than girls with ICT, parents at both schools believed there was no difference in competence with ICT based on gender. Group A parents believed that there was no difference between genders in terms of interest or enthusiasm about ICT, whereas Group B parents believed boys were more interested or enthusiastic about ICT than girls.

Open ended explanations

In the questionnaire, respondents were asked to explain their selection of "Boys", "Girls" or "No difference" to the three questions. Five categories emerged from the analysis of the open ended responses. The categories for each explanation were:

- Observation – respondents based their answers on their own observations of their children, students, or friends with computers.
- Interest/exposure – respondents believed that the greater exposure to, or interest in, computers, the more likely girls and boys were to be confident, competent, or interested in them.
- Innate ability/suitability –respondents believed that one gender (most often boys) was born with an ability or suitability to work with computers.
- Purpose – respondents believed that confidence, competence, or interest in computers depended on the reason for using a computer. Examples were games or social networking.
- A range of other reasons (each with a very small number of respondents) that did not fit into the above categories.

The percentages of responses from Group A non-DD boys and girls in each category are presented in Table 5.5.

Table 5.5

Reasons for responses – confident, competent, interested/enthusiastic

	Q4. Who is more confident using computers?			**Q5. Who is more competent using computers?**			**Q6. Who is more interested/ enthusiastic about computers?**		
Category	**Boys (*N*=32)**	**Girls (7)**	**No diff (85)**	**Boys (24)**	**Girls (9)**	**No diff (72)**	**Boys (64)**	**Girls (9)**	**No diff (39)**
1. Observation	28.1%	71.4%	30.6%	16.7%	55.5%	23.6%	17.2%	44.4%	23.1%
2. Interest/ exposure	18.7%	0.0%	38.8%	25.0%	11.1%	54.2%	4.7%	0.0%	51.3%
3. Innate ability /suitability	28.1%	0.0%	0.0%	20.8%	22.2%	0.0%	15.6%	0.0%	0.0%
4. Purpose	3.1%	14.3%	5.9%	20.8%	11.1%	5.5%	32.8%	44.4%	20.5%
5. Other	25.0%	14.3%	28.2%	16.7%	0.0%	20.8%	21.9%	11.1%	15.4%

NB. Some responses fitted into more than one category; percentages do not add to 100%.

What follows provides more insight into each of the categories in turn. First, for the category "observation", it was apparent that respondents used their observations of their own children, students, friends, or teachers as justification for their answers. As can be seen in Table 5.5, this category was used for all questions (confidence, competence, and interest/enthusiasm) and all answers (boys, girls, and no difference); most frequently, however, it was used for the answer "girls". A typical explanation was:

> *I only have to look at the amount of time my wife and daughter spend on the computer compared to the males in the household (Response: girls, Explanation: interest/enthusiasm, Category: observation).*

As can be seen in Table 5.5, 'interest or exposure' was frequently given as an explanation for the answer "boys", but it was most commonly used by those answering "no difference". Only one respondent used this explanation for their answer "girls" for Q2:

> *Girls use them more often (girls, competence, interest/exposure).*

Many of those who used the explanation 'interest or exposure' believed that when males and females have equal interest, skills, exposure, education and access to computers, there is no gender difference in confidence, competence and interest or enthusiasm. A typical example was:

> *Skills are not determined by sex, rather by interest and application (no difference, competent, interest/exposure).*

Respondents who believed that one gender had an innate ability with or suitability for computers listed qualities such as bravery, competitiveness, or a technical brain as reasons for their responses. As can be seen in Table 5.5, this response was most frequent among those who answered "boys", was used only twice by those who answered "girls", and was not used at all by those who answered "no difference". A typical example was:

> *I think boys have a natural tendency to think outside the box and like to pull things apart and dissect them, just look at things differently (boys, confident, innate ability/suitability).*

Those who used the explanation 'purpose' believed that girls and boys use computers for different purposes, that is, that girls used computers for social purposes or to do a job, while boys used computers for fun and games. This category was used as an explanation for responses (boys, girls, no difference) to all questions (confident, competent and interested) for all answers (boys, girls, no difference). Typical responses were:

Girls tend to use computers to do a job rather than just for fun (boys, interest/enthusiasm purpose).

Boys seem interested in games and girls more social networking (no difference, interest/enthusiasm, purpose).

In the category 'Other', responses were either restatements of the answer (for example, for the answer "no difference", explanation – "Both the same"), "not sure", or an answer that few other people used such as:

Girls don't like looking like a smart person (boys, confident, other).

If observation is removed from the list of categories then the range of responses is seen to reflect peoples' beliefs. This examination of the explanations shows that those who indicated there was a gender difference in favour of boys believed it was because boys are more interested in computers than girls and because they play computer games. There was also a belief that boys have a natural ability or suitability with technology which could even be seen in explanations for "no difference", for example:

No difference, but boys may be more interested, for future employment prospects (no difference, interest/enthusiasm, purpose).

Those few who believed there was a gender difference in favour of girls thought it was because girls are very involved with social networking on computers. For example:

Because they are more into the social scene (girls, competent, purpose).

When people believed there was no difference between boys' and girls' confidence, competence, or interest/enthusiasm with computers, they indicated that it was because the exposure, interest, and purpose an individual has with computers is more influential than their gender.

Interviews

While the group interviews were semi-structured and the email interviews had a list of specific questions, as described in Chapter Four, interview participants were encouraged to comment on any aspect they felt was relevant to the topic of girls and ICT. It was quite common, particularly in the email interviews, for respondents to suggest that females were much better represented in ICT than is evidenced by the facts. This is perhaps based on undue weight given to anecdotal evidence, or unjustified extrapolation from personal experience. For example:

… the number of boys and girls studying IT are quite equal and are growing too (Group or email interview: email interview, Parent or student: student, Gender: female).

I know a few people who are good with IT, most are females a few are males, they're the people I go to when I need help with anything to do with IT (email interview, student, female).

Certainly there are more men but there are still a lot of women there – not doing technical or development stuff but working in IT … especially in Project Management (group interview, parent, female).

Other comments from the group and email interviews provided further evidence for the views expressed in the questionnaires. General remarks about the influences on a child's interest in ICT supported findings from the questionnaire respondents that interest in, or exposure to, ICT made a difference. For example:

Any gender can study ICT if they are interested (email interview, student, male).

I think it goes a lot down [sic] to their personalities and what they are interested in (group interview, parent, female).

All your multi-media… your airy-fairy graphic sort of stuff rather than outright programming [whereas] a lot of lads, I have to say, they get into programming because they play the games and a lot of the games are designed for boys, they are shoot-em-up, they are not designed for girls (group interview, parent, female).

The idea that males had some innate ability or suitability to ICT was also raised in the interviews with comments such as:

I think that there are gender differences. If you look at little boys they will play with trucks and if you look at little girls they talk and some of that's how we push things but I think some of that is just the nature of males and females but I think there will always be a majority of boys who become programmers rather than girls because I just think we're different (group interview, parent, female).

In a comment that suggested both a belief in boys innate suitability to ICT and that girls and boys use ICT for different purposes one mother said:

My impression is that girls want to use it [computers] as a tool whereas boys want to understand how it works … and generally I think there is that thing about boys, some boys like to tinker and it's just the same for me – I have no interest in how they work – I just want to use it – the tools that it can provide (group interview, parent, female).

This comment from a student in the Email interviews provided more evidence for the perception that ICT was considered a male domain:

Yes, it is seen as a male's career in society (email interview, student, female).

Other interview comments related to ICT and gender reflected findings from the literature, as discussed in Chapter Three, that children remember stereotyped behaviour better than non-stereotyped behaviour. One mother witnessed her son telling his class that she did not know anything about computers:

> *He said "Oh, well Mum knows nothing about what I do, Mum knows nothing" and I thought that's really interesting because I'm, you know, I'm not an expert but I'm certainly much better than the average women, even now at my age, because I work in the area and yet my son thought because his dad is much more a geek … (group interview, parent, female).*

Other comments from parents suggested that mothers did not have an interest in using ICT with their children unless it was related to the child's homework which, as also discussed in Chapter Three, can subtly signal that ICT is not appropriate for females. This was illustrated in these comments from mothers:

> *I would leave that up to their stepdad or their father to do that stuff because I don't want to know about that stuff (group interview, parent, female).*

> *I would have when they were little, but not now, I mean I've got no interest in playing silly games (group interview, parent, female).*

And this comment from a father:

> *If it's to do with homework then they go to her but if it is to do with the operating system and why the internet doesn't work and that sort of stuff they come to me (group interview, parent, male).*

Few community members believed girls were more confident, competent or interested than boys in computers. Those who believed boys were more capable or enthusiastic than girls based their belief on a variety of reasons including their own observations and an innate ability. Those who believed there was no gender difference with regard to ICT generally thought it was because interest, exposure, and personality determined interest in ICT, not gender.

Boys, girls and ICT

Each questionnaire also included six items concerning boys, girls and various aspects of computing. Participants responded on 5-point Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1). Participants were asked to what extent they agreed with Q7-12 below about girls, boys and computers:

Q7. Girls are more likely than boys to ask for help with computers.

Q8. Girls find it easier to work with a new program than boys.

Q9. Girls are better than boys at setting up a new computer.

Q10. Boys are better than girls at fixing a computer.

Q11. Boys are more suited than girls to work in the computer industry.

Q12. Boys are better than girls at working with computers.

Table 5.6 presents the mean scores for each item for the combined community (Groups A, B and C) and for each group separately.

Table 5.6

Mean scores by community group for items about boys, girls and ICT

Item	Combined community (*N*=219)	Community Group		
		Group A (45)	Group B (73)	Group C (103)
Q7. Girls are more likely than boys to ask for help with computers.	3.30	3.38	3.34	3.24
Q8. Girls find it easier to work with a new program than boys.	2.93*	2.87*	2.88*	2.99*
Q9. Girls are better than boys at setting up a new computer.	2.59	2.67	2.49	2.63
Q10. Boys are better than girls at fixing a computer.	3.16	3.02*	3.34	3.10*
Q11. Boys are more suited than girls to work in the computer industry.	2.47	2.47	2.56	2.41
Q12. Boys are better than girls at working with computers.	2.56	2.53	2.58	2.57

*not significantly different from 3 in a one sample *t*-test.

As can be seen in Table 5.6, the combined community (Groups A, B and C) agreed that:

- Girls are more likely than boys to ask for help with computers (Q7, *M*=3.30).
- Boys are better than girls at fixing a computer (Q10, 3.16).

The combined community disagreed that:

- Girls are better than boys at setting up a new computer (Q9, 2.59).
- Boys are more suited than girls to work in the computer industry (Q11, 2.47).

- Boys are better than girls at working with computers (Q12, 2.56).

The combined community was not sure whether:

- Girls find it easier to work with a new program than boys (Q8, 2.93 - not statistically different to 3).

When the Groups A, B, and C were examined separately they each followed a similar pattern in their responses to the six items, with no statistically significant differences in mean scores.

The responses from the sub-groups (parents, teachers and non-DD students) of Groups A and B sub-groups were examined separately. The mean scores for responses from each sub-group of Group A were similar for each item (Q7-12) and there were no statistically significant differences in the mean scores by sub-group. Mean scores for each Group B sub-group responses were also fairly similar, with the exception of Group B non-DD boys for Q11 and Q12, as shown in Table 5.7.

Table 5.7

Group B (Bartik community): Mean scores by sub-group for items about boys, girls and ICT (Q11 and Q12)

Sub-group / Item	Group B parents (*N*=31)	Group B teachers (15)	Non-DD students (27)	Group B Boys (11)	Group B Girls (16)
Q11. Boys are more suited than girls to work in the computer industry.	2.39	2.40	2.85*	3.18	2.63
Q12. Boys are better than girls at working with computers.	2.42	2.47*	2.81*	3.36	2.44*

*not significantly different from 3 in a one sample *t*-test.

As can be seen in Table 5.7, Group B non-DD boys did not follow the same pattern as the other Bartik sub-groups on the two items, Q11 and Q12. Specifically, they agreed that boys are more suited than girls to work in the computer industry (Q11, 3.18) and that boys are better than girls at working with computers (Q12, 3.36), whereas the other sub-groups disagreed or were unsure.

Among the non-DD students in Group B, an independent samples *t*-test revealed no statistically significant gender difference in the mean scores for Q11; however, there were statistically significant gender differences in the mean scores for Q12. The non-DD boys agreed (*M*=3.36) that “Boys are better than girls at working with computers”, and the non-

DD girls disagreed (2.44); $t(25)=2.39$, $p<.05$. These results suggest that in Group B, the boys were more stereotyped than the girls in their beliefs about gender difference, which is consistent with the Group B parents' views for Q6, that boys are more interested or enthusiastic about computers than girls (Table 5.4) possibly indicating that children had been influenced by their parents' attitudes.

Teacher's observations

Teachers have the opportunity to observe and influence a large number of boys and girls interacting with ICT. The teachers' questionnaire included a question about gender and ICT:

> Q13. In classes you have taught in the past, have you observed boys and girls behaving differently with respect to:
>
> a. The computer hardware?
>
> b. The computing activities in which they engage?
>
> c. Any other aspect of computing?

Teachers selected from 'Yes', 'No', and 'Sometimes' for their answers. An opportunity to explain their responses was also provided. The results for teachers at both schools are summarised in Table 5.8.

Table 5.8

Responses to Q13 by Group A and Group B teachers

Q13. In classes you have taught in the past, have you observed boys and girls behaving differently with respect to:	**Sub-group *(N)***	**Yes *(N)***	**No *(N)***	**Sometimes *(N)***
Q13a. Hardware	Group A teachers (17)	29.4% (5)	35.3% (6)	35.3% (6)
	Group B teachers (13)	46.2% (6)	46.2% (6)	7.7% (1)
Q13b. Activities	Group A teachers (17)	52.9% (9)	17.6% (3)	29.4% (5)
	Group B teachers (12)	58.3% (7)	33.3% (4)	8.3% (1)
Q13c. Other	Group A teachers (17)	11.8% (2)	76.5% (13)	11.8% (2)
	Group B teachers (13)	38.5% (5)	61.5% (8)	0.0% (0)

As can be seen from Table 5.8, Group A teachers' responses to Q13a were fairly evenly divided between 'yes', 'no', and 'sometimes' while almost half of Group B teachers responded 'yes' (46.2%, $N=6$), the same percentage responded 'no'(46.2%, 6); only one (7.7%) responded 'sometimes'.

More than half of the teachers from each group (Group A: 52.9%, 9; Group B: 58.3%, 7) had observed a gender difference in the computing activities in which boys and girls engage (13b). The majority of teachers in Group A (76.5%, 13) and Group B (61.5%, 8) reported that they had not observed a gender difference in any other aspect of computing.

Teachers were given the opportunity to explain their answers. When Group A and B teachers' responses were combined, only two comments were provided for their 'No' answers and only eight for their 'Sometimes' answers, whereas 28 comments were provided when teachers had noticed a difference.

The open-ended responses were analysed (as described in Chapter Four) and condensed into four categories:

- Boys rougher – teachers had observed boys handling equipment in a rougher fashion compared with girls.
- Skill/interest - teachers had observed that girls and boys had different skill levels and different interests with regard to computing activities.
- Purpose - teachers had observed that the purpose for using computers differed for boys and for girls.
- Other - teacher observations did not fit into the above categories.

The percentages of responses in each of the four categories are presented in Table 5.9.

Table 5.9

Explanations for answers to Items 13a, b, and c for Groups A and B teachers

Q13. In classes you have taught in the past, have you observed boys and girls behaving differently with respect to:	**Answer *(N)***	**Boys rougher**	**Skill/ interest**	**Purpose**	**Other**
Q13a. Hardware	Yes (9)	44.4% (4)	44.4% (4)	0.0% (0)	11.1% (1)
	No (2)	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (2)
	Sometimes (3)	0.0% (0)	33.3% (1)	0.0% (0)	66.7% (2)
Q13b. Activities	Yes (14)	0.0% (0)	0.0% (0)	78.6% (11)	21.4% (3)
	No (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
	Sometimes (4)	0.0% (0)	50.0% (2)	25.0% (1)	25.0% (1)
Q13c. Other	Yes (5)	0.0% (0)	40.0% (2)	40.0% (2)	20.0% (1)
	No (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
	Sometimes (1)	0.0% (0)	100.0% (1)	0.0% (0)	0.0% (0)

As can be seen from Table 5.9, of the Group A and Group B teachers who had observed a gender difference in hardware use (Q13a), 44.4% explained that boys were rougher with hardware than girls and another 44.4% observed that boys were more skilled with or interested in hardware than girls. Typical responses were:

> *Boys can be rougher with the computers (Community group: Group B, Question: hardware, Answer: yes).*

> *Boys know some stuff about hardware, speakers, etc..., girls don't really pay attention to that aspect (Group A, hardware, sometimes).*

When teachers observed a gender difference in the activities in which their students engaged (Q13b), 78.6% of teachers explained that boys and girls use computers for different purposes. The most common comments suggested that boys play and explore, while girls socialize, create, and do the set work. Eight of the eleven teachers specifically mentioned that boys prefer to play games. A typical answer was:

> *Boys like games, programming, etc. Girls prefer creative stuff like Flash, Photoshop. Nobody likes Office (Group A, activities, yes).*

Two of the five teachers (40%) who indicated they had observed gender differences in other aspects of computing (Q13c) explained that the difference was in purpose. They believed girls were more interested in social networking and boys in playing games. Another two (40%) who answered 'Yes', and the one teacher who answered 'Sometimes' suggested that boys were more skilled with computers and that girls did not like using computers. Typical explanations were:

> *Off task activity - girls go to Tumbler or Facebook, boys play Counterstrike (Group B, other, yes).*

> *Boys don't panic as much if one something [sic] isn't working (Group B, other, yes).*

Although the responses were few in number, the explanations suggest that the teachers in the study believed boys to be rougher with computers than girls, and to be more interested in games, and more willing to explore; they believed that girls were more interested than boys in socializing and creating. More teachers in Group B than Group A believed that there was a gender difference in behaviour with respect to computers.

Summary of perceptions 1: Gender and ICT

In answer to sub-question 1 (What are community attitudes about gender and ICT?), the results from the media review and combined community (Groups A, B and C) responses to the questionnaires and interviews indicated that there was no consistent pattern of beliefs

among the community. Some data indicated community views were egalitarian, for instance, the results from interviews and questionnaires showed that the combined community (Groups A, B and C) generally considered there to be no gender difference in competence and confidence with computers. According to community members, this was because given access to the same education and opportunities, a student's individual interest and ability, not gender, determined success with computers. However, in those cases when a gender difference was identified it was in favour of boys, demonstrating that the stereotype that males are naturally suited to ICT exists to some extent within each of the three community groups (Groups A, B and C).

In addition almost as many members of the combined community as those who believed that there is no gender difference, believed that boys have more interest in, or enthusiasm towards, computers than girls do. The community members felt that this was because boys have an innate ability or suitability for computing and because they play computer games more often than girls.

From the media review it was found that while all ICT expert characters in the television shows reviewed were stereotyped to some extent, male ICT experts were portrayed in a more stereotypical fashion than female ICT experts. In particular males were portrayed as nerdier and more likely to be bullied. The findings are not inconsistent with the earlier findings from the literature, discussed in Chapter Three, that ICT professionals are stereotyped as nerdy males.

Finally, when the responses by the various community groups were examined separately, different attitudes were found among the sub-groups of Groups A and B. Results from within the school communities indicated that parents from both groups were the least likely to believe that there was a gender difference and, *remarkably, teachers from both groups were the most likely to believe there was a gender difference in favour of boys*. Half of the teachers at both schools recognised a gender difference: first, in the way students use hardware, believing boys to be rougher; and second, in the activities they engage in, believing boys play games and explore while girls socialize and create.

In the next section community attitudes about people who work with computers and their jobs are explored.

Perceptions 2: ICT people and jobs

This section is introduced using the data from the media review related to perceptions of ICT people and jobs. Next, there is an examination of the extent of agreement that Groups A, B, and C had with a number of items about the people who use computers and computing jobs. This is followed by a discussion of:

- Non-DD students' drawings of ICT people and the accompanying descriptions.
- Non-DD student responses to questions about employment in the ICT industry what they would like or dislike about a job in ICT.
- Comments about ICT people and jobs from email and group interviews.

Finally, a summary of community attitudes towards ICT people and jobs concludes this section and answers sub-question 2: What are community attitudes about ICT people and jobs?

ICT people and jobs on television

The stereotypes associated with ICT people and jobs were compared with the portrayals of ICT expert characters on television. It can be seen from the results, presented in Table 5.1, that among the television characters, the ICT professionals were stereotyped as unhealthy, socially isolated geeks who worked indoors.

Of the seven ICT expert characters reviewed, only one, Angela Montenegro (*Bones*), was in a long term, and apparently stable relationship, and she had a child. The most stereotyped characters, Roy Trenneman and Maurice Moss (*The IT Crowd*) regularly lamented their lack of relationship success and were often concerned that they were not masculine enough. These portrayals echo the stereotypes that ICT jobs are socially isolating and ICT professionals are geeks.

Roy and Maurice, along with Abby Sciuto (*NCIS*) regularly consumed junk food. Maurice was asthmatic and Penelope Garcia (*Criminal Minds*) and Tim McGee (*NCIS*) were overweight (although Tim slims down in later episodes). Abby, Penelope, Roy and Maurice all worked in basements with little to no natural light where they were separated from their colleagues. As well as reinforcing the stereotype that ICT professionals are geeks, these examples appear to reinforce the stereotype that ICT jobs are bad for your health.

The jobs presented in the television shows reviewed were of two types. First, ICT support technicians, a job the viewing audience would be familiar with, was portrayed as boring, repetitive, and tedious. Roy and Maurice (*The IT Crowd*) were ICT support technicians and clearly did not enjoy their jobs. Second, the other television characters reviewed had jobs that viewers may have found unrealistic, as they would be unlikely to encounter people similarly employed in the real world. Abby Sciuto (*NCIS*), for example, was an expert in every area of forensic science, a rare job description. Tim McGee (*NCIS*) and Alec Hardison (*Leverage*) were often called on to do field work, including chasing down criminals, in addition to their ICT expert roles. While these jobs were not stereotypical ICT jobs, the characters themselves, were stereotyped. Stereotypes were more likely to be applied to the

ICT technicians (Roy and Maurice) than other ICT experts, although this may have been because of the comedic value of the geeky stereotype.

ICT people and jobs as viewed by the combined community

In order to gain an understanding of perceptions of ICT people and jobs in the community, Groups A, B and C responded, on 5-point Likert-type response formats (Strongly Agree to Strongly Disagree) to the following items Q14-16, about ICT people, and Q17-21, about ICT jobs:

Q14. Computing professionals have a lot of outside interests.

Q15. People who are really good at computing are popular.

Q16. I would like it if people thought of me as a computer geek.

Q17. People who work in computing work alone.

Q18. Computing professionals work in teams.

Q19. Computing jobs are good for people with families.

Q20. People have to be very hard working if they want to work in the computer industry.

Q21. A person who works in computing makes a lot of money.

Table 5.10 presents the mean scores for each item (Q14-21) for the combined community (Groups A, B and C) and each group separately.

Table 5.10

Mean scores by community group for items about ICT people and jobs

Item	Combined community (*N*=219)	Community group		
		Group A (45)	Group B (73)	Group C (103)
Q14. Computing professionals have a lot of outside interests.	3.19	3.40	3.27	3.04*
Q15. People who are really good at computing are popular.	2.76	2.91*	2.62	2.79
Q16. I would like it if people thought of me as a computer geek.	2.38	2.45	2.39	2.35
Q17. People who work in computing work alone.	2.46	2.24	2.56	2.48

Item	Combined community (*N*=219)	Community group		
		Group A (45)	Group B (73)	Group C (103)
Q18. Computing professionals work in teams.	3.27	3.33	3.27	3.24
Q19. Computing jobs are good for people with families.	3.14	3.09*	3.14*	3.17
Q20. People have to be very hard working if they want to work in the computer industry.	3.15	3.53	3.26	2.91*
Q21. A person who works in computing makes a lot of money.	3.22	3.38	3.11*	3.22

*not significantly different from 3 in a one sample *t*-test

ICT people. As can be seen in Table 5.10, the combined community agreed that computing professionals have a lot of outside interests (Q14, *M*= 3.19), but disagreed that ICT people are popular (Q15, 2.76), and could not see themselves as computer geeks (Q16, 2.38). When disaggregated, Groups A, B and C followed a similar pattern to the combined community. A one way between group ANOVA revealed no statistically significant differences between groups.

ICT jobs. With regard to ICT jobs, the combined community disagreed that people who work in computing work alone (Q17, 2.46) and agreed that teamwork is part of an ICT job (Q18. 3.27), that it is a good job for families (Q19, 3.14), and it pays well (Q21, 3.22), but involves hard work (Q20, 3.15). Overall they had a positive view of ICT jobs. When Groups A, B and C were examined separately each followed a similar pattern to the combined community. There appeared, however, to be a difference in attitude between Groups A and B and Group C for Q19 (Computing jobs are good for people with families) and Q20 (People have to be very hard working if they want to work in the computer industry).

A one-way between groups ANOVA showed a statistically significant difference in the mean scores for only Q20 (People have to be very hard working if they want to work in the computer industry) for the three groups [$F(2, 218)=9.447$, $p<.001$]. Post-hoc comparisons using the Scheffé test indicated that the mean score for Group C (2.91) was significantly different from the mean score for Group A (3.53), and from the mean score for Group B (3.26). The mean score for Group A, was not significantly different from the mean score for Group B. These results for Q20 indicate that while the members of Group A (Goldstine SC) and of Group B (Bartik SC) agreed that people have to be very hard working if they want to work in the computer industry, the wider group of Victorian parents (Group C) was not sure whether they agreed with that item.

The mean scores for responses from each sub-group of Group A were examined for items Q14-21 and no statistically significant differences were found. Among the Group B sub-groups, however, one-way between groups ANOVAs showed statistically significant differences for three items, as shown in Table 5.11.

Table 5.11

Group B sub-groups ANOVA for statements about ICT people and jobs

Item	Group	*N*	*M*	*F*	Sig (*p* value)
Q14. Computing professionals have a lot of outside interests.	Parents	31	2.87	7.50	<.01
	Teachers	15	3.57		
	Non-DD students	27	3.58		
Q20. People have to be very hard working if they want to work in the computer industry.	Parents	31	2.81	10.99	<.001
	Teachers	15	3.47		
	Non-DD students	27	3.67		
Q21. A person who works in computing makes a lot of money.	Parents	31	2.84	6.07	<.01
	Teachers	15	2.93		
	Non-DD students	27	3.52		

Post-hoc analyses of the data shown in Table 5.11, using the Scheffé post-hoc criterion for statistical significance, indicated that, on average, Group B parents disagreed (*M*=2.87) while Group B teachers and non-DD students agreed that computing professionals have a lot of outside interests (Q14) . The pattern was similar for Q20; parents disagreed (2.81) while teachers and non-DD students agreed that people have to be very hard working if they want to work in the computer industry. In addition, Group B non-DD students agreed (3.52) while parents and teachers disagreed that a person who works in computing makes a lot of money (Q21).

While there was no statistically significant difference in the mean scores of Group B parents, teachers, and non-DD students for Q17 (People who work in computing work alone), an independent-samples *t*-test for mean scores of the sub-group non-DD students by gender indicated a trend (but there was no statistically significant difference) for boys (2.09) to disagree more strongly than girls (2.69) that people who work in computing work alone [$t(25)=-2.01$, $p<.1$].

Taken together these results suggest that among Group B, non-DD students had a more positive view of ICT than their parents, believing computing professionals have a lot of outside interests and make a lot of money. Non-DD students were also significantly more likely to think that people have to be very hard working if they want to work in the computer industry, while parents disagreed. Among the Group B non-DD students, boys strongly disagreed that people who work in computing work alone, while girls also disagreed but not nearly as strongly.

Student drawings

As part of the student questionnaire, Groups A and B non-DD students were asked to do the following:

> Q22. Please draw a picture of someone who works in the computing industry. Draw them doing something.
>
> Q23. Please describe the person and explain what is happening in the picture.

Any stereotyped perceptions of ICT people or aspects of ICT jobs that could be inferred from the drawings were identified. The checklist of characteristics used to examine the drawings was based on findings from previous research, as outlined in Chapter Three. The following stereotyped characteristics of ICT professionals and ICT jobs were included in the checklist:

> **Gender:** Whether the characters were male or female. Characters were only identified as a specific gender if clearly indicated in the non-DD student description accompanying the drawing with words such as “she” or “the man”. Long hair or pants on the drawn character were not sufficient for gender assignment. If no characters were drawn, it was identified as “no person”.
>
> **Body type:** Whether the characters had a normal or abnormal body shape or weight. Stick figures were also included here. If no characters were drawn, it was identified as “no person”.
>
> **Appearance:** Whether the characters wore glasses or displayed other stereotyped appearance, for example, the way characters were dressed (e.g., suit and tie, pocket protectors). If the person was labelled as a specific person (e.g., Steve Jobs) this was also included in this category.
>
> **Setting, position and activity:** Setting in which characters were drawn (e.g. at a desk, in a meeting). If there was only equipment and no characters were drawn, it was identified as “no person”.
>
> **People:** Whether characters were drawn alone or with other people. If no characters were drawn, it was identified as “no person”.

Activity: The activity or purpose the character was portrayed or described in, for example, "programming", or "fixing" a computer. This category also included the level of expertise the character possessed and student identified occupations.

Table 5.12 sets out the results for the analysis of the drawings. Clearly overlapping characteristics were evident in the drawings so percentages do not add to 100%. Each category is described in more detail below the table.

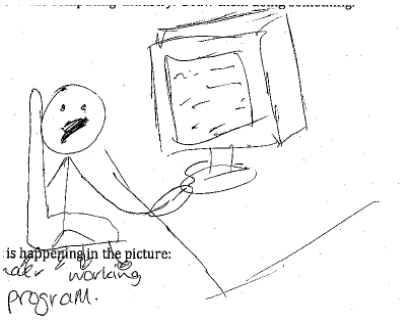
Table 5.12

Categories: Percentages (and frequencies) of student drawings and characteristics evident

Characteristic		Group A non-DD students (*N*=12)	Group A non-DD boys (7)	Group A non-DD girls (5)	Group B non-DD students (23)	Group B non-DD boys (8)	Group B non-DD girls (15)
Gender	**Male**	33.3% (4)	28.6% (2)	33.3% (2)	43.5% (10)	62.5% (5)	33.3% (5)
	Female	16.7% (2)	14.3% (1)	16.7% (1)	17.4% (4)	0.0% (0)	26.7% (4)
	Unknown	41.7% (5)	57.1% (4)	16.7% (1)	26.1% (8)	37.5% (3)	33.3%(5)
	No person	8.3% (1)	0.0% (0)	16.7% (1)	4.3% (1)	0.0% (0)	6.7%(1)
Body type	**Stick figure**	58.3% (7)	71.4% (5)	33.3% (2)	56.5% (13)	62.5% (5)	53.3% (8)
	Normal figure	33.3%(4)	28.6% (2)	33.3% (2)	39.1% (9)	37.5% (3)	40.0% (6)
	No person	8.3% (1)	0.0% (0)	16.7% (1)	4.3% (1)	0.0% (0)	6.7% (1)
Appearance	**Glasses**	8.3% (1)	14.3% (1)	0.0% (0)	17.4% (4)	25.0% (2)	13.3% (2)
	Dress	0.0% (0)	0.0% (0)	0.0% (0)	13.0% (3)	12.5% (1)	13.3% (2)
	Recognisable person	0.0% (0)	0.0% (0)	0.0% (0)	4.3% (1)	12.5% (1)	0.0% (0)
Setting	**At desk**	75.0% (9)	71.4% (5)	60.0% (3)	78.3% (18)	87.5% (7)	73.3% (11)
	Other	16.7% (2)	14.3% (1)	20.0% (1)	17.4% (4)	12.5% (1)	20.0% (3)
	No person	8.3% (1)	14.3% (1)	0.0% (0)	4.3% (1)	0.0% (0)	6.7% (1)
Number of people	**Alone**	75.0% (9)	85.7% (6)	60.0% (3)	65.2%(15)	62.5% (5)	66.6% (10)
	More than 1	16.7% (2)	14.3% (1)	20.0% (1)	26.1% (6)	25.0% (2)	26.6% (4)
	No person	8.3% (1)	0.0% (0)	20.0% (1)	4.3% (1)	0.0% (0)	6.7% (1)
	Specific occupation	16.7% (2)	14.3% (1)	0.0% (1)	4.3% (1)	12.5% (1)	0.0% (0)
Activity	**"Working" on computer**	33.3%(4)	42.9% (3)	20.0% (1)	34.8% (8)	12.5% (1)	46.7% (7)
	Programming	8.3% (1)	0.0% (0)	20.0% (1)	21.7% (5)	37.5% (3)	13.3% (2)
	Fixing	25.0% (3)	28.6% (2)	20.0% (1)	26.1% (6)	37.5% (3)	26.6% (4)
	Other	8.3% (1)	14.3% (1)	0.0% (0)	13.0% (3)	37.5% (3)	6.7% (1)

The results displayed in Table 5.12 are now described in more detail.

Gender - A large number of characters drawn by non-DD students from both schools were of unknown gender. An example of this was:



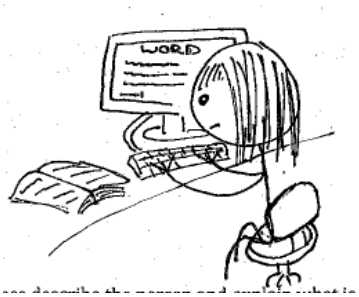
The person is sitting in a chair working hard to fix or produce a program (Student gender: female, Community: Group B).

Of the characters that could be assigned gender, the majority in each group were male.

In Group A, the largest group of characters drawn by male and female non-DD students were of unknown gender (41.7%, 5) and of those that could be identified 33.3% (4) were drawn as males compared with only 16.7% (2) drawn as females.

In Group B, the majority of characters drawn by Group B non-DD were male (*N*=5, 62.5%), more than any other group; not a single female character was drawn by this group. Group B non-DD girls drew equal numbers of unknown and male characters, and more females (4, 26.7%) than any other group.

Body type - Just over half of the non-DD students at both schools drew stick figures. No clear examples of abnormal body type were evident in the non-DD students' drawings from either school. An example of this was:

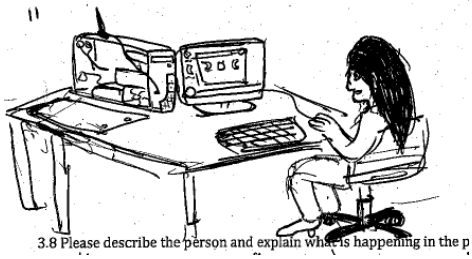


The person is a stick figure, female. She's writing a book report (female, Group B).

Appearance - There was not a lot of detail drawn on most of the characters – particularly the stick figures – and so it was difficult to distinguish appearance. Glasses were found on characters from both Group A non-DD students (8.3%, 1) and Group B non-DD students (17.4%, 4). Three characters from Group B non-DD students were drawn dressed formally wearing suits or ties (13.0%). An example of this was:

The person is typing on the computer and is dressed professionally (male, Group B).

In addition, it could be seen from the drawings and accompanying descriptions that a number of non-DD students had identified ICT with family or community members, ICT technicians at the school, familiar ICT related companies and famous ICT people. Two examples are shown below:

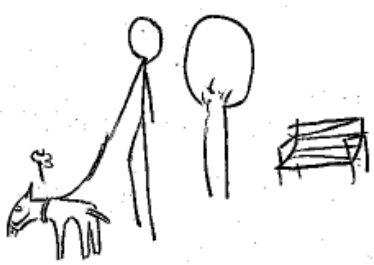


The person in the picture is my sister who works for Microsoft fixing a computer (female, Group A).

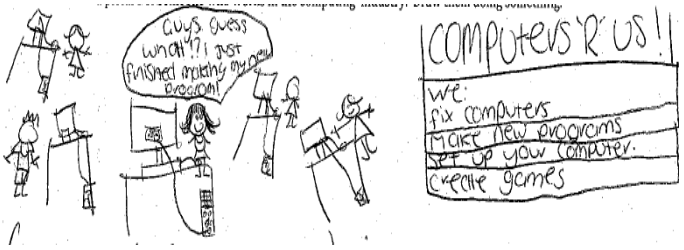
Steve Jobs is announcing the iPad (male, Group B).

Setting - At least three quarters of non-DD students at both schools showed a person at a desk. Other settings included people's houses, characters at a meeting or a conference, and one at a park walking a dog. Three non-DD students (one from Group A and two from Group B) did not draw any computing equipment to accompany their characters. Examples of settings were:

The person is working on the computer (male, Group A).

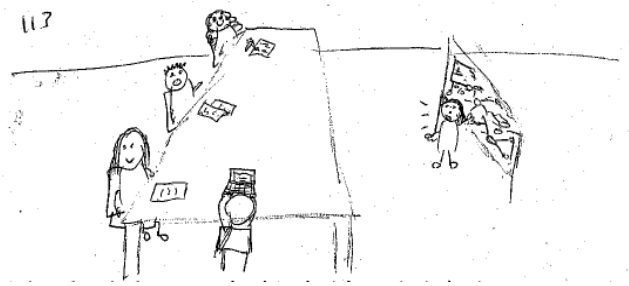


The person is walking in the park with their doggy, because they are not currently at their job (male, Group A).



Well, when I'm older, I can see myself in an office working with nice people, in a friendly environment, with both sex's. We'd work together to make new programs and help fix broken computers (female, Group A).

Number of people - The majority of drawings by Group A non-DD students (75.0%, 9) and Group B non-DD students (65.2%, 15) showed characters who were alone. While this may reflect the ICT stereotype, 16.7% (2) of Group A non-DD students and 26.1% (6) of Group B non-DD students drew more than one character despite the structure of the question, which had asked the student to draw "someone" who works in the computing industry. This trend suggests that the students may be challenging the ICT stereotype and reflecting a belief that ICT people work in teams. One example was:



The person is sharing ideas for a project her computing team is working on whilst in a meeting (female, Group B).

Activity - Three occupations were named by non-DD students: telemarketers, receptionists, and school computer technician. Other occupations were implied but not specifically identified such as pattern maker: "A person is doing computer pattern making (Group B non-DD student)", or a program developer: "the male in the diagram above is developing a new program (called pixel) (Group B non-DD student)".

Approximately one third of non-DD students from both schools drew characters "working" on computers. While this category included those who used "working" or "using" computers in their descriptions, there were also drawings included where computers were used as tools for a variety of activities including typing and emailing, as well as Photoshopping and writing book reports.

Only one (8.3%) Group A non-DD student, compared to 21.7% (5) of Group B non-DD students, drew characters programming. In the students' accompanying descriptions, programming activities included: making websites, debugging code, and writing/developing new software programs. In addition, 25% (3) of Group A non-DD students and 26.1% (6) of Group B non-DD students drew characters fixing computers. One example is shown below:

A man has gone to a woman's house to fix her Wi-Fi connection the woman is very grateful but wants to know how to do it herself. He patiently shows her (female, Group A).

Other activities described by non-DD students included a meeting, a presentation, pattern making, drawing plans, studying, and talking on the phone.

Community attitudes towards employment in the computer industry

Responding on 5-point Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1), parents and non-DD students from Group A (Goldstine community), Group B (Bartik community), and Group C (Victorian parents) were presented with the following items:

Group A and B parents:

Q24. I would like my daughter to have a job in the computer industry.

Q25. I would like my son to have a job in the computer industry.

Group C parents:

Q26. I would like my child to have a job in the computer industry.

Group A and B non-DD students:

Q27. I would like a job specifically in the computing industry.

As the items were not identical, and respondent numbers were low, statistical tests could not be performed on all of the resulting data. Group C (parents) answers were divided into those with sons and those with daughters so that comparisons could be made with Group A and B parents' and non-DD students' answers using descriptive statistics. Student answers were also differentiated by gender. These results are shown in Table 5.13.

Table 5.13

Mean scores by Group A and B sub-groups for "I would like (my child) to have a job in the computer industry"

Gender of student/child	Group A parents	Group B parents	Group C parents	Group A non-DD students	Group B non-DD students
Male	3.29*	3.04*	3.35	2.75*	3.00
	(*N*=6)	(16)	(45)	(8)	(11)
Female	3.15*	3.00	3.05*	2.17*	2.31
	(6)	(14)	(55)	(6)	(16)

*not significantly different from 3 in a one sample *t*-test

As can be seen in Table 5.13, Group C (Victorian parents) agreed that they would like their sons to have jobs in the computer industry (*M*=3.35) while Groups A and B parents with sons and Groups A and B non-DD boys indicated they were not sure (means not different from 3).

Group A, B and C parents were not sure whether they would like their daughters to have jobs in the computer industry. Group A non-DD girls were also unsure, but Group B non-DD girls disagreed that they wanted a job in the computer industry (2.31).

An independent samples *t*-test was conducted to compare the mean scores for Q26 (I would like my child to have a job in the computer industry) by child gender for Group C parents. It showed that Group C parents with sons (*M*=3.35, *SD*=.812) were significantly more likely than those with daughters (*M*=3.05, *SD*=.705) to agree that they would like their child to have a job in the computer industry ($t(101)=2.005$, $p<0.05$).

It should be noted from Table 5.13 that Group A and Group B parents were slightly more enthusiastic about their children having jobs in the computing industry (higher mean scores) than the non-DD students themselves.

Student likes and dislikes about ICT jobs

To better understand the apparent unpopularity of ICT as a profession of choice, the responses of non-DD students at the two schools to the following open-ended questions were examined:

Q28. What do you think you would like about a job in computing?

Q29. What do you think you would NOT like about a job in computing?

Responses to the questions were analysed based on findings from previous research, as outlined in Chapter Three. As the number of responses in each category was small, an

analysis by student gender was not performed. The categories, shown together with percentages and frequencies, are presented in Table 5.14 and described in more detail below.

Table 5.14

Results by Group A and B non-DD students for likes or dislikes about a computing job

	Like		Dislike	
Category*	**Group A non-DD students (*N*=14)**	**Group B non-DD students (27)**	**Group A non-DD students (14)**	**Group B non-DD students (27)**
Using computers	35.7% (*N*=5)	33.3% (9)	7.1% (1)	25.9% (7)
Physical activity	7.1% (1)	11.1% (3)	57.1% (8)	22.2% (6)
Health problem	0.0% (0)	0.0% (0)	0.0% (0)	14.8% (4)
Enjoyment	0.0% (0)	14.8% (4)	35.7% (5)	14.8% (4)
Workmates	0.0% (0)	11.1% (3)	0.0% (0)	7.4% (2)
Difficult	0.0% (0)	0.0% (0)	21.4% (3)	14.8% (4)
Learning	21.4% (3)	14.8% (4)	0.0% (0)	0.0% (0)
Perks	7.1% (1)	11.1% (3)	0.0% (0)	0.0% (0)
Helping	7.1% (1)	11.1% (3)	0.0% (0)	0.0% (0)
Nothing	21.4% (3)	3.7% (1)	7.1% (1)	0.0% (0)
Other	7.1% (1)	0.0% (0)	0.0% (0)	0.0% (0)

*NB. Some responses fitted into multiple categories; hence percentages do not add to 100.

As can be seen from Table 5.14, the highest percentages of non-DD students from both schools (Group A – 35.7%, *N*=5; Group B – 33.3%, 9) indicated that they would like "using computers" in computing jobs. There was great variation in the explanation of the ways in which non-DD students expected they would use computers, including being creative or programming, playing games, using specialised programs as tools, or even typing. However, many non-DD students (Group A – 7.1%, 1; Group B – 25.9%, 7) also believed they would not like using computers, specifically programming, fixing problems, and typing code. Examples of a like and a dislike response were:

> *Look and use the different types of programs. Maybe even create programs (Like/Dislike: like, Gender: female, Community: Group B).*

> *Being stuck at a computer all day (dislike, male, Group A).*

The perceived lack of physical activity involved in a computing job was seen positively by 7.1% (1) of Group A non-DD students and 11.1% (3) of Group B non-DD students. However, 57.1% (8) of Group A non-DD students and 22.2% (6) of Group B non-DD students listed this as something they would dislike about a job in computing making it the most frequently

listed response for dislikes. Closely related to this, 14.8% (4) of Group B non-DD students mentioned health problems associated with the lack of physical activity, and eye problems from staring at the screen for long hours. An example of a like and a dislike response were:

> *You don't have to do much physical labour (like, female, Group B).*
>
> *It may get boring and your eyesight and health may worsen because you're not exercising enough (dislike, male, Group B).*

Enjoyment was another factor for students. Many non-DD students did not think they would enjoy a job in computing, thinking it would be boring and/or repetitive. While 14.8% (4) of Group B non-DD students thought a computing job would be enjoyable or interesting, 35.7% (5) of Group A non-DD students and 14.8% (4) of Group B non-DD students did not. An example of a like and a dislike response were:

> *You continue to learn every day. It is an interesting job that covers a range of topics on your computer. It allows you to look at theory, analyse, design an effective program and then put it to work and keep benefiting the program and user (like, female, Group A).*
>
> *You might get bored always being on a computer and doing the same thing (dislike, female, Group B).*

Group A non-DD students did not mention workmates. Of Group B non-DD students 11.1% (3) considered working with people with similar interests a positive about a job in computing, while 7.4% (2) were worried that workmates may be a negative as they may not be sociable or nice. Example responses were:

> *I would like working with people who have similar interests (like, boy, Group B).*
>
> *You may not be working with nice people (dislike, girl, Group B).*

Other positives mentioned were learning how to use new programs and technology, perks such as money, fame, or access to the latest technology, and helping others by fixing their computers or writing useful programs. Example responses were:

> *Good money, using technology (like, boy, Group A).*
>
> *I would be able to help friends, family and perhaps be famous (like, boy, Group B).*

Compared with 21.4% (3) of Group A non-DD students and 3.7% (1) of Group B non-DD students who did not think they would like anything about a job in computing, 7.1% (1) of

Group B non-DD students could not think of anything they would dislike about a job in computing.

Interviews

In the group and email interviews, participants were encouraged to discuss their views on ICT people and jobs. In this section their responses are summarised.

ICT people - The descriptions of ICT people from those interviewed strongly reflected ICT stereotypes. Interviewees who knew people who worked in ICT, however, while expressing the stereotypes as a general description of all ICT professionals, commented that their personal experience of the individuals they knew in the industry did not always reflect these stereotypes. For example:

> *The general … perception of IT people is fairly "geeky" and … they spend the whole time on computers whether they are at home or work and … they sort of sit away in a little closet and that's their whole world, whereas, you know, the IT people I know are completely the reverse of the stereotype ... I mean my cousin has been doing computers for years now … He's made a lot of money out of it. He emigrated to NZ, skiing, mountain biking, rock climbing, a physical person which doesn't fit the stereotype. He was in soccer teams! (Group interview, male, parent).*

> *My husband [working in ICT] is outgoing. He's funny. He's one of the funniest people you've met. He's very much a people person (Does not fit the stereotype of ICT people being socially inept. Group interview, female, parent).*

As the terms 'geek' and 'nerd' had been mentioned in the questionnaires as well as during the interviews, the interviewees were asked to compare the terms. It was generally agreed that although there was not much difference in meaning between the terms, geeks were associated with computer expertise, while nerds were generally smart and more likely to have issues with their appearance and social skills. Descriptions of geeks and nerds included the following:

> *Geeks and nerds are a little similar, but geeks are kind of obsessed with computers and know a lot about computers, whereas nerds are obsessed with anything intellectual (Email interviews, female, non-DD student).*

> *[Geeks are] driven and focused… and the rest of the world can go by and if they forget to eat and those sort of things, that's just what happens because they are very, very focused (Group interview, female, parent).*

> *[A geek is] a non-sporty, non-physical kid, an intellectual type (Group interview, male, parent).*

ICT jobs - When asked to give specific examples of ICT jobs, group and email interview participants cited the following general areas: data entry, retrieving lost data, programming, software development, networking, managing the operating system, web page development, using different computer languages, computer support, and installing new programs. These responses reveal a general awareness of the diversity within computing jobs.

When describing an ICT expert's day, descriptions were often negative, for example, working alone, although an understanding of the positive aspects of ICT jobs, for example with regard to location, were evident. Typical descriptions included:

> *If you were an ICT expert, you would work in an office, a few people complaining why some programs aren't user friendly, have to fix and edit programs to suit the needs of your company (Email/Group interview: Email interview, Gender: female, Sub-group: non-DD student).*

> *Having to put up with people's anger – like "my computer won't do this" and that, basically, having to educate people on how to do basic maintenance on the computer, how to… the computer, like sort of maintain it so it works at its optimum … so basically an educator's role and also having to understand how the basic thing works so that when you do get glitches you know how to sort it out (Group interview, female, parent).*

> *Could be intense and alone if working on a program. Could be constant phone calls and troubleshooting if a support worker. Could be project management and discussion about how to implement ICT solutions to a problem. Programming, teaching, cabling and hardware, software creation and installation, answering questions, design, project management... From home, at people's houses, big company, small company, creative, silent, noisy, tedious, cold, messy, late nights.... (Email interview, female, parent).*

Both positive and negative aspects of ICT careers were mentioned in response to a range of questions in the group and email interviews. Positive aspects of ICT jobs included: suitability to personality and interests; meeting others with similar interests; flexible hours and opportunities. One typical example was:

> *There's always development and opportunities to grow and learn more and I think that's always good in a job because you don't become stagnant and bored (Group interview, female, parent).*

Negative aspects included an impact on health, in particular the lack of physical work, posture problems, and eye strain; social isolation; boredom; unrealistic demands; and long hours. A typical example was:

> *Not being very physical and slightly isolated. However for a person who has Asperger's it might be an ideal working environment (Email interview, female, parent).*

This comment is a reflection of the stereotypes that ICT jobs do not involve social interaction and so is ideal for people who are socially challenged. While the next comment starts off on a positive note, it later reflects the stereotypes that ICT jobs are difficult and involve long hours, and that ICT people are obsessive, unhealthy slobs who survive on a diet of fast food:

> *My child would benefit in a job in ICT as it is most suited to his personality and interests. He would be working in an industry that he enjoys and gains personal satisfaction from. I would hope that he would be working with others that have similar interests. Some of the problems he may encounter could be if he is in an environment that doesn't provide positive feedback and is constantly putting unrealistic demands onto staff. Also if he is in an environment that has no set working hours he may lose track of time and not get adequate rest, refreshments, time for personal hygiene, etc. (Email interview, female, parent).*

In summary, the comments from the interviewees about ICT jobs were very similar to the categories derived from non-DD students' responses to Q28 and Q29 where they reported what they thought they would like and not like about a job in computing (see previous section). In particular, the consistent negative themes that emerged were health problems, boredom, and difficulty of work; the consistent positive theme was the enjoyment of working with computers.

Summary of perceptions 2: ICT people and jobs

The results suggest that in answer to sub-question 2 (What are the community attitudes about ICT people and jobs?), community attitudes about ICT people and jobs were somewhat mixed. While the media review revealed stereotypes of social ineptness, health issues, geekiness, and poor working environments in the portrayals of ICT experts, and worries about health problems, lack of physical activity, boredom, and the difficulty of the work in an ICT career were mentioned by the combined community, some positive characteristics of ICT people and jobs were also recognised. The combined community agreed that ICT jobs involved teamwork, were good jobs for families, and offered high salaries and additional perks. Working on computers was considered enjoyable and there was agreement among the school groups (Groups A and B) that computing professionals

have a lot of outside interests; although only Group A (Goldstine community) believed ICT people were popular; and no group wanted to be seen as computer geeks.

This mixture of attitudes was further evidenced by student drawings of both stereotyped ICT people, in particular, male nerds sitting at desks, and non-stereotypical depictions, such as groups of people, away from computers, discussing ideas. In addition, those interviewed often revealed that while they thought of anonymous ICT professionals in stereotyped ways, those they knew personally did not reflect the stereotypes.

In terms of attitudes about computing careers, when non-DD students were asked whether they would like a computing job and parents were asked whether they would like their children to have jobs in ICT most were uncertain. Victorian parents (Group C) indicated they would like their sons to have jobs in the computer industry but were not sure about computer jobs for their daughters. Group B non-DD girls did not want a job in computing. Parents from all community groups were more enthusiastic about their children having jobs in the computer industry than were their children.

In the next section community attitudes about the importance and enjoyment of computing, as distinct from computing as an occupation, are examined.

Perceptions 3: Importance and enjoyment of computing

The results from the media review concerning general perceptions of computing open this section. Community attitudes about the enjoyment and importance of computers, and beliefs about support for student computer use from the questionnaire respondents and interviewees are then discussed. The section concludes with a summary which will answer sub-question 3: What are community attitudes about the importance and enjoyment of computing?

Perceptions of computing on television

In the media review, perceptions of whether computing was portrayed as interesting and enjoyable were investigated, as well as the strength of on-screen (fictional) community support and acceptance for ICT experts in the television shows. The results of the review were presented in Table 5.1 of this chapter. In the four dramas reviewed, ICT expert characters appeared to find their jobs enjoyable and fulfilling. The other characters on the shows accepted the expertise of the ICT professionals and valued their contributions to the team. However, in the comedy, *The IT Crowd,* the ICT technicians, who had the most traditionally portrayed jobs, did not appear to enjoy their jobs and spent most of their time

avoiding work (e.g., not answering the phone) although they were very interested in ICT and enjoyed inventing gadgets and playing computer games during working hours.

The treatment of ICT expert characters in the shows by their colleagues and the fictional public indicated, and perhaps reflected, the level of community support for an involvement in ICT. While Alec Hardison (*Leverage*) was a self-proclaimed geek and proud of it, he was occasionally teased about it by colleagues; Tim McGee (*NCIS*) was regularly called names such as "McGeek" in jest by one particular workmate. Roy Trenneman and Maurice Moss (*The IT Crowd*) were bullied both in the workplace and by the fictional public in the television show, apparently because of their geekiness.

Perceptions of computing from the combined community

Whether the community considers computing enjoyable or interesting, and whether it is valued by schools, teachers, or parents, is likely to influence other ideas about ICT such as whether it is important or a worthwhile career. The combined community responded on 5-point Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1) to the following items:

Q30. Using a computer makes learning more enjoyable.

Q31. I think computing is very interesting.

Q32. My (child's) school is enthusiastic about students using computers.

Table 5.15 presents the mean scores on Q30 to 32 for the combined community (Groups A, B and C) and for each group separately.

Table 5.15

Mean scores by community group for items about perceptions of computing

Item	Combined community (*N*=219)	Community group Group A (45)	Group B (73)	Group C (103)
Q30. Using a computer makes learning more enjoyable.	3.84	3.98	3.81	3.81
Q31. I think computing is very interesting.	3.59	3.67	3.64	3.52
Q32. My (child's) school is enthusiastic about students using computers.	3.91	3.91	3.75	4.02

As can be seen in Table 5.15, the combined community and each community group agreed quite strongly with all three items (means close to or higher than 4).

The responses for Group A (Goldstine community) have been disaggregated and the results shown separately for each sub-group (parents, teachers, and non-DD students) in Table 5.16.

Table 5.16

Mean scores by Group A sub-groups for items about perceptions of computing

Item	Group A Parents (*N*=14)	Group A teachers (17)	Group A Non-DD students (14)	Group A Boys (8)	Group A Girls (6)
Q30. Using a computer makes learning more enjoyable.	3.86	3.82	4.29	4.38	4.17
Q31. I think computing is very interesting.	3.86	3.41	3.79	4.13	3.33
Q32. My (child's) school is enthusiastic about students using computers.	4.07	4.11	3.50	3.38	3.67

As can be seen in Table 5.16, all Group A sub-groups agreed with all items, some very strongly. A one-way between subjects ANOVA was conducted to compare Group A sub-group mean scores for items Q30 to 32. There was a statistically significant difference in the mean scores for Q32 (My (child's) school is enthusiastic about students using computers) for parents, teachers, and non-DD students [$F(2, 42)=3.58$, $p<.05$]. Post-hoc comparisons using the Scheffé test indicated that the mean score for non-DD students (M=3.50, SD=0.855) was significantly lower than the mean score for parents (M=4.07, SD=0.616) and the mean score for teachers (M=4.11, SD=0.600). The mean score for parents, however, was not statistically significantly different from the mean score for teachers. These results suggest that adults (parents and teachers) in Group A agree more strongly that schools are enthusiastic about students using computers than do the non-DD students themselves. A possible explanation could be that the computer activities the non-DD students would like to do at school are not the same as those that their teachers or parents would like students to perform.

It should be noted that for Q31 (I think computing is very interesting), an independent samples *t*-test revealed no statistically significant difference in mean scores in the responses for boys (4.13) and girls (3.33). However, there was a clear indication that boys agreed more strongly than girls that computing is interesting.

The mean scores for Group B (Bartik community) for Q30-32 are shown in Table 5.17.

Table 5.17

Mean scores by Group B sub-groups for items about perceptions of computing

Items	Group B parents (*N*=31)	Group B teachers (15)	Group B non-DD students (27)	Group B Boys (11)	Group B Girls (16)
Q30. Using a computer makes learning more enjoyable.	3.65	3.80	4.00	4.09	3.94
Q31. I think computing is very interesting.	3.58	3.20	3.96	4.17	3.75
Q32. My (child's) school is enthusiastic about students using computers.	3.65	4.40	3.52	3.73	3.38

As can be seen in Table 5.17, within Group B all sub-groups agreed with all items.

A one-way between subjects ANOVA was conducted to compare the mean scores of Group B parents, teachers, and non-DD students for items Q30-32. There was a statistically significant difference in the mean scores for Q31 (I think computing is very interesting; F=3.46, p<.05). Post-hoc analyses using the Scheffé test indicated that the extent of agreement that computing is very interesting (Q31) was significantly higher for non-DD students (M=3.96) when compared to teachers (3.20), but there was no significant difference between non-DD students and parents (3.58) or between teachers and parents. This indicates that non-DD students find computing more interesting than teachers. Similarly, there was a statistically significant difference in the mean scores for Group B for Q32 (My (child's) school is enthusiastic about students using computers; F=6.56, p<.05). The post-hoc tests indicated that Group B teachers (4.40) agreed more strongly that their school is enthusiastic about students using computers (Q32) than either parents (3.65) or non-DD students (3.52).

Overall, Groups A and B agreed that computing was enjoyable and interesting and that schools are supportive of students using computers. The extent of agreement, however, differed significantly among Group A sub-groups and among Group B sub-groups.

Further support for student computer use

Perceived support for student computer use from parents and teachers was also explored. Groups A and B teachers and non-DD students responded on 5-point Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1) to the following items.

Teacher items:

Q33. My female students' parents want them to use computers.

Q34. My male students' parents want them to use computers.

Non-DD student items:

Q35. Teachers think it is important to use computers.

Q36. My parents encourage me to use computers.

Teachers from both Groups A and B did not perceive a great difference (if any) between parents' desires for their daughters (Q33: Group A, *M*=3.29; Group B, 3.20) or their sons (Q34: Group A, 3.35; Group B, 3.20) to use computers.

Group A non-DD students agreed that teachers think it is important to use computers (*M*=3.64) while Group B non-DD students were not sure whether teachers think it is important to use computers (3.15 – not significantly different from 3). An independent samples *t*-test revealed there was a trend for Group A non-DD students' mean scores to be higher than Group B non-DD students mean scores' for Q30 (Teachers think it is important to use computers; $t(39)=1.753$, $p < .1$). These results are in contrast to the ICT culture described in Chapter Two where the principal's support for ICT, existing ICT subjects run at the school and provisions for the DD program were examined to get a picture of the ICT culture of the school. Group B appeared to have a much stronger ICT culture than Group A.

Group A non-DD students agreed that their parents encourage them to use computers (3.64), but Group B non-DD students were unsure whether they agreed with this item (3.04 – not significantly different from 3). There was, however, no statistically significant difference in Group A or B non-DD student mean scores for this item.

In summary, parents and teachers were generally considered supportive of student computer use, however, Group B non-DD students were not as certain of their support as Group A non-DD students.

Evidence from interviews

Comments that arose at various points in the discussions (i.e. not necessarily in response to one particular question) from the group and email interviews suggested support for student computer use. Studying some ICT was considered advantageous for students, as ICT is prevalent in all areas of society. However, it was not necessarily thought to be important to study ICT at VCE level. Typical comments included:

Because of the era we live in, it's a part of every business to some extent (Group or Email interview: Email interview, Sub-group: parent, Gender: female).

ICT is important for most jobs now, but I don't think studying ICT at VCE or higher level would necessarily be advantageous for careers other than those in IT (Email interview, parent, female).

Gives them options and a background to face future technological developments in any career they choose (Email interview, parent, female).

The ICT education available at some schools was criticized:

Maybe it's just the school they're at, but it sounds like they are not getting some good basic training on how to use – you know, everybody's going to need to know how to use Word because they, it's just the standard… I think we need some really good basic training on how to use them properly (Group interview, parent, female).

There were also some negative comments about students' dependency on ICT, for example:

I would sort of prefer them to be away from gizmo dependent. I suppose sort of getting back to the fact that what happens when the power goes off. And I know my son is terrible, you know, the power went off one time – it was off for about three days – it was like "what do we do", he was so... No, I feel that getting back to "real" sort of thing (Group interview, parent, female).

The last comment combines the stereotypes that people involved with ICT become obsessed with computers and that ICT professionals have no outside interests.

In response to the question "What do you think about an all-girl computer class?" participants from the group interviews supported an intervention program, such as the DD program, that would encourage more females to consider a career in ICT, although only if an existing interest in ICT was expressed. Typical comments included:

I think it is important for women to be out there in the world doing things that supposedly are "men" jobs. I think that women can do anything and I encourage my girls to be that way – just go for it (Group interview, parent, female).

Only if she wanted to do it, and I really think she wouldn't because she's got enough confidence with the IT programs and stuff – that she's more interested in, basically how the sun goes round – like science, maths, those sort of things – the actual hands-on type stuff – poking at cells in test tubes and that sort of stuff (Group interview, parent, female).

> *Yes, probably because I am very aware that boys in the class usually have more knowledge (Group interview, parent, female).*

Discussion about what was considered ICT expertise and how ICT experts were viewed in the community gave rise to comments such as:

> *I think there's the impression that if you work in IT, you're an IT expert, then you're very, very intelligent (Group interview, parent, female).*

> *My colleagues will think that I'm an expert because I've just used computers a lot, so I know more than them (Group interview, parent, female).*

> *They undervalue IT and they think an expert is someone who can put on a good PowerPoint presentation, that's their idea of an expert (Group interview, parent, female).*

> *Parents think the kids are absolute experts because they can use Facebook and that's their perception because it's more than what they can do (Group interview, parent, male).*

These comments from parents indicate that if mastery of basic computer skills is all that is needed to be considered an ICT expert, then the value of true expertise does not appear to be understood. Students may not see the point of going on to do further study if they are considered experts within their social circles and/or by their parents. This highlights the need for education about what ICT professionals do.

Summary of perceptions 3: Importance and enjoyment of computing

The combined community (Groups A, B and C) believed that computing was interesting, made learning more enjoyable, and acknowledged community support for student computer. This pattern was consistent across Groups A, B, and C, however, within Groups A and B, sub-groups disagreed on the extent of agreement. The community groups endorsed these views more strongly than any other items in this study. This suggests that in answer to sub-question 3 (What are community attitudes about the importance and enjoyment of computing?), there was strong evidence that the combined community (Groups A, B and C) considered computer use valuable and interesting.

As further evidence of this, the media review revealed that all ICT expert characters enjoyed their work and were valued by colleagues with only one exception: In the comedy, where stereotypes were played upon for comedic effect, the ICT expert characters avoided work and were not respected by colleagues.

In addition, the parents interviewed believed that some ICT study was important for students, as ICT is involved in many areas of society. They also believed that intervention programs such as the DD program were worthwhile. Parents suggested that a lack of understanding of what true ICT expertise is, has actually undervalued the profession. It could be speculated that this lack of prestige may be one reason why women are not attracted to a career in ICT.

Chapter summary

In this chapter, results from the media review, and community questionnaire and interview data from Groups A (Goldstine community), Group B (Bartik community), and Group C (Victorian parents) were presented and discussed.

Biographical data revealed that although Group B parents appeared slightly better educated than Groups A or C parents, there was little difference between the three groups of parents, indicating that a representative sample of parents and students participated in this study. While Group B teachers were better educated than Group A teachers with regard to ICT, five Group B teachers admitted they did not use computers at home at all and four admitted they did not use the computer at school, indicating there may have been some differences between the teachers in each school community.

Attitudinal data gathered from Group A and B were compared with Group C to determine whether the Goldstine and Bartik community attitudes were typical of the Victorian community. ANOVAs revealed that there was only one statistically significant difference between the groups: while Groups A and B agreed that people have to be very hard working if they want to work in the computer industry, Group C were not sure about this statement.

To gain further insight into the community attitudes about gender and ICT, ICT people and jobs, and the enjoyment and importance of computing, three subsidiary research questions were addressed in this chapter. The findings are summarised below.

Sub-question 1: What are community attitudes about gender and ICT?

In answer to SQ1, the overall majority of the combined community (Groups A, B and C) believed there was no intrinsic gender difference in computing ability, as interest in and skills with computers were considered more important than gender. Where a gender difference was perceived, it was in favour of boys. Around a fifth of the combined community believed that boys had an innate ability with computers which aligns with the ICT stereotype that males are more suited to ICT than females. The idea that males fitted the ICT stereotypes more strongly than females also emerged in the media review when male ICT experts were portrayed in a more stereotypical way than female ICT experts.

The combined community's responses to a number of items about gender differences with regard to various aspects of ICT such as fixing computers, setting up computers and working in the computer industry, failed to establish a strong pattern. This indicated that the overall community did not have strong opinions about whether males or females are more suited to ICT. Within the two school communities (Group A and Group B), Group A sub-group attitudes were uniform while Group B sub-group attitudes were diverse. More specifically, Group B non-DD boys' attitudes were more stereotyped than other Group B sub-groups.

Sub-question 2: What are community attitudes about ICT people and jobs?

In answer to SQ2, combined community attitudes about ICT people and jobs were mixed. While all ICT expert characters from the media review were stereotyped in some way, stereotypes such as appearance, social competence, and ability to combine a family with an ICT career were all challenged to some degree. The portrayal of ICT computer support technicians in the comedy reviewed played on a number of stereotypes for comedic effect; however, these stereotypes were also echoed in the results from the combined community who painted a picture of an unpopular male geek with work related health problems, working long hours at a computer in a difficult job. On the other hand, the combined community also believed that ICT professionals could have a variety of interests other than computing, and worked in well-paid, enjoyable jobs which involved team work and these attitudes were reflected in the drama programs that were examined in the media review. Community attitudes about whether an ICT career was considered desirable were unclear.

When compared, the Groups A, B, and C were fairly homogenous in their attitudes about ICT people and jobs. Group C (Victorian parents) attitudes were different from Groups A and B attitudes on only one occasion: Group C were unsure whether people have to be very hard working if they want to work in the computer industry, while Group A and B agreed that they do. When the two school communities (Groups A and B) were examined, there was a diversity of sub-group attitudes within each community with regard to future participation in ICT. Group A sub-group attitudes about ICT people and jobs were otherwise uniform, while, interestingly, Group B sub-group attitudes were diverse for nearly half of the items examined.

Sub-question 3: What are community attitudes about the importance and enjoyment of computing?

In answer to SQ3, the combined community strongly agreed that computing was valuable, interesting, and made learning enjoyable. These attitudes were consistent with those found in the media review, where ICT experts in the dramas enjoyed their jobs and, although sometimes teased about being geeks, were considered valuable team members by their

colleagues. In only one television show reviewed, the comedy *The IT Crowd*, did the ICT support technicians not enjoy their jobs; they were also regularly bullied by their colleagues.

While there was some disagreement within Group A and within Group on the extent of agreement, overall, Groups A, B, and C were homogenous in their attitudes that computing is enjoyable and interesting, and recognised that students were supported in their use of computers by schools, parents, and teachers.

To summarise the differences between the two school communities for all items considered in this chapter, the mean scores for Group A (Goldstine SC) and Group B (Bartik SC) are shown in Figures 5.5 and 5.6 respectively for the following items:

Q7. Girls are more likely than boys to ask for help with computers.

Q8. Girls find it easier to work with a new program than boys.

Q9. Girls are better than boys at setting up a new computer.

Q10. Boys are better than girls at fixing a computer.

Q11. Boys are more suited than girls to work in the computer industry.

Q12. Boys are better than girls at working with computers.

Q14. Computing professionals have a lot of outside interests.

Q15. People who are really good at computing are popular.

Q16. I would like it if people thought of me as a computer geek.

Q17. People who work in computing work alone.

Q18. Computing professionals work in teams.

Q19. Computing jobs are good for people with families.

Q20. People have to be very hard working if they want to work in the computer industry.

Q21. A person who works in computing makes a lot of money.

Q24. I would like my daughter to have a job in the computer industry.

Q27. I would like a job specifically in the computing industry (non-DD girls only).

Q30. Using a computer makes learning more enjoyable.

Q31. I think computing is very interesting.

Q32. My (child's) school is enthusiastic about students using computers.

The graphs should be interpreted using the following information:

- A mean score of 5 indicates very strong agreement with an item and a mean score of 1 indicates very strong disagreement. The areas shaded in yellow indicate the desired outcomes for the DD program.
- The mean scores for Groups A and B are represented by blue diamonds (◆). Where there was a difference in attitude among Group A or B sub-groups, the mean scores for each sub-group are plotted with B for non-DD boys, G for non-DD girls, P for parents, T for teachers and S for non-DD students.

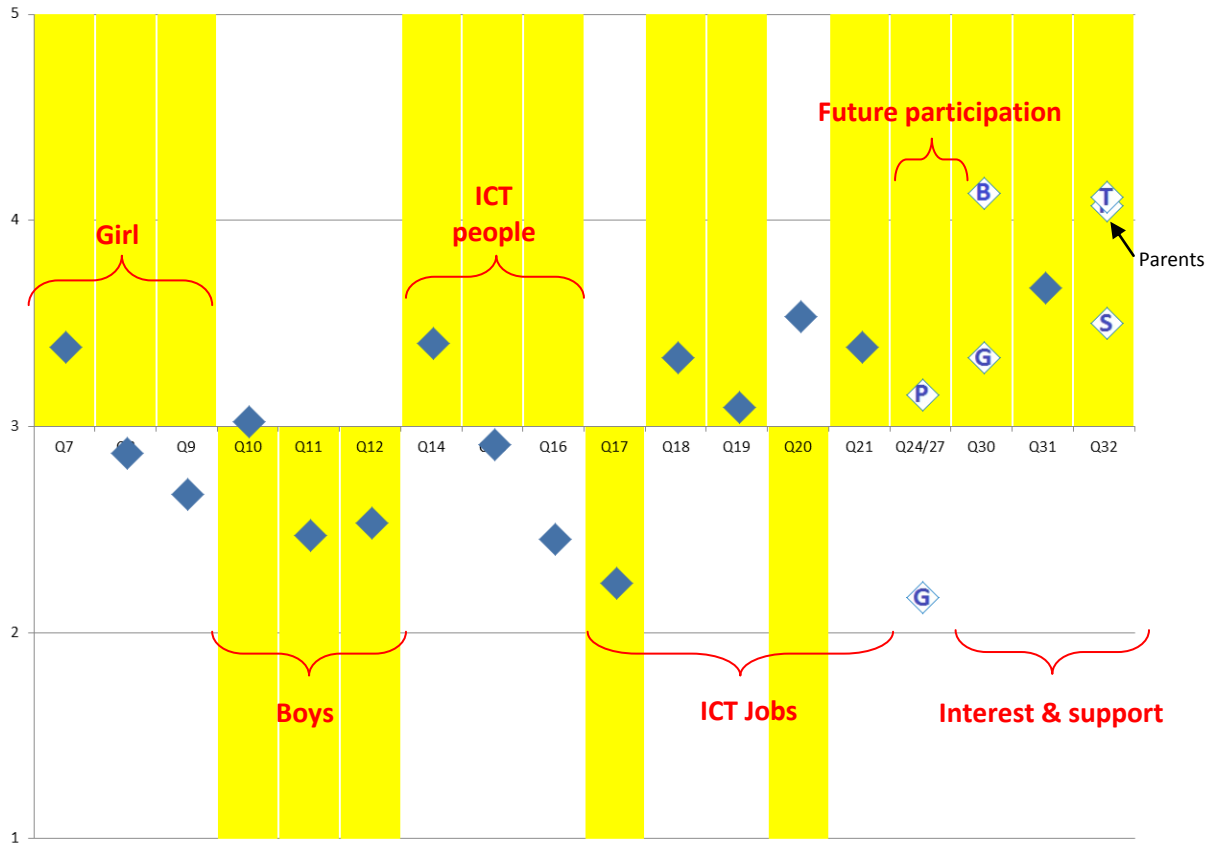


Figure 5.5. Community attitudes: Mean scores for Group A (Goldstine SC).

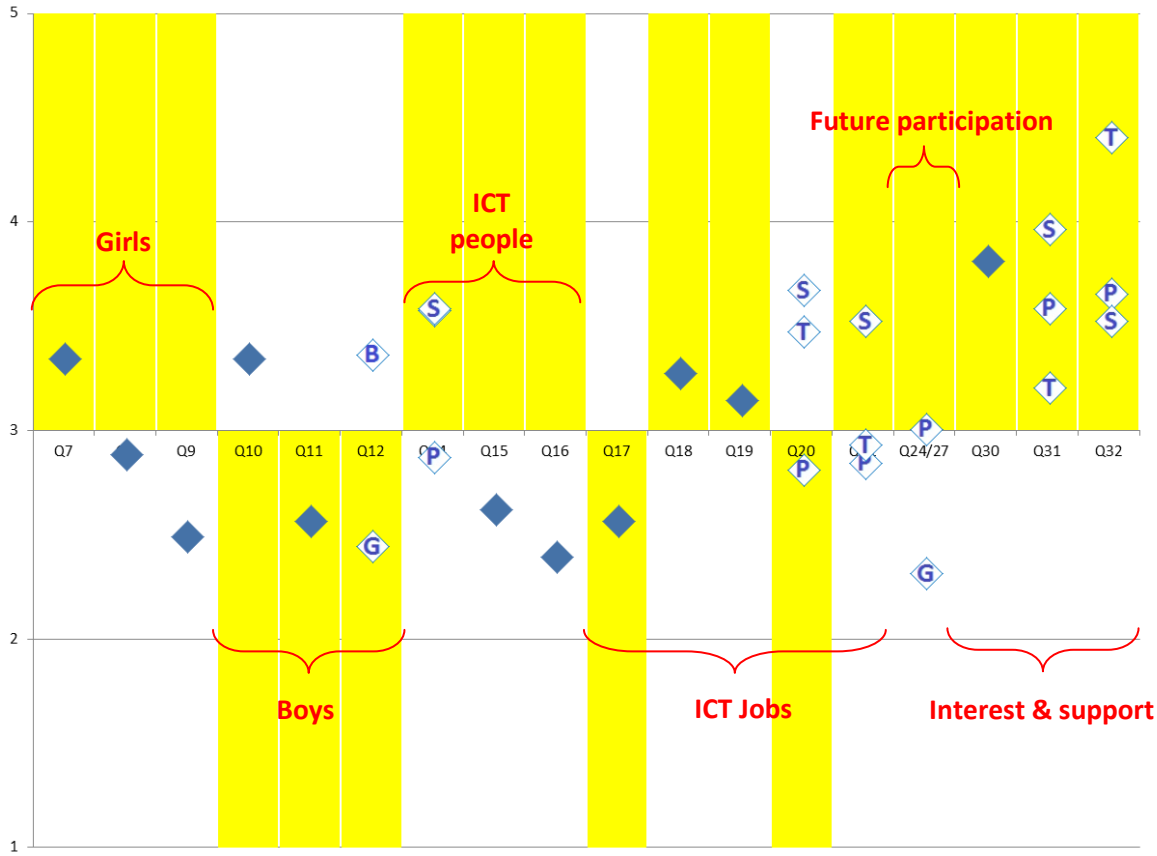


Figure 5.6. Community attitudes: Mean scores for Group B (Bartik SC).

Figures 5.5 and 5.6 show that there were fewer differences among the community sub-groups in their attitudes towards ICT within Group A, than within Group B. Both Group A and Group B had varied sub-group attitudes regarding how interesting computing is (Q31), how much school support for student computing exists (Q32), as well as differences in attitude about employment in the computing industry (Q27). Among Group B sub-groups, disagreements in attitude concerning the nature of ICT jobs were found. Group B non-DD boys and girls differed in their attitudes about who was better at working with computers.

Similar figures will be included in Chapters Six and Seven as a pictorial representation of the data to allow for simple comparisons of community attitudes and the DD program outcomes.

In the next chapter the focus shifts to the findings from the students who participated in the DD program at Goldstine SC and Bartik SC.

Chapter Six: Results and Discussion - Digital Divas Intervention Program Results

The previous chapter examined broader community attitudes; this chapter shifts the focus onto some of the direct participants in the DD program. Here, the results of the pre- and post-DD program surveys (note that the DD program used the term "survey" instead of "questionnaire") from the two schools. First, an overview of the student groups involved in the DD program is given. To put any change in attitude among participants in the context of the DD program, the DD program goals are restated. This is followed by an explanation of the statistical analysis used in this chapter. The pre- and post-program participant mean scores for a series of items are then presented and discussed in the following three sections which relate directly to those in Chapter Five and will also be used in Chapter Seven:

Perceptions 1: Gender and ICT.

Perceptions 2: ICT people and jobs.

Perceptions 3: Importance and enjoyment of computing.

These data will then be used to answer sub-questions 4 and 5:

SQ 4: To what extent was there a change in attitude among Digital Divas Intervention program participants?

SQ 5: To what extent was the change in attitude consistent with or different from the goals of the Digital Divas Intervention program?

The chapter concludes with a summary of the DD program results which will partially address the primary research question of the thesis (i.e. Are the attitudes of the community towards ICT important in terms of a successful intervention program?).

DD program groups

The DD program ran at ten schools from 2009 to 2012. The findings for the project as a whole are beyond the scope of this study which focuses on two school groups that participated in the DD program in 2011:

1) The Goldstine DD students – Year 9 girls from Goldstine SC. Thirteen students completed both the pre- and post-program surveys and an additional student completed only the pre-program survey.

2) The Bartik DD students – Year 8 girls from Bartik SC. Twenty-two students answered the pre-program survey and 23 answered the post-program survey. Of these eighteen students completed both the pre- and post-program surveys.

Goals of the Digital Divas Intervention Program

Of particular interest in this study was whether the attitudes of the community towards ICT are important in terms of a successful intervention program. The success of the intervention, (i.e., whether any changes in attitude among the groups were consistent with the DD program goals), therefore, needed to be considered. The relevant DD program goals that are discussed with the results in this chapter are:

G1. Design material that will engage the girls as part of the middle school curriculum.

G2. Raise awareness and ignite girls' interest in ICT and ICT careers.

G3. Increase girls' confidence and improve their attitudes towards ICT.

G4. Identify what factors influence the program's implementation.

G5. Create sustainable programs for schools.

G6. Increase the number of girls electing to undertake computing subjects in later years (Craig et al., 2011).

Statistical analysis

The data used for descriptive statistical analysis in this chapter include all DD students from Goldstine SC and Bartik SC who answered the question on the pre- or post-program survey. However, for the paired *t*-tests that were conducted, sample sizes are reduced when the results from DD students who did not complete both surveys are removed. Mean scores from paired *t*-tests are used in this chapter.

The following descriptive statistics and statistical analyses using *SPSS 20.0 for Windows* (described in more detail in Chapter Four) were used to analyse the data from the pre- and post-program DD surveys:

- Independent samples *t*-tests were used to test whether the mean scores on particular variables differed for two groups.
- One sample *t*-tests were used to indicate whether mean scores were significantly different from 3, the middle value in the score range of relevant items (Not sure). An asterisk in the tables in which data are presented indicates that the mean is not significantly different from 3.

- Paired *t*-tests were used to compare mean scores of pre- and post-item.
- Following convention in the social sciences (Tabachnick & Fidell, 2013) the p-value was set at .05 for statistical significance, that is, 95% confidence levels were adopted. A p-value between .05 and .1 indicated a trend.

Discussion about the findings is presented with the results.

Numbering of items

The numbering of the various items in the questionnaires used in this study was different for each group. In this chapter questions have been renumbered sequentially for clarity, as was the case in the previous chapter.

Perceptions 1: Gender and ICT

This section begins with an examination of the extent to which Goldstine and Bartik DD students agreed with a number of items concerning whether males or females are better at certain aspects of ICT. Comparisons were made between the results before and after the DD program to determine whether there was any change in attitude. This is followed by a summary of the findings.

Boys, girls and ICT

The DD pre- and post- surveys included six items concerning boys, girls, and various aspects of computing. Participants responded to the following items, deliberately created to address polarity of stereotypes associated with computing and ICT careers. Likert-type response formats, ranging from Strongly Agree (5) to Strongly Disagree (1), were used:

Q1. Girls are more likely than boys to ask for help when they are not sure what to do next when working on the computer.

Q2. Girls find it easier to work with a new program than boys.

Q3. Girls are better than boys at setting up a new computer.

Q4. Boys are better than girls at fixing a computer.

Q5. Boys are more suited than girls to work in the computer industry.

Q6. Boys are better than girls at working with computers.

The DD program goal related to these six items is:

G3. Increase girls' confidence and improve their attitudes towards ICT.

It was also assumed that an improvement in attitudes towards ICT was likely to lead to an interest in future participation in ICT. This relates to the following DD program goals:

G2. Raise awareness and ignite girls' interest in ICT and ICT careers.

G6. Increase the number of girls electing to undertake computing subjects in later years at secondary school (and ultimately tertiary education).

The indicators that the DD program had been successful would be that the girls' mean scores for Q1, 2 and 3 would increase. This would indicate stronger agreement that girls are better at, or more suited to, ICT than boys. In addition, mean scores for Q4, 5 and 6 would decrease, that is, weaker agreement that boys are better at, or more suited to, ICT than girls.

Independent samples *t*-tests indicated there were no significant differences between Goldstine and Bartik DD students before the DD program began. The mean scores and results of independent samples *t*-tests for Goldstine and Bartik DD students for the items on the pre- and post-surveys are shown in Table 6.1.

Table 6.1

Mean scores and paired t-test results by school for items about boys, girls, and ICT

Group Item	Goldstine pre (*N*=13)	Goldstine post (13)	Sig (*p*-level)	Bartik pre- (18)	Bartik post (18)	Sig (*p*-level)
Q1. Girls are more likely than boys to ask for help when they are not sure what to do next when working on the computer.	3.08*	3.00	NS†	3.33*	3.33*	NS
Q2. Girls find it easier to work with a new program than boys.	3.15*	3.15*	NS	3.00	3.11*	NS
Q3. Girls are better than boys at setting up a new computer.	2.62*	3.00	NS	2.61*	2.22	NS
Q4. Boys are better than girls at fixing a computer.	2.15	1.92	NS	2.56	2.39	NS
Q5. Boys are more suited than girls to work in the computer industry.	2.08	2.15	NS	2.56	2.11	<.05
Q6. Boys are better than girls at working with computers.	1.92	2.23	NS	2.28	1.72	<.01

* Not significantly different to 3 in a one sample *t*-test.

†NS = not significantly different.

As can be seen in Table 6.1, where a mean score less than three indicates disagreement and more than three indicates agreement with the item, prior to participation in the DD

program, students at both schools were unsure whether girls were better than boys at ICT related activities, but disagreed that boys were better than girls at those activities.

After participation in the program, there were no statistically significant changes in attitude about gender and computing among Goldstine DD students. There were, however, two significant changes in attitudes towards DD program goals among the Bartik DD students at the conclusion of the program: They disagreed statistically significantly more strongly that boys are more suited than girls to work in the computer industry (Q5) and better than girls at working with computers (Q6) after participation in the DD program.

Summary of Perceptions 1: Gender and ICT

As part of Goal 3 (to increase girls' confidence and improve their attitudes towards ICT) the stereotype that boys are better than girls at ICT was countered in the module material. There were, however, no statistically significant changes in mean scores for Goldstine DD students. Among Bartik DD students, there were two statistically significant decreases in mean scores for items indicating that boys were better than girls at ICT related activities after participation in the DD program, consistent with DD program goals.

These results suggest that after completing an average of 12 weeks in the DD program, students were still unsure whether girls are better than boys at various aspects of computing, but that Bartik DD students now disagreed more strongly that boys are better than girls at various computing tasks.

Perceptions 2: ICT people and jobs

Perceptions 2 opens with an examination of the extent to which Goldstine and Bartik DD students agree with a number of items concerning perceptions of ICT people and jobs. This is followed by a discussion of the comparisons between the results before and after the DD program. Next, students' drawings and accompanying descriptions of ICT people are presented and discussed, followed by student responses to questions about what they would like or dislike about a job in ICT. A summary of the findings is then presented.

ICT people and jobs

Goldstine and Bartik DD students responded on Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1) to the following items related to ICT people and jobs:

Q7. People who are really good at computing are popular.

Q8. I would like it if people thought of me as a computer geek.

Q9. Kids who are good with computers are admired.

Q10. People who work in computing work alone.

Q11. I have to work hard to do well in computing.

Q12. A person who works in computing makes a lot of money.

Independent samples *t*-tests indicated there were no statistically significant differences in the mean scores for the students at the two schools before the DD program began. In Table 6.2 the mean scores from the pre- and post-surveys and paired *t*-test results for Goldstine and Bartik DD students for items Q7-12 are shown.

Table 6.2

Mean scores and paired t-test results by school for items about ICT people and jobs

Item / Group	Goldstine pre (*N*=13)	Goldstine post (13)	Sig (*p*-level)	Bartik pre- (18)	Bartik post (18)	Sig (*p*-level)
Q7. People who are really good at computing are popular.	2.54*	2.46	NS†	2.44	2.56*	NS
Q8. I would like it if people thought of me as a computer geek.	2.08	1.77	NS	1.94	1.44	<.01
Q9. Kids who are good with computers are admired.	3.00	3.00	NS	2.71*	2.72*	NS
Q10. People who work in computing work alone.	2.54*	2.23	NS	2.61*	1.67	<.001
Q11. I have to work hard to do well in computing.	3.31*	2.85*	NS	3.17*	3.28*	NS
Q12. A person who works in computing often makes a lot of money.	3.54	3.62	NS	3.28*	3.67	<.05

* Not significantly different to 3 in a one sample *t*-test.

†NS = not significantly different.

As can be seen from Table 6.2, DD students from both schools were unsure about a number of these items prior to participation in the DD program. Afterwards, there were no statistically significant changes in attitude among Goldstine DD students. Among Bartik DD students, however, there were three statistically significant changes in attitude:

- While they disagreed that they would like to be thought of as computer geeks (Q8) before the DD program, after completion, students disagreed significantly more strongly.
- Prior to the DD program, the DD students were not sure whether people who work in computing work alone (Q10) but disagreed that they do after the DD program.

- While they agreed that a person who works in computing often makes a lot of money (Q12) before the DD program, students were more likely to agree after the DD program.

Future participation in ICT

Goldstine and Bartik DD students were also asked to what extent they agreed with the following items about studying or working with computers in the future:

Q13. I want to study computing as part of my VCE.

Q14. I would like a job working with computers when I finish studying.

Q15. I would like a job specifically in the computing industry after I finish studying.

Q16. I would like a job working with computers when I leave school.

Prior to participation in the program, Bartik DD students had lower means for Q13-16 than Goldstine DD students. Independent samples *t*-tests indicated a trend for Bartik DD students to disagree more strongly than Goldstine DD students that they would like a job specifically in the computing industry after they finished studying (Q15, .1>*p*>.05). This suggests that Goldstine DD students were more likely than Bartik DD students to consider an ICT related job before participating in the DD program.

Mean scores for the items for students at each school, pre- and post-program, are presented in Table 6.3 together with results of paired *t*-tests for students at each of the two schools, i.e., pre- and post- comparisons.

Table 6.3

Mean scores and paired t-test results by school for items about future participation in ICT

Group Item	Goldstine pre (*N*=13)	Goldstine post (13)	Sig (*p*-level)	Bartik pre- (18)	Bartik post (18)	Sig (*p*-level)
Q13. I want to study computing as part of my VCE.	3.00	2.23	<.05	2.83*	2.22	<.1
Q14. I would like a job working with computers when I finish studying.	3.25*	2.08	<.05	2.61*	2.44	NS†
Q15. I would like a job specifically in the computing industry after I finish studying.	2.85*	2.23	NS	2.28	2.28	NS
Q16. I would like a job working with computers when I leave school.	3.15*	2.23	<.1	2.61*	2.56*	NS

* Not significantly different to 3 in a one sample *t*-test.

†NS = not significantly different.

As can be seen in Table 6.3, after initially indicating they were unsure about continued involvement with ICT, after participation in the DD program, Goldstine DD students' mean scores were statistically significant lower for Q13 (studying computing as part of their VCE) and Q14 (working with computers when they finish studying) indicating that after participation in the DD program Goldstine DD students were *no longer as interested in future involvement with ICT*. Similarly, there was a trend for Goldstine DD students' mean scores to be lower for Q16 (working with computers when they leave school, .1>*p*>.05) after participation in the DD program.

At Bartik SC there was only one change in attitude, a trend for DD student mean scores to be lower (indicating stronger disagreement) for Q13 (I want to study computing as part of my VCE, .1>*p*>.05) after participation in the DD program.

These results from both schools suggest that the DD program did not make a positive impact on the students' future plans involving ICT. Interestingly, similar results indicating a decrease in desire for future participation have been found in other intervention programs (Anderson, 2003; Nott & Arnold, 2011; Weisgram & Bigler, 2006) as discussed in Chapter Three.

Student drawings

Goldstine and Bartik DD students were asked to:

> Q17. Please draw a picture of someone who works in the computing industry and what they are doing.
>
> Q18. Please describe the person and explain what is happening in the picture.

A checklist of characteristics examined in the drawings was based on findings from previous research on ICT stereotypes, as outlined in Chapter Three. As described when used to analyse community responses to the drawing question in Chapter Five, the following stereotyped characteristics of the ICT professional and ICT jobs were included in the checklist:

- Gender
- Body type
- Appearance
- Setting, position and activity
- People
- Activity

Table 6.4 sets out the results for the drawing analysis for Goldstine and Bartik DD students' pre- and post-program responses.

Table 6.4

Student drawing analysis

Characteristic		Goldstine pre- (*N*=14)	Goldstine post- (13)	Bartik pre- (20)	Bartik post- (21)
Gender	**Male**	28.6% (*N*=4)	15.4 % (2)	20.0%(4)	4.8%(1)
	Female	21.4% (3)	23.1% (3)	20.0%(4)	28.6%(6)
	Unknown	42.9% (6)	53.8% (7)	55.0%(11)	66.7%(14)
	No person	7.1% (1)	7.7% (1)	5.0%(1)	0.0%(0)
Body type	**Stick figure**	57.1% (8)	53.8% (7)	65.0%(13)	81.0%(17)
	Normal figure	35.7%(5)	38.5% (5)	35.0%(7)	19.0%(4)
	No person	7.1% (1)	7.7% (1)	0.0%(0)	0.0%(0)
Appearance	**Glasses**	21.4% (3)	7.7% (1)	20.0%(4)	0.0%(0)
	Dress	14.3% (2)	0.0% (0)	5.0%(1)	0.0%(0)
Setting	**At desk**	85.7% (12)	53.8% (7)	100.0%(20)	81.0%(17)
	Other	14.3% (2)	38.5% (5)	0.0%(0)	19.0%(4)
	No person	7.1% (1)	7.7% (1)	0.0%(0)	0.0%(0)
Number of people	**Alone**	85.7% (12)	76.9% (10)	95.0%(19)	71.4%(15)
	More than 1	7.1% (1)	23.1% (3)	5.0%(1)	28.6%(6)
	No person	7.1% (1)	7.7% (1)	0.0%(0)	0.0%(0)
Activity	**"Working" on computer**	64.3% (9)	69.2% (9)	75.0%(15)	81.0%(17)
	Programming	7.1% (1)	0.0% (0)	0.0% (0)	4.8%(1)
	Fixing	7.1% (1)	7.7% (1)	10.0%(2)	0.0% (0)
	Non work purposes	14.3% (2)	15.4% (2)	10.0%(2)	9.5%(2)
	Other	7.1% (1)	7.7% (1)	5.0% (1)	4.8% (1)

As indicated in Table 6.4, with regard to ICT people, pre- and post-program results were similar for students at both schools and so they will be described together. Overall the pre-/post- patterns at both schools showed the stereotype was challenged. The student drawings revealed the following:

Gender:

Prior to participation in the DD program, Goldstine DD students drew slightly more male (28.6%, *N*=4) than female (21.4%, 3) characters, Bartik DD students drew equal numbers of male and female characters (20.0%, 4). Around half of the students from both schools drew characters of unknown gender before (Goldstine, 42.9%, 6; Bartik, 55%, 11) participation in the DD program.

After the DD program the number of male characters drawn at both schools decreased (Goldstine, 15.4%, 2; Bartik, 4.8%, 1). In addition, the number of females drawn by Bartik DD students increased from 20.0% (4) to 28.6% (6) and at both schools the number of characters of unknown gender increased (Goldstine, 53.8%, 7; 66.7%, 14). This may indicate that the stereotype was challenged by the experiences and activities in the DD program and students began to see ICT as a career equally suited to males and females. An example was:

Not all guys working in the computing industry, girls work as well (Pre- or Post-program drawing: post-, Goldstine or Bartik DD student: Goldstine).

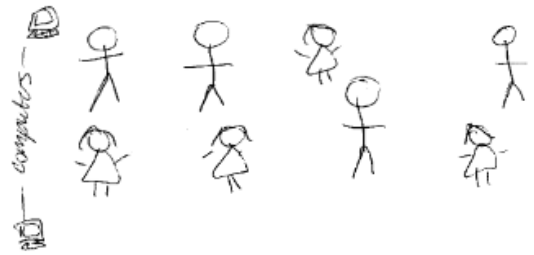
Body type - Before and after the DD program Goldstine and Bartik DD students drew stick figures or characters of normal appearance. While the stereotype suggests that those who work in ICT are either grossly over or underweight, no characters drawn by students at either school appeared to be of abnormal body type.

Appearance - Prior to participation in the DD program, 21.4% (3) of the characters drawn by Goldstine DD students wore glasses; for Bartik DD students, 20% (4) of the characters had glasses. Fewer characters were drawn with glasses by students at both schools after participation in the DD program (Goldstine, 7.7%, 1; Bartik, 0.0%, 0). Two of the characters with glasses drawn by Goldstine DD students and one by a Bartik DD student had other nerdy characteristics such as bucked teeth, shirts with prominent pockets containing pens, loud ties, and bad hairdos. The word “nerd” was used to describe one character drawn by a student at Bartik SC. After the DD program no characters appeared “nerdy”. The decrease

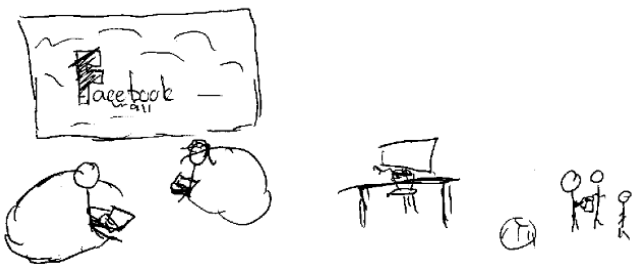
in glasses and "nerdy" appearances suggests that after participation in the DD program, students may have been less inclined to subscribe to the stereotype that people who work with computers are geeks. An example of a "nerd" drawn was:

A little bit of a nerd, dressed well - making a program (pre-, Goldstine).

Setting - Prior to the DD program the majority (85.7%, 12) of characters drawn by Goldstine DD students and 100% (20) of characters drawn by Bartik DD students were shown in front of computers at desks. After the DD program that number reduced (Goldstine, 53.8%, 7; Bartik, 81.0%, 17). Characters not drawn at desks included people standing next to each other, holding clip boards and laptops, giving the thumbs up, posing for photos, eating lunch, chatting around the water cooler, sitting on beanbags with laptops, and in front of whiteboards. Drawing such as these suggest that the stereotypes that ICT professionals are socially isolated and work alone in dark rooms surrounded by computers may have been challenged by participation in the DD program. Two examples of this were:



Everyone talking and using their legs, ha ha! (post-, Brentwood).



It's a picture of the head office of Facebook. Where it's not cublicle and black and white office. The people having face to face contact and there's another group of people drinking while gossiping. And there's bean bags and a board of goals of things expect to do or want to achieve [sic] (post-, Brentwood).

Number of people - Before participating in the DD program, 85.7% (12) of the characters drawn by Goldstine DD students and 95.0% (19) of the characters drawn by Bartik DD students were depicted as being alone. After participation in the DD program this percentage dropped to 76.9% (10) for Goldstine and 71.4% (15) for Bartik DD students, with around a quarter of students at each school (Goldstine, 23.1%, 3; Bartik, 28.6%, 6) including more than one character in their drawings. An example of this was:

In the computing industry you don't work alone. You work with other people (post-, Goldstine).

Activity - Before and after the DD program, the majority of Goldstine (pre-, 64.3%, 9; post, 69.2%, 9) and Bartik (pre-, 75.0%, 15; post-, 81.0%, 17) DD students depicted their characters "working" on computers rather than specifically programming or fixing computers. This included a variety of tasks including typing, emailing, discussing work, and using computers as tools (for example, using design programs). Programming or fixing computers was only described by a few students from Goldstine and Bartik SC. Prior to participation in the DD program a couple of students from each school drew characters using computers for "non-work" purposes such as socialising on *Facebook*, blogging, and "playing". Teaching, having a lunch break, "not sure" and "bored" were included under the category "other". An example of a character working on their computer was:

This lady has got a job in ICT and she's typing up some information for a new software[sic] (post-, Brentwood).

Changes in the features of characters drawn by DD students from both Goldstine and Bartik SC suggest that stereotypes about gender, nerdiness, appearance, working alone, and spending all day in front of the computer were challenged by participation in the DD program. Ideas about the activities people in the computing industry undertake, however, did not broaden after participation in the DD program.

Student likes and dislikes about ICT jobs

Students at each school were asked to respond to the following open-ended questions:

Q19. What do you think you would like about a job in computing?

Q20. What do you think you would NOT like about a job in computing?

Responses to the questions were analysed based on findings from previous research, as outlined in Chapter Three. The categories previously used to analyse community responses to questions about likes and dislikes about ICT jobs in Chapter Five are used again and the response frequencies for DD students are shown in Table 6.5.

Table 6.5

What DD students thought they would like or dislike about a computing job

	Like		Dislike		Like		Dislike	
Category*	**Goldstine pre- (*N*=14)**	**Goldstine post- (13)**	**Goldstine pre- (14)**	**Goldstine post- (13)**	**Bartik pre- (22)**	**Bartik post- (23)**	**Bartik pre- (22)**	**Bartik post- (23)**
Using computers	21.4% (3)	38.5% (5)	21.4% (3)	30.8% (4)	27.3% (6)	39.1% (9)	9.1% (2)	26.1% (6)
Physical activity	7.1% (1)	15.4% (2)	7.1% (1)	15.4% (2)	4.5% (1)	4.3% (1)	18.2% (4)	26.1% (6)
Health problems	0.0% (0)	0.0% (0)	28.6% (4)	15.4% (2)	0.0% (0)	0.0% (0)	27.3% (6)	4.3% (1)
Enjoyment	35.5% (5)	7.7% (1)	7.1% (1)	7.7% (1)	4.5% (1)	4.3% (1)	22.7% (5)	17.4% (4)
Workmates	0.0% (0)	7.7% (1)	0.0% (0)	0.0% (0)	4.5% (1)	0.0% (0)	0.0% (0)	4.3% (1)
Difficulties	7.1% (1)	0.0% (0)	35.7% (5)	30.8% (4)	9.1% (2)	4.3% (1)	31.8% (7)	17.4% (4)
Learning	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	4.5% (1)	8.7% (2)	0.0% (0)	0.0% (0)
Perks	14.3% (2)	15.4% (2)	0.0% (0)	0.0% (0)	4.5% (1)	30.4% (7)	0.0% (0)	0.0% (0)
Creativity	28.6% (4)	15.4% (2)	0.0% (0)	0.0% (0)	0.0% (0)	13.0% (3)	0.0% (0)	0.0% (0)
Other	21.4% (3)	30.8% (4)	21.4% (3)	30.8% (4)	50.0% (11)	17.4% (4)	9.1% (2)	8.7% (2)

*Note that some responses fitted into more than one category; that is, percentages do not add to 100%.

Goldstine SC

As can be seen in Table 6.5, prior to participation in the program, Goldstine DD students considered that the enjoyment of using computers (35.5%, *N*=5) and the creativity involved (28.6%, 4) were the things they would like most about a computing job. However, fewer students believed this after participation in the program (enjoyment, 7.7%, 1; creativity 15.4%, 2). This change suggests that the DD program may not have functioned as intended. Possible explanations for this will be explored later in this thesis.

Prior to the DD program, Goldstine DD students considered the things they would like least about a computer job were health problems (28.6%, 4), including eye problems and "the stress of getting hard tasks done on a due date", and the difficulty and challenges of computer jobs (35.7%, 5), because it may be hard, confusing, and involve "thinking too much". On the other hand, one (7.1%) Goldstine DD student thought the challenges involved with a computing job was something she might like prior to the DD program. After participation in the program, however, fewer students believed this (health problems, 15.4%, 2; difficult/challenges, 30.8%, 4). This suggests that participation in the DD program may have influenced DD students positively with regard to health issues and ICT.

The perceived lack of physical activity in a computing job was a problem for one (7.1%) Goldstine DD student before the DD program and 15.4% (2) indicated they thought it was something they would dislike about an ICT job after participation in the DD program. Interestingly, one (7.1%) Goldstine DD student prior to the DD program and 15.4% (2) after participation in the DD program considered "being able to sit down all day", "in an air conditioned office" a thing they would like about an ICT job.

Before participation in the DD program, 21.4% (3) of Goldstine DD students thought that they would like "using computers". This increased to 38.5% (5) after the DD program and included typing, programming, using the internet, and the way computers "make your work easier". Conversely, some students thought that using computers was something they would not like about a computer job before (21.4%, 3) and after (30.8%, 4) the DD program. They did not like fixing computers, or the way computers "crashed" and work was lost.

Prior to the DD program, two (14.3%) Goldstine DD students thought perks such as money were something they would like about a computing job; there was no change after the DD program. Before the DD program no Goldstine DD students mentioned anything to do with workmates and after the DD program only one student out of 13 mentioned the thing they would like about a computing job was "meeting people".

Around a quarter of Goldstine DD students were not interested in computing or did not know what they would like (pre- 21.4%; post- 30.8%) or dislike (pre- 21.4%; post- 30.8%) about a job in computing.

Bartik SC

The most common answer Bartik DD students gave for what they thought they would like about a computing job prior to participation in the program was categorised as "other" (50%, 11). The answers consisted mainly of "I don't know" or "I do not want a job in computing." After the DD program the percentage of answers categorized as "other" dropped to 17.4% (4).

At 27.3% (6), using computers was the next most common category prior to participation in the DD program for Bartik DD student responses. This included programming, using programs, playing games, communicating with others over the computer, and typing. After the DD program this percentage increased to 39.1% (9). Conversely, the percentage of Bartik DD students who thought that using the computer was something they would dislike about a computing job increased from 9.1% (2) prior to participation in the DD program to 26.1% (6) after, indicating that participation in the DD program had mixed results at best.

Prior to participation in the DD program 31.8% (7) of Bartik DD students thought they would dislike the difficulties and challenges associated with a computing job. This included difficult mathematics, getting confused, and frustration when the computer did not work. This percentage decreased to 17.4% (4) after the DD program. Interestingly, the challenges involved in a computing job were also something a couple of Bartik DD students thought they would like before (9.1%, 2) and after (4.3%, 1) the DD program. For example:

> *I think I would like the good feeling when you work out why it has mucked up or when you work out why it won't let you do something (post-program survey, Bartik DD student).*

Prior to the DD program, 27.3% (6) of Bartik DD students were worried about health problems including eye strain and headaches from staring at the screen and back problems from sitting for too long. After participation in the DD program this decreased to 4.3% (1). Similarly, prior to participation in the DD program, students thought they would dislike the lack of physical activity involved in a computing job (18.2%, 4); this increased to 26.1% (6) after the DD program. Interestingly, for one (4.3%) student, the physically undemanding aspect of the job was an attraction.

While the perks of a computing job, including good pay, travel associated with computing jobs, and the possibility of working from home, were remarked upon by only one (4.5%) Bartik DD student prior to participation in the DD program, afterwards perks were mentioned by 30.4% (7) of the students indicating that Bartik DD student attitudes towards ICT jobs were more positive after participation in the DD program in this respect.

In addition, prior to the DD program 22.7% (5) of students believed the job would not be enjoyable but this decreased to 17.4% (4) after the DD program. Before and after the DD program only one Bartik DD student thought the job would be enjoyable. One (4.5%) Bartik DD student before the DD program, and two (8.7%) after, thought that the learning involved in a computing job was something they might like.

In summary, participation in the DD program appears to have had mixed impact with regard to student ideas about likes and dislikes of a computing job. It was evident that initially, Bartik DD students did not see ICT jobs in a positive light; half of the Bartik DD students could not think of something they would like about a computing job, although this decreased after participation in the DD program. In addition the perceived lack of physical activity was the most common dislike for Bartik DD students and, unfortunately, this increased after participation in the DD program. Initially, the highest percentage of Goldstine DD students listed enjoyment as something they would like about a job in computing, but this decreased after participation in the DD program. Conversely, at both schools worries about health problems decreased and there was an increase in the number of students indicating that they liked using computers.

Summary of Perceptions 2: ICT people and jobs

Changes in attitude about ICT people and jobs among Goldstine and Bartik DD students, after participation in the DD program, were mixed. There were variations in the extent of change in attitude at each school with some statistically significant changes and trends in the data, but on the whole the direction of change was about the same for both groups.

Some changes in attitude were consistent with the DD program goals G2 (Ignite girls' interest in ICT careers) and G3 (Improve girls' attitudes towards ICT). Students from both schools agreed more strongly that people who work in computing make a lot of money and do not work alone. At both schools, student drawings contained fewer characters who were male, wore glasses, or sat alone at their desks, challenging the existing stereotypes about ICT. When asked what they thought they would like or dislike about a job in computing, almost half of Bartik DD students could not think of anything they liked prior to the DD program, but after the DD program this decreased.

Other changes in attitude were different from the DD program goals G2 (Ignite girls' interest in ICT careers), G3 (Improve girls' attitudes towards ICT), and also G6 (Increase the number of girls electing to undertake computing subjects in later years at Secondary Schools). After participation in the DD program, students at both schools disagreed more strongly than before, that they would like to be thought of as geeks. They also disagreed more strongly that they would like to study computing at VCE level or would like a job in computing. Prior to participation in the DD program, Goldstine DD students indicated that they thought computer jobs would be fun, enjoyable and creative but fewer students answered in this way after the DD program. Among Bartik DD students, worries about the lack of physical activity involved in computing jobs increased following the DD program.

While the stereotypes that those working in the computing industry are males who work alone at their desks all day were challenged after participation in the DD program, other

stereotypes about health problems and the difficulty or monotony of computing jobs were not. Goal 3 (Improve girls' attitudes towards ICT) was therefore only partially achieved by the DD program. Other goals were not met. These students did not want to study computing at VCE level (G6. Increase the number of girls electing to undertake computing subjects in later years at Secondary school), and did not want an ICT career (G2. Ignite girls' interest in ICT careers).

Perceptions 3: Importance and enjoyment of computing

DD students were asked, in the pre- and post-program surveys, how enjoyable and interesting they found computing (outside of workplace considerations) and whether they believed the community around them (parents, teachers, and the school) were supportive of computer use. The results of these questions are now presented and discussed.

Computing

Students were asked to respond to the following items on Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1):

Q21. Using a computer makes learning more enjoyable.

Q22. I think computing subjects are very interesting.

Q23. My school is enthusiastic about students using computers.

Q24. Teachers think it is important to use computers for learning.

Q25. My parents encourage me to use computers.

Independent samples *t*-tests showed that prior to the DD program, there was a trend ($.1>p>.05$) for Goldstine DD students to agree more strongly than Bartik DD students that computing is very interesting.

Table 6.6 presents the mean scores for each item (Q21-25) on the pre- and post- surveys for students from each school and the results from the corresponding paired *t*-tests.

Table 6.6

Mean scores and paired t-test results by school for items about computing

Group Item	Goldstine pre (*N*=13)	Goldstine post (13)	Sig (*p*-level)	Bartik pre- (18)	Bartik post (18)	Sig (*p*-level)
Q21. Using a computer makes learning more enjoyable.	4.15	4.00	NS†	3.94	3.72	NS
Q22. I think computing subjects are very interesting.	3.92	3.15*	<.1	3.56	3.00	<.05
Q23. My school is enthusiastic about students using computers.	3.23*	3.23*	NS	3.50	3.71	NS
Q24. Teachers think it is important to use computers for learning.	3.46*	3.54	NS	3.83	4.11	NS
Q25. My parents encourage me to use computers .	3.54*	3.31*	NS	3.33*	3.06*	NS

* Not significantly different to 3 in a one sample *t*-test.

†NS = not significantly different.

As can be seen in Table 6.6, there was only one change in attitude among DD students at both schools. For Q22 (I think computing subjects are very interesting) there was a statistically significant difference in mean scores for Bartik DD students ($p<.05$) and a trend ($.1>p>.05$) for Goldstine DD students' mean scores to be lower after participation in the DD program. Before the DD program, DD students at both schools agreed that computing subjects were interesting; however, after participation in the DD program DD students at both schools were unsure. This change was contrary to DD program goals.

Summary of Perceptions 3: Importance and enjoyment of computing

Before participation in the DD program, the DD students from both schools believed computing to be very interesting, but after the DD program they agreed less strongly. These changes in attitude are inconsistent with the DD program goals as they suggest that the girls at Bartik and Goldstine SC were not inspired by the material (G1. Design material that will engage the girls as part of the middle school curriculum). It appears that the program did not inspire girls sufficiently to spark an interest in ICT (G2. Raise awareness and ignite girls' interest in ICT and ICT careers) or improve their attitudes towards ICT (G3. Increase girls' confidence and improve their attitudes towards ICT).

There were no statistically significant changes in mean scores with respect to perceived community support for students using computers from the school, the teachers, or parents, before and after the DD program.

Chapter summary

In this chapter, in order to answer SQ 4 (To what extent was there a change in attitude among Digital Divas Intervention program participants?) and SQ 5 (To what extent was the change in attitude consistent with or different from the goals of the Digital Divas Intervention program?) the responses to the pre- and post-program surveys by DD program participants at Goldstine SC and Bartik SC were explored.

While the DD program, at the two schools that are the focus of this thesis, appears to have produced some changes in attitude among participating students, these changes were not always consistent with DD program goals.

While there were four changes in attitude among Goldstine DD students, unfortunately they were inconsistent with the DD program goals. After the DD program there were changes in attitude for the following items:

- After initially being unsure, Goldstine DD students disagreed that they wanted a job working with computers when they leave school or after they finish studying and were less likely to want to study computing as part of their VCE. These three changes were inconsistent with G2 (Raise awareness and ignite girls' interest in ICT and ICT careers) and G6 (Increase the number of girls electing to undertake computing subjects in later years at Secondary school (and ultimately tertiary education)).
- After participation in the DD program, Goldstine DD students became unsure whether computing is very interesting, after initially thinking it was. This was inconsistent with G1 (Design material that will engage the girls as part of the middle school curriculum) and G2 (Raise awareness and ignite girls' interest in ICT and ICT careers).

Among Bartik DD students there were seven changes in attitudes, four of which were consistent with the DD program goal G3 (Improve girls' attitudes towards ICT). After the DD program, Bartik DD students:

- Disagreed more strongly that boys are better at working with computers, or more suited to work in the computer industry (2 items).

- Disagreed that people in computing work alone after initially being unsure, and agreed more strongly that those who work in computing make a lot of money (2 items).

The three remaining changes in Bartik DD students' attitudes which were inconsistent with the DD program goals were:

- They disagreed more strongly that they want to study computing as part of VCE which was inconsistent with G6 (Increase the number of girls electing to undertake computing subjects in later years).
- Agreed less strongly that computing subjects are very interesting which was inconsistent with G1 (Design material that will engage the girls as part of the middle school curriculum) and G2 (Raise awareness and ignite girls' interest in ICT and ICT careers).
- Disagreed more strongly that they want to be thought of as a computer geek which was inconsistent with G3 (Improve girls attitudes towards ICT).

After participation in the DD program, both the Goldstine and Bartik DD students' drawings indicated that stereotypes about nerdy males spending all day alone in front of a computer were challenged. However, responses to questions about what students would like or dislike about computer jobs indicated that the perceived lack of physical activity in ICT jobs was an issue.

To highlight the extent of change in attitude and whether changes were consistent with DD program goals, the mean scores for statements about ICT for the Goldstine DD students and the Bartik DD students are set out in Table 6.7. This is also shown in Figures 6.1 and 6.2 respectively for the same questions listed in Table 6.7.

Table 6.7

Mean scores by school for statements about ICT

Item / Group	Goldstine pre (*N*=14)	Goldstine post (13)	Bartik pre- (22)	Bartik post (23)
Q1. Girls are more likely than boys to ask for help when they are not sure what to do next when working on the computer.	3.08*	3.00	3.33*	3.33*
Q2. Girls find it easier to work with a new program than boys.	3.15*	3.15*	3.00	3.11*
Q3. Girls are better than boys at setting up a new computer.	2.62*	3.00	2.61*	2.22
Q4. Boys are better than girls at fixing a computer.	2.15	1.92	2.56	2.39
Q5. Boys are more suited than girls to work in the computer industry.	2.08	2.15	2.56	2.11
Q6. Boys are better than girls at working with computers.	1.92	2.23	2.28	1.72
Q7. People who are really good at computing are popular.	2.54*	2.46	2.44	2.56*
Q8. I would like it if people thought of me as a computer geek.	2.08	1.77	1.94	1.44
Q9. Kids who are good with computers are admired.	3.00	3.00	2.71*	2.72*
Q10. People who work in computing work alone.	2.54*	2.23	2.61*	1.67
Q11. I have to work hard to do well in computing.	3.31*	2.85*	3.17*	3.28*
Q12. A person who works in computing makes a lot of money.	3.54	3.62	3.28*	3.67
Q13. I want to study computing as part of my VCE.	3.00	2.23	2.83*	2.22
Q14. I would like a job working with computers when I finish studying.	3.25*	2.08	2.61*	2.44
Q15. I would like a job specifically in the computing industry after I finish studying.	2.85*	2.23	2.28	2.28
Q16. I would like a job working with computers when I leave school.	3.15*	2.23	2.61*	2.56*
Q21. Using a computer makes learning more enjoyable.	4.15	4.00	3.94	3.72
Q22. I think computing subjects are very interesting.	3.92	3.15*	3.56	3.00
Q23. My school is enthusiastic about students using computers.	3.23*	3.23*	3.50	3.71
Q24. Teachers think it is important to use computers for learning.	3.46*	3.54	3.83	4.11
Q25. My parents encourage me to use computers.	3.54*	3.31*	3.33*	3.06*

* Not significantly different to 3 in a one sample *t*-test.

The graphs (Figures 6.1 and 6.2) should be interpreted using the following information:

- A mean score of 5 indicates strong agreement with an item, and a mean score of 1 indicates strong disagreement. The areas shaded in yellow indicate the desired outcomes for the DD program.
- The mean scores for Goldstine and Bartik DD students from the pre-program survey are plotted with green circles (●) and the mean scores from the post-program survey are represented by red squares (■). Where changes in attitude were statistically significant ($p<.05$) or there was a trend ($.1>p>.05$) they are indicated with a black arrow (↓).

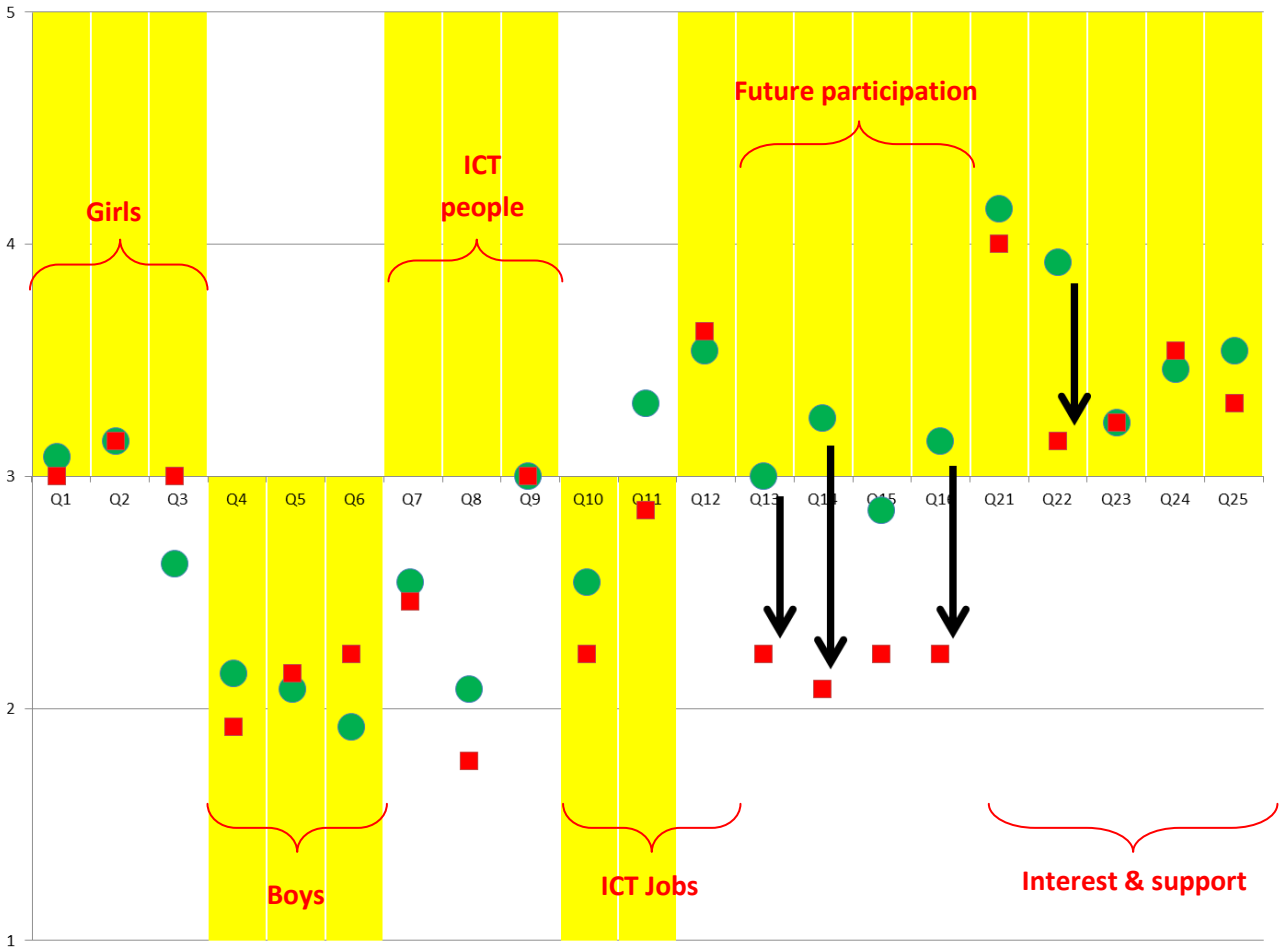


Figure 6.1. Goldstine DD student perceptions: Mean scores before and after participation in the DD program.

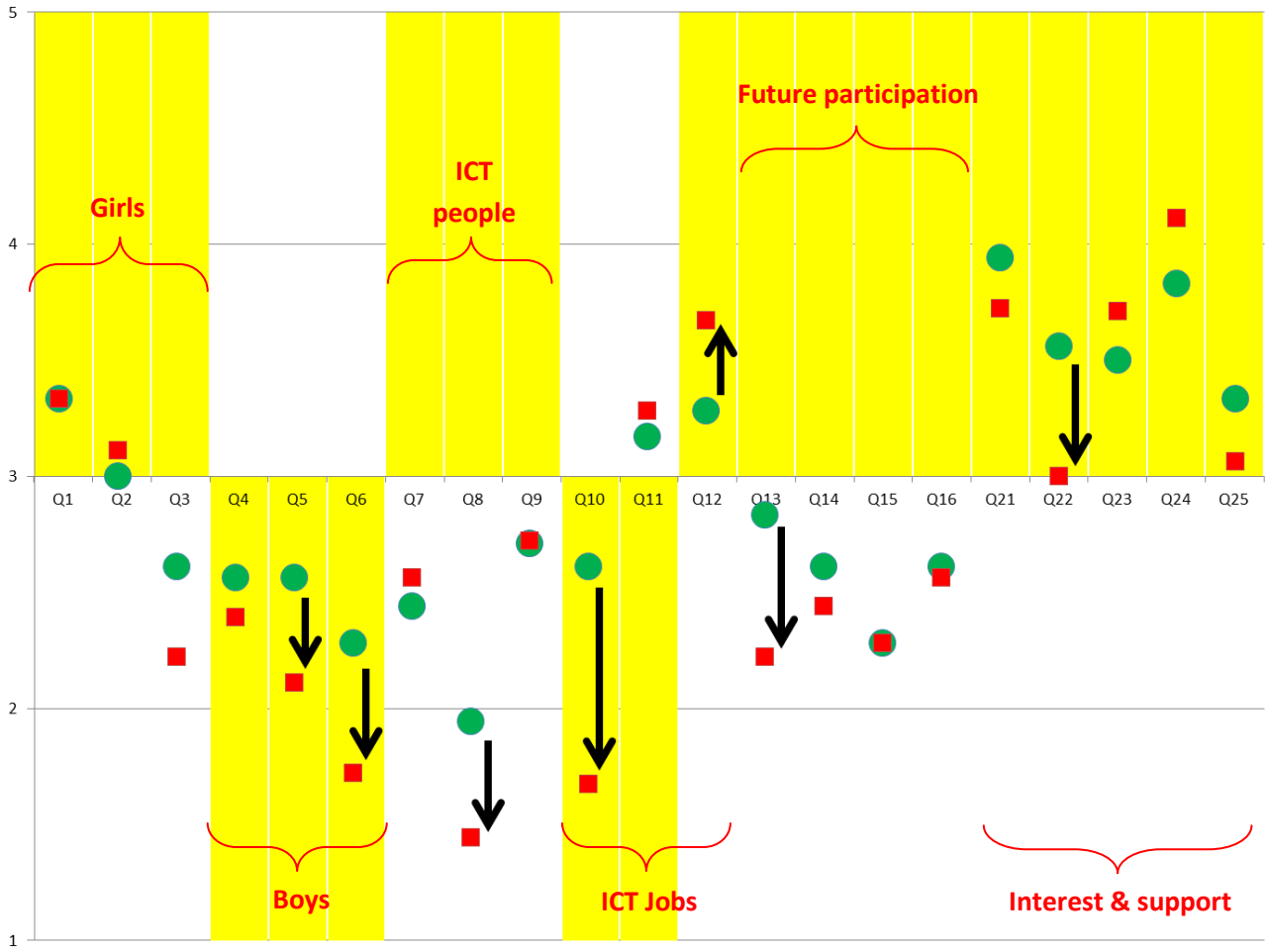


Figure 6.2. Bartik DD student perceptions: Mean scores before and after participation in the DD program.

The attitudinal changes that were inconsistent with the DD program goals, illustrated with black arrows in Figures 6.1 and 6.2, could be explained in a number of ways. It is possible that the material provided for the DD program did not engage all the students, modules addressing stereotypes were not taught, or the material was not presented by the teachers in a stimulating manner. It is also possible that the teachers themselves did not present as positive, non-stereotypical role models, thereby reinforcing negative stereotypes about ICT. It could be that the expectation that a 12 week program could change student attitudes was, perhaps, unrealistic. Finally, the community attitudes may have influenced the students more strongly than the DD program. These ideas will be explored later in this thesis. In the next chapter, community attitudes and the results from the DD program described in this chapter are compared.

Chapter Seven: Results and Discussion - Comparison of Community Results and Digital Divas Intervention Program Results

In this chapter changes in attitude among DD students are compared to the wider community attitudes to investigate potential links between them. Thus, a key research question of the thesis is addressed: To what extent was the change in attitude among the DD program participants related to community attitudes (SQ 6)?

A brief review of the groups involved in this study is followed by an explanation of analytical issues. The format of this chapter then follows that of Chapters Five and Six, with comparisons made in three sections:

Perceptions 1: Gender and ICT.

Perceptions 2: ICT people and jobs.

Perceptions 3: Importance and enjoyment of computing.

In each section community attitudes will be reviewed, the extent and direction of change of attitude among the DD program participants recapped, and then – the focus of the chapter - the two sets of data will be compared in order to explore possible relationships. A summary of the findings finishes the chapter.

DD program groups and community groups

While the DD program ran at ten schools over three years, in this study the focus was on two classes conducted in 2011. To recap, the two *participant* groups were Goldstine and Bartik DD students. The c*ommunity* was made up of the following groups:

Group A (the Goldstine community) – members of the school community surrounding the Goldstine DD students, comprising three sub-groups: parents, teachers, and non-DD students.

Group B (the Bartik community) – members of the school community surrounding the Bartik DD students, comprising three sub-groups: parents, teachers, and non-DD students.

Group C (Victorian parents): Parents recruited through *Facebook* with a child in Years 8 or 9 in Victoria, the state in which Goldstine SC and Bartik SC can be found.

Analytical issues

As in previous chapters, statistical analyses using *SPSS 20.0 for Windows* were used to analyse the data. The DD student data presented in this chapter are only from those students who completed both the pre- and post-program surveys. Statistically significant differences in the data reported in this chapter were identified using independent samples *t*-tests, ANOVA, and paired samples *t*-tests. The p-value was set at .05 for significance with a p-value between .05 and .1 indicating a trend.

The community questionnaires were modified from the DD program surveys. Not all questions and items from the DD program surveys were included in the community questionnaires, some questions were modified and new questions were added as described in more detail in Chapter Four. Where the wording varied between questionnaires, it is noted with a dagger (†). The non-DD student community questionnaire wording is used throughout this chapter. The numbering of the items originally used in this study was different for each questionnaire. In this chapter the items have been renumbered sequentially for clarity.

The data compared in this chapter are the mean scores for 19 items from the DD program surveys and the community questionnaires as described in Chapter Four. The mean scores for the following items are compared in this chapter:

Perceptions 1: Gender and ICT.

Q1. Girls are more likely than boys to ask for help with computers.†

Q2. Girls find it easier to work with a new program than boys.

Q3. Girls are better than boys at setting up a new computer.

Q4. Boys are better than girls at fixing a computer.

Q5. Boys are more suited than girls to work in the computer industry.

Q6. Boys are better than girls at working with computers.

Perceptions 2: ICT people and jobs.

Q7. People who are really good at computing are popular.

Q8. I would like it if people thought of me as a computer geek.

Q9. People who work in computing work alone.

Q10. A person who works in computing makes a lot of money.

Q11. I would like a job specifically in the computing industry.†

Q12. I would like a job working with computers when I finish studying.

Q13. I would like a job specifically in the computing industry after I finish studying.

Q14. I would like a job working with computers when I leave school.

Perceptions 3: Importance and enjoyment of computing.

Q15. Using a computer makes learning more enjoyable.

Q16. I think computing is very interesting.†

Q17. My school is enthusiastic about students using computers.†

Q18. Teachers think it is important to use computers.†

Q19. My parents encourage me to use computers.†

Analysis focused on looking for a relationship between community attitudes and changes in attitude among the DD students based on an examination of each item in terms of three possible relationships:

1. *Community attitudes and DD program goals*. Whether changes in attitude among DD students consistently occurred when community attitudes and DD program goals were similar, or when they were different.

2. *Community attitudes and initial DD student attitudes.* Whether changes in attitude among DD students consistently occurred when community attitudes and initial DD student attitudes were similar, or when they were different.

3. *Diversity or uniformity of community attitudes.* Whether changes in attitude among the DD students consistently occurred when there was a diversity of attitudes across community sub-groups, but not when community sub-group attitudes were uniform.

Perceptions 1: Gender and ICT

In this section, a summary of community attitudes towards gender and ICT, as discussed in Chapter Five, is followed by a summary of the changes in attitude among program participants, as discussed in Chapter Six. The mean scores for the equivalent items from the DD program surveys and the community questionnaires are then compared. This section concludes with a summary of the findings.

Community attitudes

The community groups held fairly egalitarian views about gender differences with regard to ICT, but when there was a perceived gender difference it tended to be in favour of boys. While the majority of the community did not see a gender difference, those who did considered males more competent, confident, interested, and enthusiastic than females about computers.

When the views of parents, teachers, and non-DD students of Groups A (Goldstine SC) and B (Bartik SC) were examined, similar patterns were identified. In both surveyed school communities parents were the least likely to believe there was a gender difference with regard to computing, and teachers were the most likely to believe there was a gender difference, in favour of boys. Teachers surveyed believed that boys were rougher with the computing equipment and perceived a difference in the activities that students engage in, that is, that boys play games on computers and girls use computers to socialize and create.

As noted previously in Chapter Five, the combined community responded on Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1) to a series of items which related to gender stereotypes about ICT (Q1-Q6).

While the responses from Group A indicated that attitudes were homogenous with no statistically significant differences in mean scores among sub-groups, in Group B, non-DD boys had more stereotyped views than other sub-groups. While Group B parents, teachers, and non-DD girls disagreed that boys were more suited than girls to work in the computer industry (Q5) and better than girls at working with computers (Q6), non-DD boys agreed with these items. Non-DD boys' attitudes towards Q5 (M=3.18) were clearly different to those of non-DD girls (2.63) but they were not statistically significantly different. This may have been due to the low number of participants. However, for Q6 (Boys are better than girls at working with computers) the difference in non-DD girls and boys mean scores was statistically significant.

Results from the DD program

The DD program groups from Goldstine SC and Bartik SC were also asked to respond to Q1-Q6 above. Within the DD program the stereotype that boys are better than girls at ICT was challenged. There were, however, no changes in attitude about gender and ICT among the Goldstine DD students following participation in the DD program. On the other hand, there were two changes in attitude among Bartik DD students: They were more likely to disagree that boys are better suited to work in the computer industry (Q5); and more likely to disagree that boys are better than girls at working with computers (Q6). These changes

were consistent with program goals which indicated that the program had some success in challenging the stereotype at Bartik SC.

Comparisons

To demonstrate the proposed relationship between the Group A (Goldstine community) attitudes and changes in attitude among the Goldstine DD students, and the Group B (Bartik community) attitudes with changes in attitude among the Bartik DD students, the mean scores for each group are presented graphically for relevant items throughout this chapter.

The graphs should be interpreted using the following information:

- A mean score of 5 indicates strong agreement with an item and a mean score of 1 indicates strong disagreement. The areas shaded in yellow indicate the desired outcomes for the DD program.

- The mean scores for Groups A and B are represented by blue diamonds (◆). Where there was a statistical difference in attitude among Group A or B sub-groups, the mean scores for each sub-group are plotted with Ⓑ for non-DD boys, Ⓖ for non-DD girls, Ⓟ for parents, Ⓣ for teachers and Ⓢ for non-DD students.

- The mean scores for Goldstine and Bartik DD students from the pre-program survey are plotted with green circles (●) and the mean scores from the post-program survey are represented by red squares (■). Where changes in attitude were statistically significant ($p<.05$) or there was a trend ($.1>p>.05$) they are indicated with a black arrow (↓).

The results are then explored in terms of the three possible relationships described previously. Importantly, the identification of a consistent pattern across all items (gender and ICT, ICT people and jobs, importance and enjoyment of computing) only became apparent after all results were considered together and this is shown at the end of the chapter.

Perceptions of gender and ICT: The relationship between Goldstine DD students' attitudes and Group A results

The results from Goldstine DD students and the Group A (Goldstine SC) community for the following items are presented in Figure 7.1:

Q1. Girls are more likely than boys to ask for help with computers.†

Q2. Girls find it easier to work with a new program than boys.

Q3. Girls are better than boys at setting up a new computer.

Q4. Boys are better than girls at fixing a computer.

Q5. Boys are more suited than girls to work in the computer industry.

Q6. Boys are better than girls at working with computers.

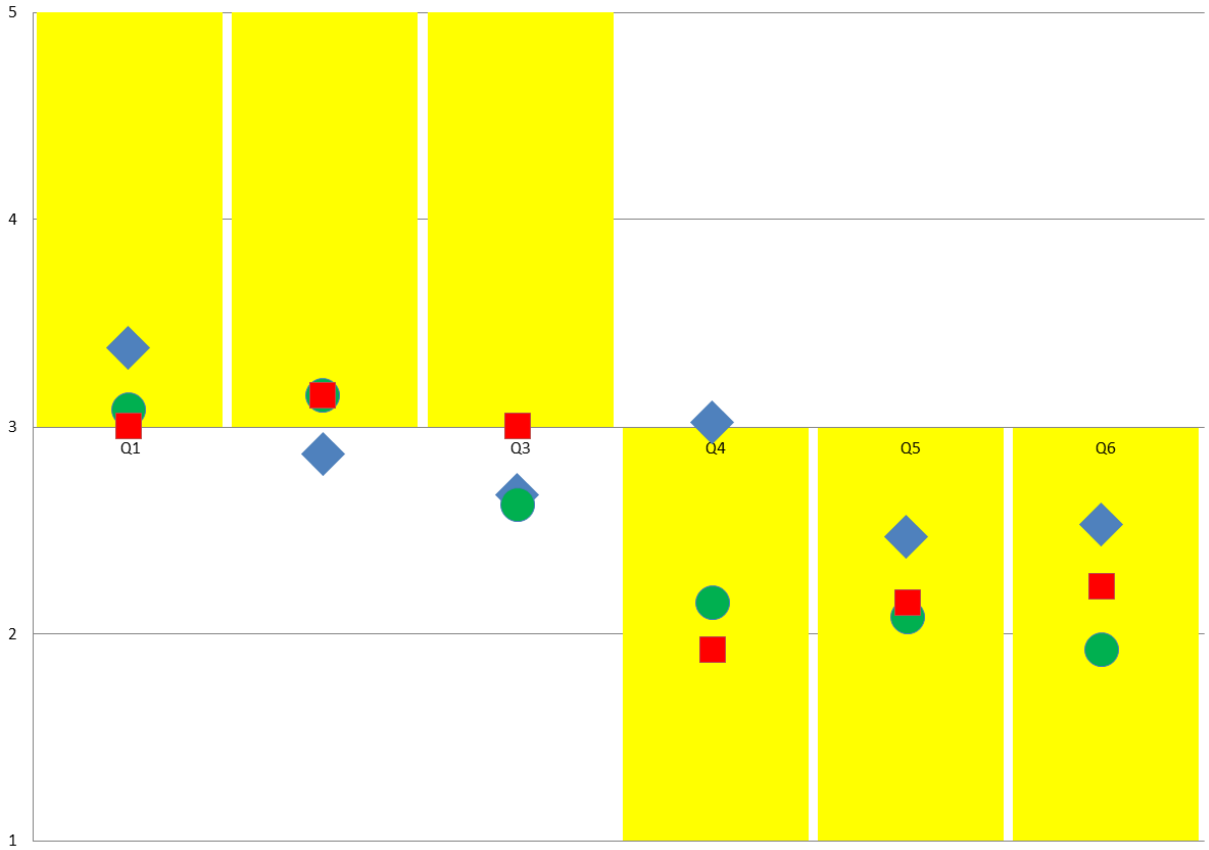


Figure 7.1. Goldstine DD students and Group A results for perceptions of gender and ICT.

Key: Community mean scores; Pre-DD students' mean scores; Desired outcomes for DD program; Post-DD students' mean scores

As can be seen in Figure 7.1, there were no changes in attitude among Goldstine DD students for items about ICT and gender.

1. *Community attitudes and DD program goals.* Figure 7.1 clearly shows that Group A attitudes were consistent with DD program goals for Q1 (Girls are more likely than boys to ask for help with computers), Q5 (Boys are more suited than girls to work in the computer industry), and Q6 (Boys are better than girls at working with computers); but not for Q2 (Girls find it easier to work with a new program than boys), Q3 (Girls are better than boys at setting up a new computer), or Q4 (Boys are better than girls at fixing a computer). As no statistically significant changes in mean scores occurred among the Goldstine DD students after participation in the DD program, no evidence of a pattern relating changes in attitude among DD students with the consistency of Group A attitudes and DD program goals was apparent.

2. *Community attitudes and initial DD student attitudes.* The initial Goldstine DD student mean score (*M*=2.62) and Group A mean score (2.67) were closest for Q3, however, there was no change in attitude. As there were no statistically significant changes in DD student mean scores after participation in the DD program it is difficult to see any pattern.

3. *Diversity or uniformity of community attitudes.* It can be seen in Figure 7.1 that at Goldstine SC there were no statistically significant changes in mean score about gender and ICT among the DD program participants. In addition, there were no statistically significant differences in mean scores between Group A sub-groups. This is consistent with the pattern that attitude change occurs only when there is a diversity of community attitudes.

Perceptions of gender and ICT: The relationship between Bartik DD students' attitudes and Group B results

The results from Bartik DD students and the Group B (Bartik SC) community for the following items are presented in Figure 7.2:

Q1. Girls are more likely than boys to ask for help with computers.†

Q2. Girls find it easier to work with a new program than boys.

Q3. Girls are better than boys at setting up a new computer.

Q4. Boys are better than girls at fixing a computer.

Q5. Boys are more suited than girls to work in the computer industry.

Q6. Boys are better than girls at working with computers.

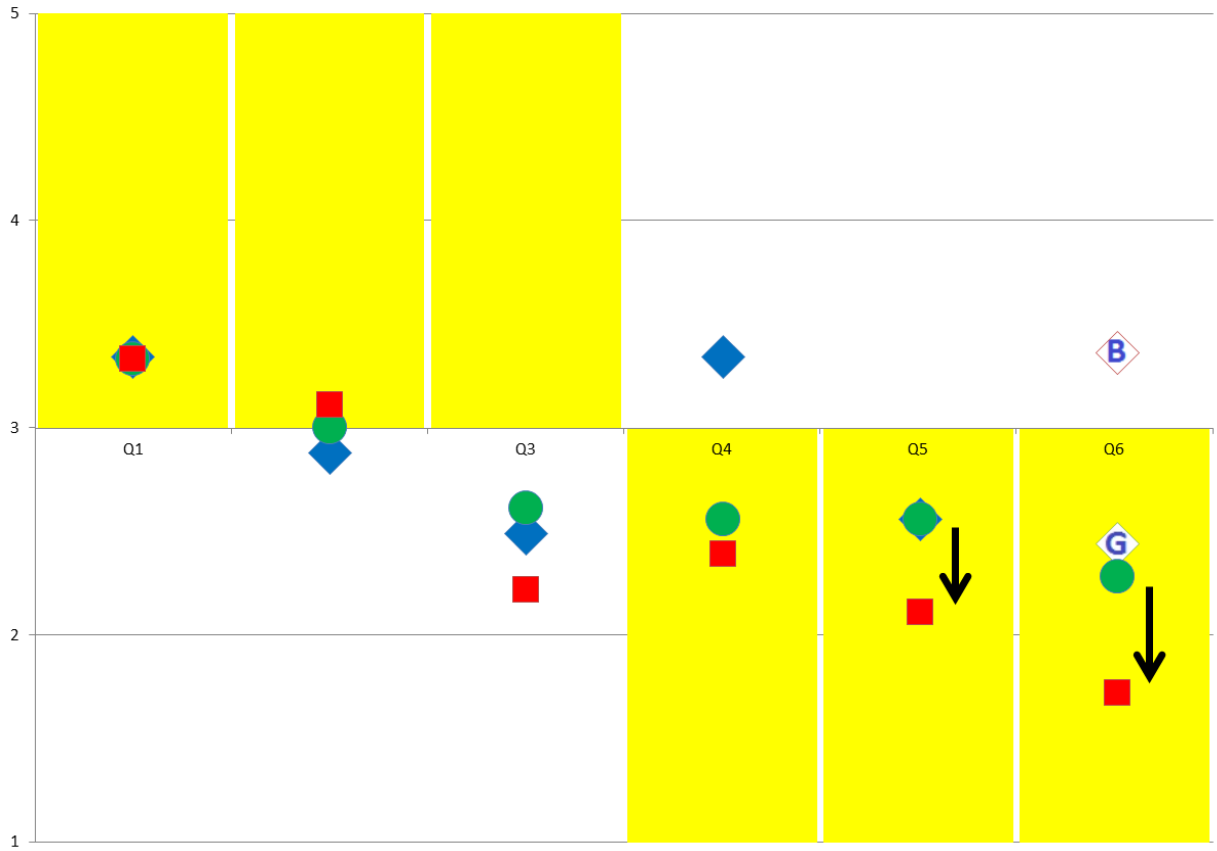


Figure 7.2. Bartik DD student and Group B results for perceptions of gender and ICT.

Key:
Community mean scores
Community sub-groups mean scores
Desired outcomes for DD program
Pre-DD students' mean scores
Post-DD students' mean scores
A statistically significant change or trend

As can be seen in Figure 7.2, there were two changes in attitude among Bartik DD students after participation in the DD program, for Q5 (Boys are more suited than girls to work in the computer industry) and Q6 (Boys are better than girls at working with computers). As in the previous section these results were explored in terms of the three possible relationships.

1. *Community attitudes and DD program goals.* Figure 7.2 shows that there is some support for a pattern whereby DD participants' attitudes changed for Q5 when community attitudes and the goals of the DD program aligned. This pattern did not hold for Q1 (Girls are more likely than boys to ask for help with computers) where no change occurred but community attitudes and the DD goals were the same. It is unclear whether the pattern held for Q6, where DD participant attitudes did change, because the attitudes of the community were divided. These results do not indicate a strong pattern in support of the idea that DD student attitude change occurs when community attitudes and DD program goals are consistent.

2. *Community attitudes and initial DD student attitudes.* Initial Bartik DD student mean scores were very similar to Group B mean scores for Q1 (DD students, *M*=3.33; Group B, 3.34) where there was no change in DD student attitude, and for Q5 (DD students, 2.56; Group B, 2.56) where there was a change in attitude. As Group B sub-group attitudes were diverse for Q6 it was unclear whether the pattern held for this item. This shows inconsistent support for this pattern.

3. *Diversity or uniformity of community attitudes.* Bartik DD student attitudes changed for Q6, where Group B sub-group attitudes were diverse, and for Q5, where, although Group B non-DD boys agreed with this item (*M*=3.18) and Group B non-DD girls disagreed (2.63), the mean scores for these sub-groups were not statistically significantly different. As explained previously, this may have been due to the low numbers of participants. Offering further support for this relationship, when Group B sub-group attitudes were uniform (Q1-4) changes in attitude among Bartik DD students did not occur. As such, there appears to be some support for this relationship.

Summary of Perceptions 1

As there were no changes in attitude among Goldstine DD students towards gender and ICT after participation in the DD program, it was difficult to see evidence of any relationship with community attitudes other than possible relationship 3 (*diversity or uniformity of community attitudes*), where uniform Group A sub-group attitudes corresponded with no changes in attitude among Goldstine DD students.

Two changes in attitude occurred among Bartik DD students, for Q5 (Boys are more suited than girls to work in the computer industry) and Q6 (Boys are better than girls at working with computers). There was no consistent discernible pattern based on whether community attitudes aligned with initial DD student attitudes or DD program goals aligned with community attitudes. There was some indication that there may be a pattern whereby changes in attitude among Bartik DD students correlated with a diversity of attitudes among the Group B sub-groups; where Group B sub-group attitudes were uniform, changes in attitude were less likely to occur.

Perceptions 2: ICT people and jobs

This section begins with a reminder of both community perceptions of ICT people and jobs as discussed in Chapter Five and the observed changes in attitude about ICT people and jobs among the DD program participants as discussed in Chapter Six. The patterns among the mean scores for the equivalent items from the DD program surveys and the community questionnaires are then considered.

Community results

After examining responses from the combined community (Groups A, B and C) to the community questionnaires, mixed attitudes about ICT people and jobs were found (see Chapter Five). In some ways, the combined community was reasonably positive about ICT jobs in that they thought those working in ICT had a lot of outside interests and that the jobs were well-paid, involved teamwork and were good for people with families. While Group A thought computing people were popular, Groups B and C did not agree, and no group wanted to be identified as geeks. Non-DD students in both Group A and Group B thought they would enjoy working with computers and that the perks of the job were good. They also indicated that they were worried about the lack of physical activity and possible health problems from an ICT job and thought the jobs would be boring and difficult.

The combined community responded on Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1) to the items Q7-10 which related to the computer industry stereotypes of unpopularity, geekiness, working alone, and making a lot of money.

When Group A responses to these items were examined, they were fairly consistent across all sub-groups (parents, teachers, and non-DD students). For Group B, however, views were not as uniform, with the following statistically significant differences and trends: While Group B non-DD students agreed, Group B parents and teachers disagreed that a person who works in computing makes a lot of money (Q10). There was also a trend (.1>*p*>.05) for boys to disagree much more strongly than girls that people who work in computing work alone (Q9).

Parents from Groups A, B and C were unsure whether they wanted their children to have ICT jobs. Group A and B non-DD students were also unsure whether they wanted ICT jobs for themselves. These beliefs were fairly uniform across the three community groups with the following differences: Group C (Victorian parents) agreed that they wanted their sons to have ICT jobs (mean = 3.35) and Group B non-DD girls disagreed that they wanted ICT jobs (mean = 2.31).

Results from the DD program participants

As discussed in Chapter Six, before and after participation in the DD program, DD students at Goldstine and Bartik SC were asked to respond to items about ICT people and jobs, draw people who worked in ICT, and discuss what they thought they would like or dislike about a job in ICT.

After the program DD students at both schools drew fewer characters who were male, wore glasses, sat at their desks, or worked alone. They were less concerned about any health problems or the difficulties and challenges of an ICT job than before participation in the DD program. On the other hand, after the DD program the students were also less likely to suggest computer jobs were fun, enjoyable, or creative and continued to believe they involved working inside all day.

No changes in attitude were found among Goldstine DD students. Interestingly, among Bartik DD students there were three changes in attitude following participation in the DD program:

- While not changing attitudes as such but strengthening them in a direction consistent with the DD program goals, Bartik DD students disagreed more strongly that people who work in computing work alone (Q9) and agreed more strongly that a person who works in computing makes a lot of money (Q10).
- Contrary to the DD program goals, after participation in the DD program the Bartik DD students disagreed more strongly that they would like it if people thought of them as a computer geek (Q8).

Goldstine and Bartik DD students were also asked to respond to the following items about future ICT plans to work in the industry, before and after the DD program:

Q12. I would like a job working with computers when I finish studying.

Q13. I would like a job specifically in the computing industry after I finish studying.

Q14. I would like a job working with computers when I leave school.

Prior to participation in the DD program, Goldstine DD students agreed more strongly than Bartik DD students that they were interested in future participation in ICT.

After the DD program, there were no changes in attitude for these items among the Bartik DD students. For Goldstine DD students, however, there were two changes in attitude away from DD program goals. Goldstine DD students disagreed more strongly that they would like to have a job working with computers when they finish studying (Q13) or when they leave school (Q14). As the community and the DD students were asked similar but not equivalent questions about future involvement in ICT, items Q12-14 are contrasted with the community question Q11 (I would like a job specifically in the computing industry).

In addition, students were also asked whether they would be interested in studying computing at VCE level. While initially unsure, after the program both Goldstine and Bartik DD students disagreed that they would be interested in studying ICT at VCE level (the community was not asked this question and so it is not compared in this chapter).

Perceptions of ICT people and jobs: The relationship between Goldstine DD students' attitudes and Group A results

The results from Goldstine DD students and the Group A (Goldstine SC) community results for the following items are presented in Figure 7.3:

Q7. People who are really good at computing are popular.

Q8. I would like it if people thought of me as a computer geek.

Q9. People who work in computing work alone.

Q10. A person who works in computing makes a lot of money.

Q11. I would like a job specifically in the computing industry.†

Q12. I would like a job working with computers when I finish studying.

Q13. I would like a job specifically in the computing industry after I finish studying.

Q14. I would like a job working with computers when I leave school.

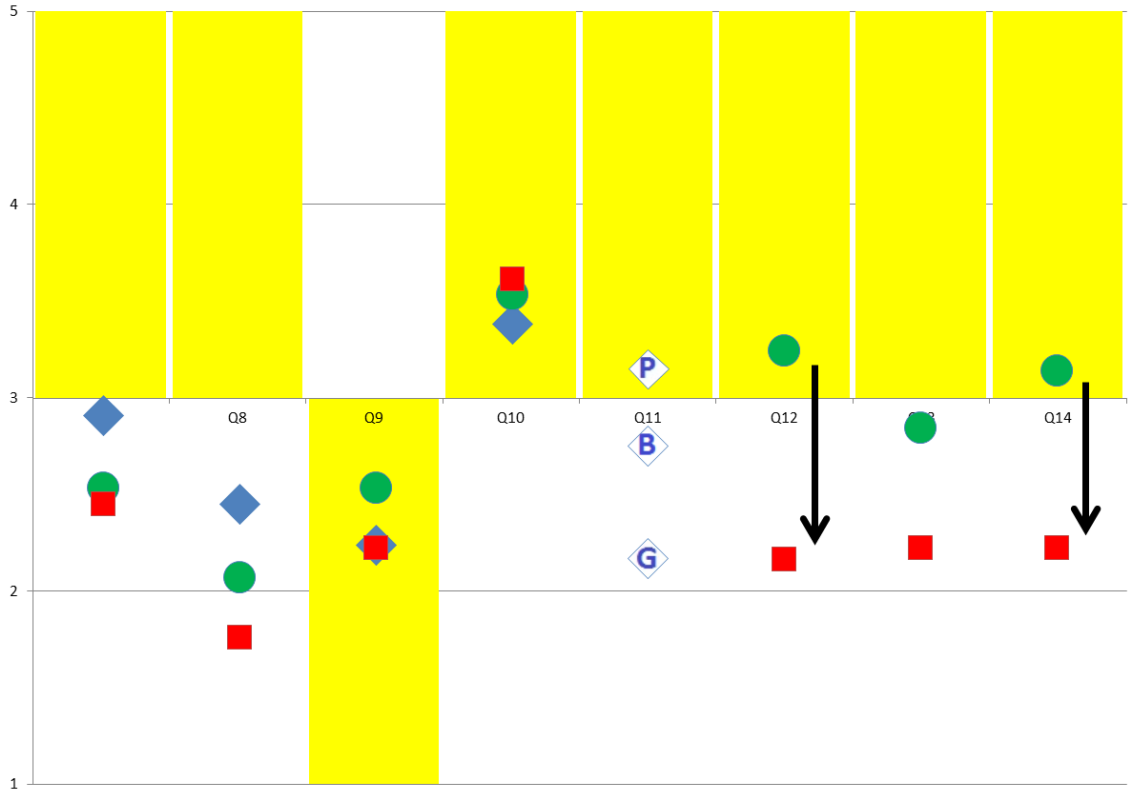


Figure 7.3. Goldstine DD students and Group A results for perceptions of ICT people and jobs.

Key:
- Community mean scores
- B G P T S Community sub-groups mean scores
- Desired outcomes for DD program
- Pre-DD students' mean scores
- Post-DD students' mean scores
- A statistically significant change or trend

As can be seen in Figure 7.3, there were two changes in attitude among Goldstine DD students after participating in the DD program, for items Q12 (I would like a job working with computers when I finish studying) and Q14 (I would like a job working with computers when I leave school). These items were only in the DD student surveys and were compared with a similar item which was only in the community questionnaires, item Q11 (I would like a job specifically in the computing industry). The responses for Q7-14 are now explored in terms of the three possible relationships.

1. *Community attitudes and DD program goals.* Group A sub-group attitudes were divided for Q11, with parent mean scores consistent with DD program goals but non-DD student mean scores inconsistent with DD program goals. It was therefore difficult to see a pattern relating to consistency or inconsistency of Group A attitudes with DD program goals and changes in attitude among DD students.

2. *Community attitudes and initial DD student attitudes.* For Q7-14, the initial Goldstine DD student mean score for Q10 (A person who works in computing makes a lot of money) was the most similar to the Group A mean score and no change in attitude occurred. As Group A attitudes for Q11 were divided, it was difficult to know how similar initial DD attitudes were to community attitudes for Q12 and 14 where changes in attitude did occur. No evidence of a pattern is clear here.

3. *Diversity or uniformity of community attitudes.* The items Q12 and Q14 where there was a change in attitude among DD students after participation in the DD program were compared with the community item Q11 (I would like a job specifically in the computing industry). For Q11, Group A non-DD boys and girls, and parents' mean scores were diverse. These results give some support to a pattern whereby a diversity of attitudes across community sub-groups (Q11), correlate with changes in attitude among the DD students (Q12 and Q14). Where attitudes were consistent across all community sub-groups, change in attitude among DD students did not occur (Q7-10).

Perceptions of ICT people and jobs: The relationship between Bartik DD students' attitudes and Group B results

The results from the Bartik DD students are compared with the Group B (Bartik SC) community results for the following items in Figure 7.4:

Q7. People who are really good at computing are popular.

Q8. I would like it if people thought of me as a computer geek.

Q9. People who work in computing work alone.

Q10. A person who works in computing makes a lot of money.

Q11. I would like (my daughter to have) a job specifically in the computing industry.†

Q12. I would like a job working with computers when I finish studying.

Q13. I would like a job specifically in the computing industry after I finish studying.

Q14. I would like a job working with computers when I leave school.

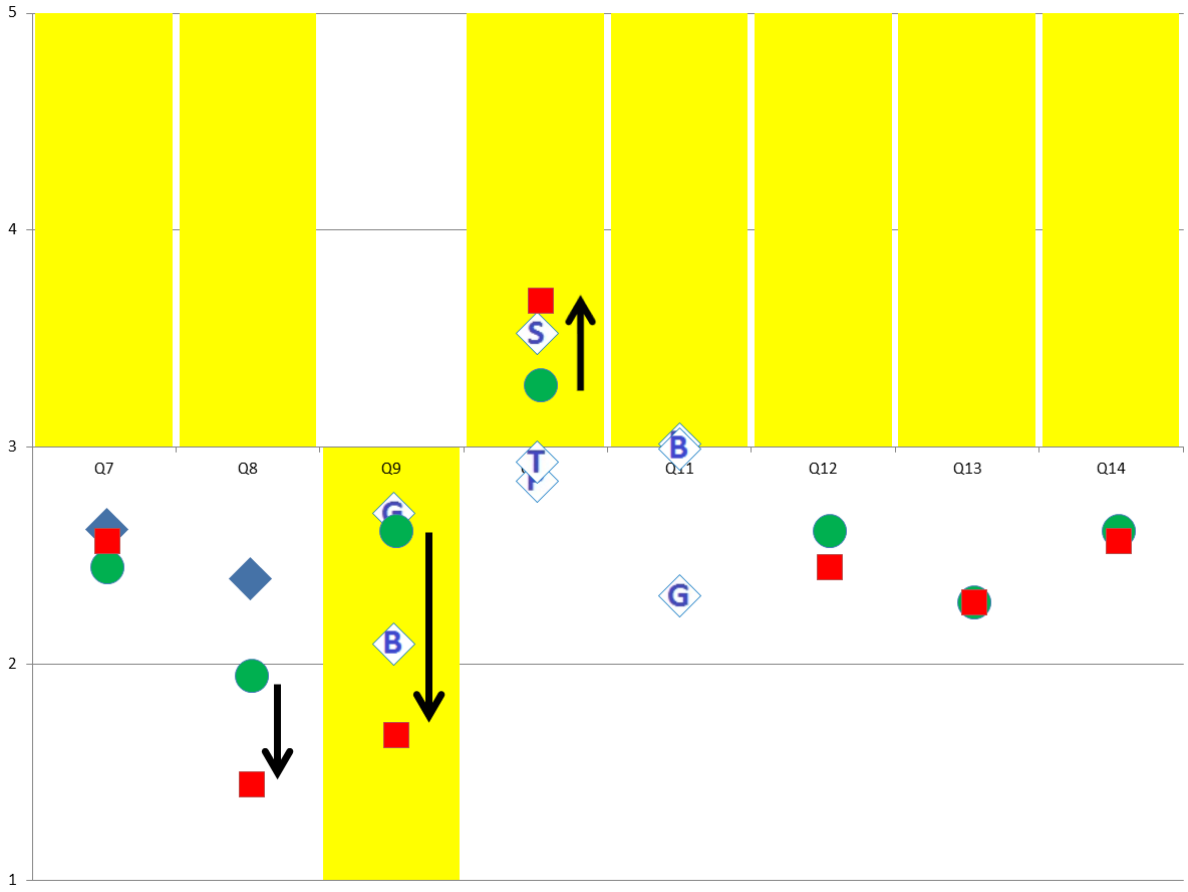


Figure 7.4. Bartik DD students and Group B results for perceptions of ICT people and jobs.

Key:
- Community mean scores
- Community sub-groups mean scores (B G P T S)
- Desired outcomes for DD program
- Pre-DD students' mean scores
- Post-DD students' mean scores
- A statistically significant change or trend

As can be seen in Figure 7.4, there were three changes in attitude among Bartik DD students after participation in the DD program, for Q8 (I would like it if people thought of me as a computer geek), Q9 (People who work in computing work alone), and Q10 (A person who works in computing makes a lot of money). Items Q7-14 are now explored in terms of the three possible relationships.

1. *Community attitudes and DD program goals*. As can be seen in Figure 7.4, significant changes in attitude occurred among Bartik DD students after participation in the DD program for items where Group B sub-group attitudes were both consistent (Q9) and inconsistent (Q8) with DD program goals. Group B sub-group attitudes were divided for Q10. Thus, there was little evidence of a discernible pattern relating changes in DD student attitudes with a correlation between DD program goals and community attitudes.

2. *Community attitudes and initial DD student attitudes.* For Q7-14, the initial Bartik DD student mean scores and the Group B mean score were closest for Q7 (People who are really good at computing are popular) but there was no attitude change for Bartik DD students for this item. Where changes in attitude did occur, Group B attitudes were either divided (Q9) or not similar to initial Bartik DD student attitudes (Q8). Therefore, there is little evidence of a pattern linking the correlation of initial Bartik DD student attitudes and Group B attitudes with any changes in attitude among DD students after participation in the DD program.

3. *Diversity or uniformity of community attitudes.* Group B sub-group mean scores were significantly different for Q9 and Q10 and corresponding changes in attitude among Bartik DD students occurred, indicating some evidence of a pattern. However, the pattern did not hold for Q8 (I would like it if people thought of me as a computer geek) when sub-group attitudes were uniform or Q11-Q14 (desire to have a computing job) when sub-group attitudes were diverse but no change in attitude among Bartik DD students was in evidence.

Summary of Perceptions 2

Among Goldstine DD students there were two changes in attitude after participation in the DD program, for Q12 (I would like a job working with computers when I finish studying) and Q14 (I would like a job working with computers when I leave school). In both cases students disagreed more strongly after participation in the DD program. These items were contrasted with the community item Q11 (I would like a job specifically in the computing industry).

When these results were viewed in terms of the three possible relationships it was difficult to see a pattern whereby DD student attitudes changed when community attitudes and DD program goals were consistent or DD student attitudes changed when initial DD student attitudes and DD program goals were consistent. There was, however, and some support was apparent for a pattern where DD student attitude change occurred when there was a diversity of community attitudes.

Among Bartik DD students there were three statistically significant changes in mean scores, for Q8 (I would like it if people thought of me as a computer geek), Q9 (People who work in computing work alone), and Q10 (A person who works in computing makes a lot of money). These results appear to indicate little evidence for a pattern whereby DD student attitude changes occur when community attitudes and DD program goals are consistent, or initial DD student attitudes and DD program goals are consistent. There was some evidence of a pattern indicating that DD student attitude change occurred when there was a diversity of community attitudes, however, only two of the three changes in attitude were consistent with this suggestion.

Perceptions 3: Importance and enjoyment of computing

This section begins with a restatement of how interesting computers are considered by the community and their perceived support for student computer use. This is followed by an overview of any DD participant changes in attitude and finally, by a comparison of the Group A and Goldstine DD student results, and the Group B and Bartik DD student results.

All participants in this study responded on 5-point Likert-type response formats ranging from Strongly Agree (5) to Strongly Disagree (1) to items Q15-19 about whether computing is enjoyable or interesting, and school, teacher, and parental support for student computing.

Community results

The combined community (Groups A, B and C) had very positive attitudes towards computing. They strongly believed that computers make learning more enjoyable (Q15), that computing is very interesting (Q16), and that schools (Q17), teachers (Q18) and parents (Q19) were supportive of student computer use. While all positive, the extent of agreement was diverse within Group A sub-groups and within Group B sub-groups for Q16 and 17. In addition, there was a difference of opinion between the two communities; Group A non-DD students agreed more strongly than Group B non-DD students that teachers think it is important to use computers (Q18).

Results from the DD program

The DD program participants from Goldstine SC and Bartik SC were also asked to respond to Q15-19. There was only one change in attitude which occurred for both Goldstine and Bartik DD students; each group agreed less strongly that computing is very interesting (Q16) after participation in the DD program.

Perceptions of importance and enjoyment of computing: The relationship between DD students' attitudes and community attitudes

In this section the results from Goldstine DD students and Group A and the results from Bartik DD students and Group B were very similar and will be discussed together. The results from the Goldstine DD students are compared with the Group A community results in Figure 7.5, and results from Bartik DD students are compared with the Group B community results in Figure 7.6 for the following items:

Q15. Using a computer makes learning more enjoyable.

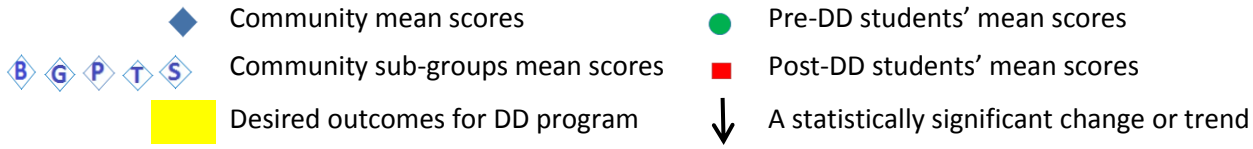
Q16. I think computing is very interesting.†

Q17. My school is enthusiastic about students using computers.†

Q18. Teachers think it is important to use computers.†

Q19. My parents encourage me to use computers.†

Key for Figures 7.5 and 7.6:



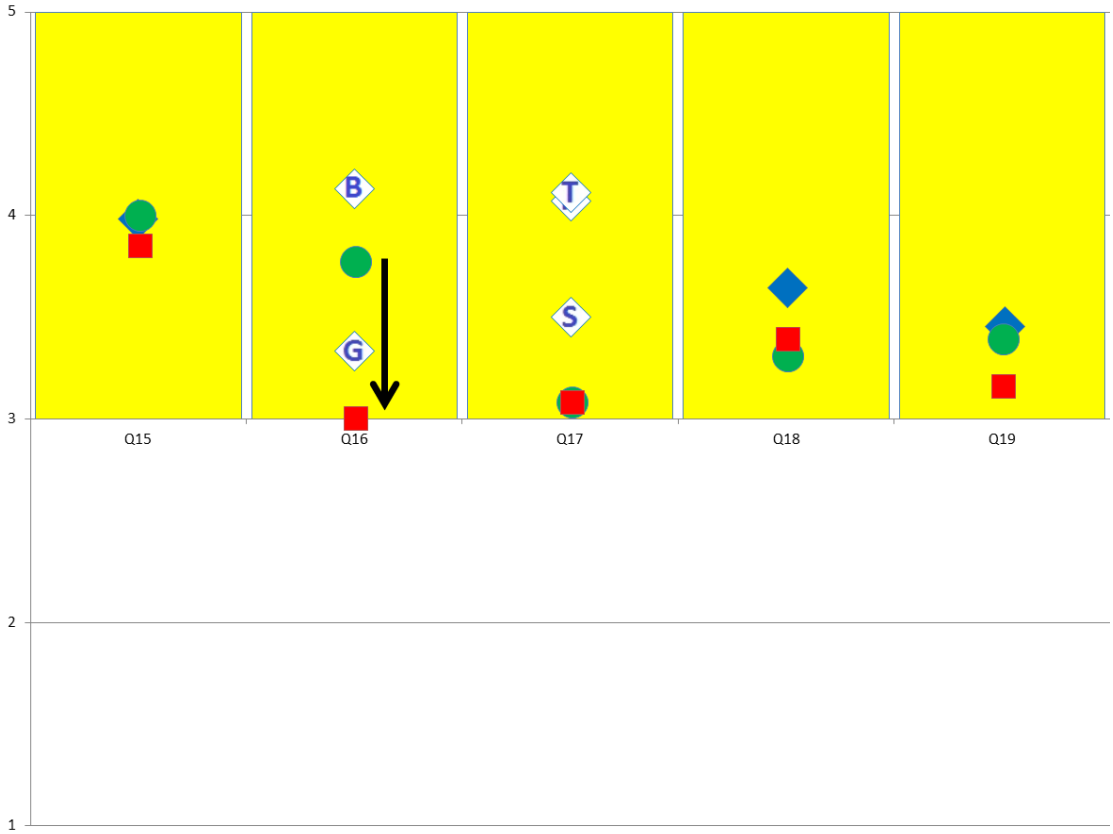


Figure 7.5. Goldstine DD students and Group A results for perceptions of computing.

Figure 7.6. Bartik DD students and Group B results for perceptions of computing.

As can be seen in Figures 7.5 and 7.6, there was only one change in attitude among the Goldstine and Bartik DD students, for Q16 (I think computing is very interesting). As in the previous sections, this result was explored in terms of the three possible relationships.

1. *Community attitudes and DD program goals*. Group A and B community attitudes were consistent with DD program goals for all items. However, as a statistically significant change in mean scores among DD students occurred for only one question (Q16), there was no strong evidence of a pattern whereby attitude change among DD student occurred when community attitudes and DD program goals were consistent.

2. *Community attitudes and initial DD student attitudes.* As can be seen in Figures 7.5 and 7.6, prior to participation in the DD program initial DD students' attitudes were closest to community attitudes for item Q15 at both schools. However, there were no changes in attitude among DD students for this item. As Group A and Group B attitudes were divided for items Q16 and 17, it was difficult to determine how similar they were to the initial attitudes of Goldstine and Bartik DD students. There was little evidence of a pattern whereby DD student attitude changes occurred when initial DD student attitudes and community attitudes were consistent.

3. *Diversity or uniformity of community attitudes.* For item Q16, the change in Goldstine and Bartik DD students' attitudes coincides with a diversity in Group A sub-group attitudes and in Group B sub-group attitudes. In contrast, for item Q17 (My school is enthusiastic about students using computers), Group A sub-groups' and B sub-groups' mean scores were diverse, but there was no change in attitude among either Goldstine or Bartik DD students. For items Q15, 18, and 19 uniform sub-group attitudes were in evidence for Group A and Group B and, following the pattern, no change in attitude occurred for Goldstine or Bartik DD students. This provides some evidence that DD student attitude change occurs when there is a diversity of community attitudes.

Summary of Perceptions 3

Group A and B community attitudes and initial Goldstine and Bartik DD student attitudes were consistent with DD program goals for all items Q15-19, however, after participation in the DD program Goldstine and Bartik DD students' attitudes only changed for Q16. Thus, there was no evidence for the first two possible relationships. There was some evidence that changes in DD student attitudes occur when there is a diversity of community attitudes, but this was not a consistent pattern.

Further analysis

A closer examination of both the primary research question and sub-question 6 (To what extent was the change in attitude among the DD program participants related to community attitudes?) will now be offered.

In this chapter, the mean scores for the Group A community and Goldstine DD students, and the Group B community and Bartik DD students, were compared for the following items in order to explore a possible relationship between community attitudes and the outcome of the DD program:

Q1. Girls are more likely than boys to ask for help with computers.†

Q2. Girls find it easier to work with a new program than boys.

Q3. Girls are better than boys at setting up a new computer.

Q4. Boys are better than girls at fixing a computer.

Q5. Boys are more suited than girls to work in the computer industry.

Q6. Boys are better than girls at working with computers.

Q7. People who are really good at computing are popular.

Q8. I would like it if people thought of me as a computer geek.

Q9. People who work in computing work alone.

Q10. A person who works in computing makes a lot of money.

Q11. I would like a job specifically in the computing industry.†

Q12. I would like a job working with computers when I finish studying.

Q13. I would like a job specifically in the computing industry after I finish studying.

Q14. I would like a job working with computers when I leave school.

Q15. Using a computer makes learning more enjoyable.

Q16. I think computing is very interesting.†

Q17. My school is enthusiastic about students using computers.†

Q18. Teachers think it is important to use computers.†

Q19. My parents encourage me to use computers.†

Evidence of patterns for the following three possible relationships between community attitudes and the outcomes of the DD program were explored; a summary of the findings for each is presented below:

1. *Community attitudes and DD program goals*. Whether changes in attitude among DD students consistently occurred when community attitudes and DD program goals were similar, or when they were different.

2. *Community attitudes and initial DD student attitudes.* Whether changes in attitude among DD students consistently occurred when community attitudes and initial DD student attitudes were similar, or when they were different.

3. *Diversity or uniformity of community attitudes.* Whether changes in attitude among the DD students consistently occurred when there was a diversity of attitudes across community sub-groups, but not when community sub-group attitudes were uniform.

1. Community attitudes and DD program goals. The results of the analysis for the first relationship is summarised for Goldstine and Bartik DD student results and Group A and B attitudes in Table 7.1. Statistically significant changes in mean scores are highlighted in red and a tick is placed in the row when community attitudes and DD goals correlate, a cross when they do not, and a question mark when only some of the community sub-groups correlated with DD goals. Please note that for questions relating to a desire for a computing job, the Group A and B attitudes for Q11 (community question only) have been used for Q12, 13, and 14 (DD student question only).

Table 7.1

Summary of possible relationship 1: Group A and B attitudes and DD program goals

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19
Group A & DD goals	✓	×	×	×	✓	✓	×	×	✓	✓	?	?	?	✓	✓	✓	✓	✓
Group B & DD goals	✓	×	×	×	✓	?	×	×	✓	?	?	?	?	✓	✓	✓	✓	✓

As can be seen in Table 7.1, changes in DD student attitudes occurred when community attitudes were: in line with DD goals, when they were not in line with DD goals, and when some community sub-group attitudes were in line with DD goals and some were not. While a similar pattern of consistency between Group A attitudes and DD goals, and Group B attitudes and DD goals could be seen, there was no strong pattern suggesting a relationship whereby changes in attitude among DD student attitudes occurred when community attitudes were consistent with DD goals.

2. Community attitudes and initial DD student attitudes. The results of the analysis for the second relationship is summarised for Group A and Goldstine DD students, and Group B and Bartik DD students, in Table 7.2. Statistically significant changes in mean scores for DD students after participation in the DD program are highlighted in red. The difference in initial DD student mean scores and community group scores is shown for each item to highlight any similarity, and a question mark indicates that community attitudes were divided. Please note that for questions relating to a desire for a computing job, the Group A and B attitudes for Q11 (community question only) have been used for Q12, 13, and 14 (DD student question only).

Table 7.2

Summary of possible relationship 2: Initial Goldstine DD student attitudes and Group A attitudes, and initial Bartik DD student attitudes and Group B attitudes

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19
Goldstine initial & Group A	.30	.28	.05	.87	.39	.61	.37	.37	.30	.16	?	?	?	.17	?	?	.18	.10
Bartik initial & Group B	.01	.12	.12	.78	.00	.30	.18	.45	?	?	?	?	?	.13	?	?	.68	.29

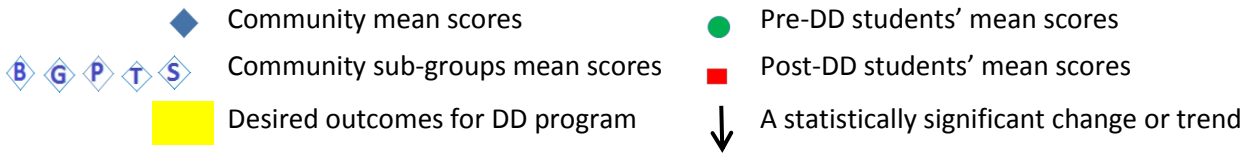
As can be seen in Table 7.2, where changes in attitude occurred for Goldstine DD students, the similarity of initial Goldstine DD student attitudes and Group A attitudes were difficult to determine as in all three cases the Group A attitudes were divided. The mean scores for Goldstine DD students and Group A were closest for Q3, 10, 15, 18, and 19 where the difference in mean scores was under .2. However, there were no significant changes in mean scores for these items for Goldstine DD students after participation in the DD program.

The initial Bartik DD student attitudes and Group B attitudes for Q5, where there was no difference in mean scores, corresponded with a change in attitude among Bartik DD students. For Q6 and 8, however, where there was also a change in attitude among Bartik DD students, there was a difference in initial Bartik DD student mean scores and Group B mean scores of .30 for Q6 and .45 for Q8. The similarities for Q6, 9, 10, and 16 (where changes in Bartik DD student attitudes also occurred) could not be determined as Group B attitudes were diverse. It can also be seen that there was no change in attitude among Bartik DD students for Q1, even though the difference in mean scores was only .01. As such, no consistent pattern could be seen based on the consistency of initial Goldstine and Bartik DD student attitudes with community attitudes.

3. Diversity or uniformity of community attitudes. The summaries of the third relationship suggested are displayed in the same graphical format used throughout this chapter. The

results for Goldstine DD student outcomes and Group A results are shown in Figure 7.7, and those for Bartik DD student outcomes and Group B results are shown in Figure 7.8. A red box will indicate where the relationship has *not* been followed.

Key for Figures 7.7 and 7.8:



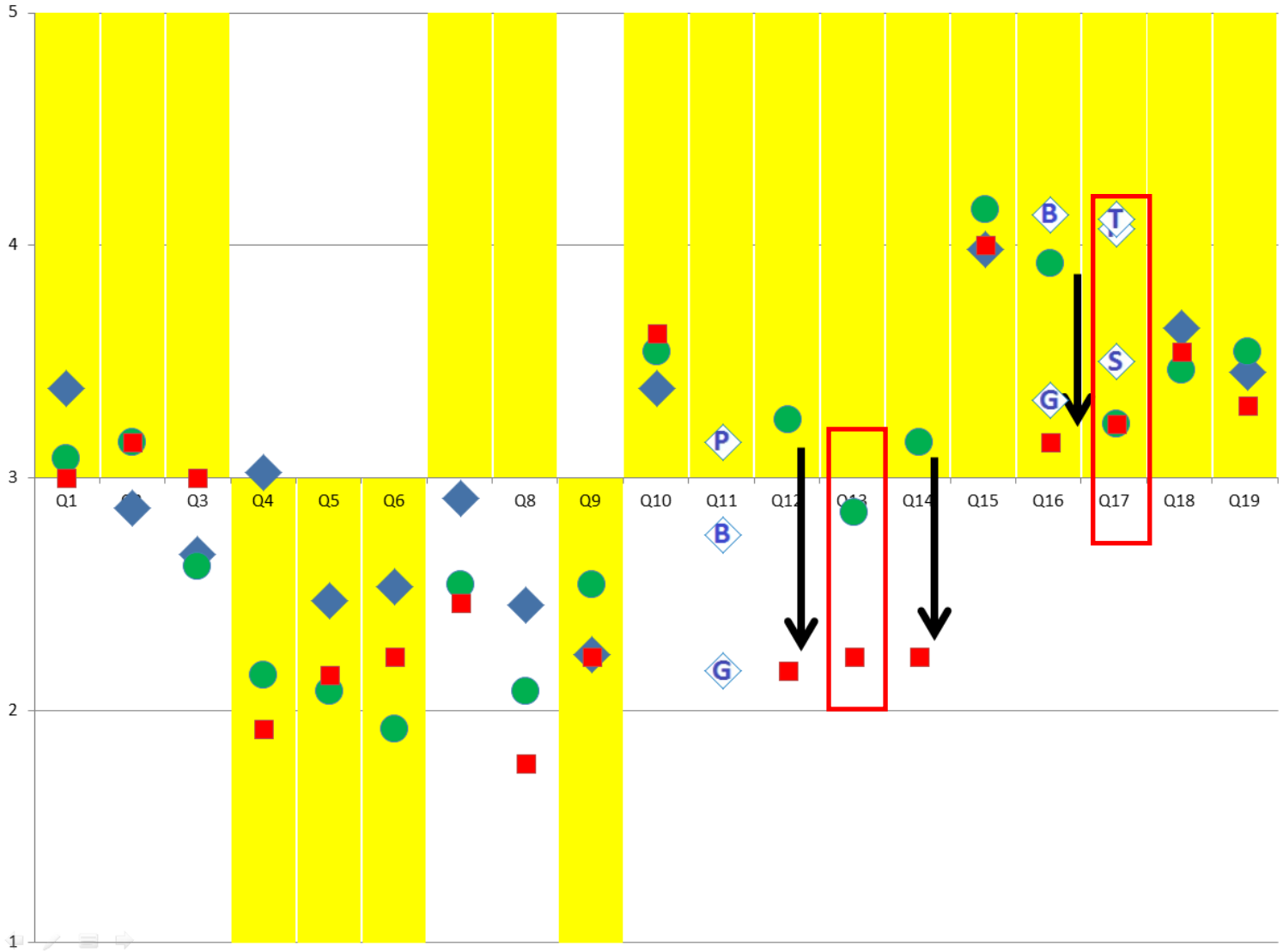


Figure 7.7. Summary of possible relationship 3: Goldstine DD students and Group A.

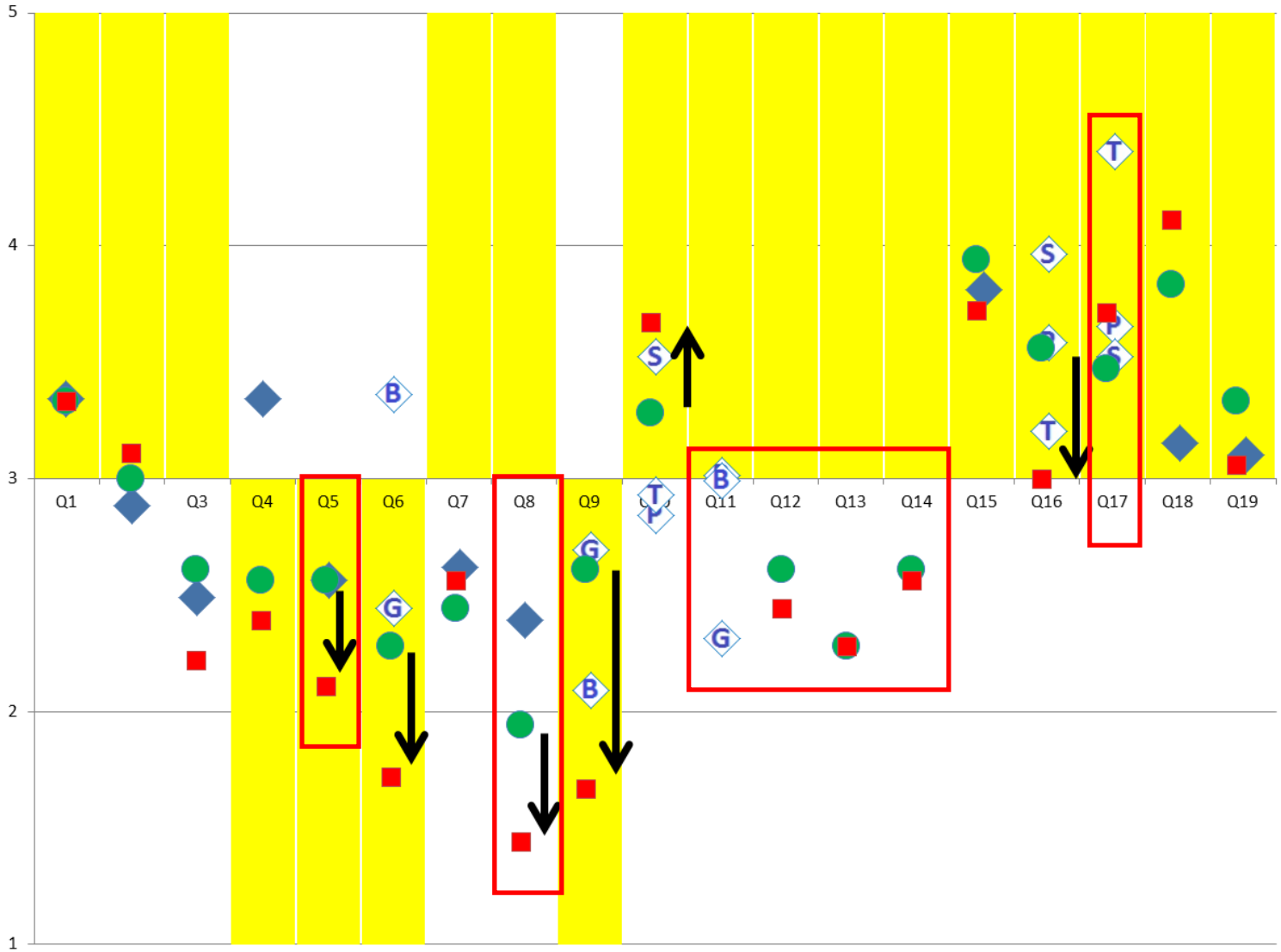


Figure 7.8. Summary of possible relationship 3: Bartik DD student outcomes and Group B.

As can be seen in Figure 7.7, three changes in attitude (Q12, 14, and 16) occurred among Goldstine DD students after participation in the DD program. Changes in Goldstine DD student attitudes for Q12 and 14 (DD student questions about the desire for a computer job) were compared with Group A attitudes for Q11 (community question about desire for a computer job) where sub-group attitudes were diverse. It can be seen that this is consistent with a pattern whereby changes in attitude occur when community sub-group attitudes are varied. Similarly, for Q16 (I think computing is very interesting), Goldstine DD student attitude change occurred where Group A sub-group attitudes were varied. Further evidence of this pattern is seen where community attitudes are uniform and no change in attitude among Goldstine DD students occurs (Q1-10, 15, 18, and 19).

Conversely, for Q13 (DD student question about the desire for a computer job), which was also compared with Q11 where Group A sub-group attitudes were diverse, a large change in mean scores is clear, but was not statistically significant; and for Q17 (My school is enthusiastic about students using computers), Group A sub-group attitudes were diverse, but there was no change in Goldstine DD student attitudes.

As can be seen in Figure 7.8, six changes in attitude (Q5, 6, 8, 9, 10, and 16) occurred among Bartik DD students after participation in the DD program. Of these six, four (Q6, 9, 10, and 16) followed the proposed relationship whereby changes in attitude among Bartik DD students occurred when Group B sub-group attitudes were diverse. For the two remaining items, Q5 (Boys are more suited than girls to work in the computer industry) and Q8 (I would like it if people thought of me as a computer geek), community attitudes were uniform, but changes in attitude occurred for Bartik DD students. For Q5, although mean scores were not statistically significantly different (possibly due to the low number of participants) Group B non-DD boys agreed with this item (*M*=3.18) while Group B non-DD girls disagreed (2.63). These results suggest the relationship could still be valid for this item. For Q8, Bartik DD students had a significant change in attitude away from program goals and away from community attitudes, which was also seen among Goldstine DD students. This suggests other factors may have influenced the outcomes of the DD program (to be discussed in the next chapter).

As can be seen in Figure 7.7, the results for Q1-4, 7, 15, 18 and 19, where Group B sub-group attitudes were uniform and Bartik DD student attitudes did not change, also suggest support for the relationship. However, Q12, 13, and 14 (DD student questions about the desire for a computer jobs, each compared with the community question about computer jobs - Q11) did not fit the pattern as there was no change in Bartik DD student attitude even though the community sub-group responses for Q11 were divided. It should be noted, that Bartik DD students initially disagreed with these three statements and continued to disagree after

participation in the DD program. Finally, Group B sub-groups had diverse attitudes about Q17 (My school is enthusiastic about students using computers), however, Bartik DD student attitudes did not change. Interestingly the same pattern was seen for Group A and Goldstine DD students suggesting that perhaps something in the DD program may have contributed to this result (discussed in the next chapter).

This third possible relationship shows the most promise. The pattern seems to indicate that changes in attitude among the DD students, after participation in the DD program, occurred to a substantial extent when there was a diversity of attitudes across community sub-groups; but, when community sub-group attitudes were uniform such changes generally did not occur.

Chapter summary

In answer to the research sub-question SQ6 (To what extent was the change in attitude among the DD program participants related to community attitudes?), the findings presented in this chapter indicate that the most consistent pattern was that changes in attitude among the DD students, after participation in the DD program, generally occurred when there was a diversity of attitudes across their community sub-groups; when community sub-group attitudes were uniform such changes generally did not occur. This relationship seemed to hold more strongly for Goldstine DD students and Group A than for Bartik DD students and Group B. There did not appear to be any consistent pattern for the other two possible relationships explored.

It has been noted that all three changes in attitude among Goldstine DD students and three of the six changes in attitude among Bartik DD students discussed in this chapter were inconsistent with the DD goals. While it might be expected that these changes in attitude were instead consistent with community attitudes, in fact, as can be seen in Figures 7.6 and 7.7, not only did some items move in a direction inconsistent with DD program goals, but DD student attitudes were even more negative than community attitudes. After participation in the DD program, DD students at both schools disagreed more strongly than all community sub-groups that computing is very interesting (Q16), and the same was true for Bartik DD students for Q8 (I would like it if people thought of me as a computer geek). While there was no statistically significant change in mean scores for Q8 at Goldstine SC, there was a clear change away from DD goals and Group A attitudes. This may indicate that other factors, perhaps related to school culture or demographics, may have influenced the outcomes of the DD program. In Chapter Eight these other factors are discussed and the conclusions and implications of this study presented.

Chapter Eight: Conclusions and Implications

This thesis began with an idea that gender and occupational or activity stereotypes held in society were discouraging females from participating in ICT. The purpose of this study was to investigate whether the attitudes of the community (parents, teachers, and peers) towards ICT were important to the outcome of an intervention program which encouraged girls to consider further study in ICT. To this end, the communities surrounding students from two secondary schools in Victoria, who were participating in the DD program in 2011, were surveyed to determine their attitudes about gender and ICT, ICT people and jobs, and both the importance and the enjoyment of computing. These community attitudes were compared with the changes in attitudes of participants in the DD program. In this chapter, after looking back on salient points from the study, conclusions are drawn. This is followed by a discussion of the limitations of the study and recommendations regarding intervention programs and further research.

Background

At the time of this study, the number of women working in ICT in Australia (DEEWR, 2014) and many other countries around the world (NCWIT, 2014) was low by comparison with the number of men. In addition, and directly related to this, some researchers believed that practical applications for technology were being developed with less consideration of the needs and interests of the female population (Margolis & Fisher, 2002); so, while more people in general, both women and men, needed to be recruited to fill ICT jobs, it was considered important to attract more women in particular so that technology design and creation could be approached from a balanced perspective (Sandberg, 2011). In an apparent vicious circle, the lack of females in ICT has been suggested as one reason why females have been discouraged from developing an interest in the area (von Hellens et al., 2001).

Previous research indicates that females begin to distance themselves from ICT around the time they enter puberty. This is evidenced in the equal interest in, and involvement with, ICT in primary school shown by boys and girls (Colley & Comber, 2003) followed by low female participation in ICT in secondary school where, in Victoria, particularly low numbers of females have enrolled in ICT units at VCE level (VCAA, 2014d). Low numbers of female enrolments in ICT related University courses, despite an increase in overall female enrolments in higher education in Australia (VTAC, 2014), provide further evidence for this trend.

As explained in the Expectancy Value Model of Achievement-Related Choices (Eccles, 2005), a child's perception of the gender and ICT stereotypes held within their cultural milieu, and

their socializers' beliefs, behaviours, attitudes, and expectations have an influence on whether they consider ICT a suitable interest. While female rejection of ICT appears to be a freely made choice, these other social forces may also be at work (Trauth, 2012).

Stereotypes are "a set of beliefs about the personal attributes of a group of people" (Ashmore & Del Boca, 1981, p.16). Mercier et al. (2006) point out that examining ICT stereotypes helps explain why only a relatively small number of women identify with ICT professionals. Stereotypes appear to override contrary evidence, with studies showing that children systematically forget behaviour that goes against the stereotype while stereotypical behaviour is remembered and serves to confirm beliefs (Pettigrew, 1981; Susskind, 2003). These findings from the literature may shed some light on why ICT interventions which try to counter stereotypes have thus far had little success.

As previously discussed, a number of stereotypes are associated with ICT. For instance, there are widely held beliefs that males are 'naturally' better at maths, science and technology (Forgasz & Leder, 2011). People who work in ICT are thought to be 'nerdy', 'geeky', or highly intelligent and obsessive about computers, an image most girls entering puberty are unlikely to embrace (Mercier et al., 2006). In addition, although ICT professionals are thought to make a lot of money (von Hellens et al., 2009), the work is considered difficult, boring (Fisher et al., 2009), bad for your health (Sheehan, 2003), and to involve long hours (Johnson & Miller, 2002) with few social interactions (Miliszewska et al., 2006).

According to the literature, stereotypical attitudes about ICT can be passed on to children through socialization (Clayton et al., 2009). Negative stereotypes and images are introduced by, and reinforced through, socializers such as the media (MMV, 2001), parents, peer groups, and educational institutions (Roger & Duffield, 2000). Such findings made community attitudes towards ICT worthy of investigation.

Furthermore, students report that parents are the major influence on their decisions about subject choices and career pathways (Lang, 2007; Gal-Ezer et al., 2009; Shashaani, 1993, Bovee et al., 2007). Both male and female students feel encouraged by their parents to gain computer skills (Shashaani, 1993, Bovee et al., 2007); however, a sizeable minority of parents have been found to believe that males were more competent in STEM and encourage their sons more than their daughters to pursue an interest in ICT (Gal-Ezer et al. 2009; Wigfield et al., 1997; Shashaani, 1993).

Other researchers have reported that the way students are socialized in schools during their formative years relates to their participation in ICT (Shashaani, 1993, Margolis and Fisher, 2002). Females strive to achieve in classes where they have a good relationship with their

teacher (Alban Metcalfe, 1981), and teachers' assumptions and expectations greatly influence their students (Margolis & Fisher, 2002). Similarly, it is reported that peers also have a strong effect on students' perceptions of ICT (Thomas & Allen, 2006); however, there is mixed evidence that they influence subject and career choice decisions (Adya & Kaiser, 2005; Gal-Ezer et al., 2009). In addition, students report that the media, which often transmits community stereotypes (Ashmore & Del Boca, 1981), is also a strong influence on their perceptions of ICT (Adya & Kaiser, 2005).

In an attempt to increase female interest in ICT and participation in ICT careers, intervention programs have been run by educational institutions and industry for more than 25 years in Australia and other western countries (Craig, Lang, & Fisher, 2008). The number of women studying or working in ICT, however, has remained fairly low and, in some cases, actually decreased (DEEWR, 2014b).

Unfortunately, ICT intervention program reports are difficult to find and tend to highlight the limited successes. Craig (2008) points out that often the assessment criteria and aims of the interventions are also missing in these reports. If experiences are not circulated and lessons are not learned from previous intervention programs, the same mistakes may be repeated over and over again and little new is learned (Bernhardt, 2006). This thesis is one part of a broader effort to address this problem.

The research question and the DD program

In this thesis the attitudes about ICT held within the community were investigated and compared with the results of a specific intervention program to determine how important community attitudes were in terms of a successful intervention. The primary research question was:

> *Are the attitudes of the community towards ICT important in terms of a successful intervention program?*

The research focused on the case of the Digital Divas intervention program (DD program) in two secondary school classes in Melbourne in 2011.

The DD program was a semester long, all-female, elective computer class run for girls in Years 8, 9 or 10. It ran from 2010 to 2012 in ten Australian secondary schools in Victoria and New South Wales. The program included curricula guidelines for a number of modules which focussed on encouraging girls' interest in ICT; and endeavoured to increase their confidence with, and enjoyment of, computers, counter stereotypes, and make the girls more aware of ICT careers (Lang et al., 2010). Role models and mentors were included in

the program design and the overall aim of the DD program was to encourage more females to undertake future study in ICT.

One aspect of the DD program was examined in this study, specifically, whether the attitudes of the wider community towards ICT were important to the success of the DD program at the two participating schools (Goldstine SC and Bartik SC). The communities were comprised of teachers at the two schools, and peers and parents of program participants (Group A from Goldstine SC and Group B from Bartik SC). A third community group (Group C) was recruited via the social networking website *Facebook* in order to investigate whether the attitudes of the two school communities were typical of the wider Victorian community. Group C was comprised of Victorian parents who had children attending Years 8 or 9 in the state.

Initial community data were gathered using questionnaires adapted from the DD program surveys to ensure that the data gathered from the community and the DD program participants could be compared. These results, and a media review of the way male and female ICT characters were portrayed in television shows, were used to inform group and email interview questions for the community. The DD research team made available for this investigation data collected during the DD program from the two Melbourne schools. The information released included demographic data on the schools, student and teacher questionnaires and interviews, and DD research team and Expert Diva (female ICT university students) observations and reflections.

Findings

In answer to the primary research question "Are the attitudes of the community towards ICT important in terms of a successful intervention program?" it was found that these attitudes were indeed important to the prospects of success in the DD program, *but not always in ways that might be expected. In particular, changes in attitude among the DD students, after participation in the DD program, generally occurred when there was a diversity of attitudes across community sub-groups (parents, teachers, and non-DD students); when community sub-group attitudes were uniform such changes mostly did not occur. Further, it seems that community attitudes, or the attitudes of any particular community sub-group, did not influence the direction of change of attitude among DD participants; rather they reflected the degree of potential or opportunity for change.*

An additional important finding was that *the direction of change of attitude among DD participants was not always towards DD program goals or community attitudes, suggesting the influence of other factors*. In addition, there were more changes in attitude among Bartik DD students (7) than Goldstine DD students (4) after participation in the DD program,

suggesting some differences between influences on the two cohorts participating in the DD program or in the delivery of the DD program at each school. These findings have important implications for how future intervention programs are devised and implemented and for future research.

If the direction of change cannot be explained in terms of community attitudes or DD goals, what other factors could have played a part? The answer here is not clear. After all, statistically significant differences between Groups A, B, and C were found for only one statement, indicating Groups A and B were typical of the Victorian community. Biographical data collected revealed some minor differences between the profiles of Group A and B, and Goldstine and Bartik DD students. While these factors look unconvincing as complete explanations for the direction of change away from DD program goals, suggestive evidence for this supposition will be expanded below under the heading *Other factors*.

As outlined in Chapter One, the primary research question was broken into six sub-questions. Findings related to each of these are restated in summary form below.

SQ 1: What are community attitudes about gender and ICT?

To facilitate understanding of how community attitudes to ICT careers are formed, a media analysis was conducted. While all the ICT expert characters examined in the television shows displayed some stereotypical ICT characteristics, other stereotypes were challenged. The traditional ICT stereotypes were seen in male characters more frequently than in female characters, and for technicians more often than for people in other ICT related jobs. Similarly, combined community attitudes (Groups A, B, and C) were mixed, with both stereotyped and non-stereotyped attitudes about gender and ICT found. While the most common response to questions about gender differences in ICT with regard to confidence, competence and interest was that there was no gender difference, where community members did perceive a gender difference, it was in favour of boys. Responses to specific statement about gender differences showed some stereotyped and some non-stereotyped attitudes. Within Group A (Goldstine SC) attitudes were consistent among sub-groups (parents, teachers, and non-DD students). Among Group B (Bartik SC), however, not all sub-groups were in agreement: Group B boys were significantly more likely than Group B girls to think that boys are better than girls at working with computers. In summary, it seems that community attitudes regarding the relationship between gender and ICT are mixed and without a clear pattern: simply put, some attitudes were stereotypical and some were not.

SQ 2: What are community attitudes about ICT people and jobs?

In the television shows reviewed, ICT professionals, particularly males, were stereotyped as unhealthy, socially isolated geeks who worked indoors. While most ICT professionals appeared to enjoy their jobs they were often confined to a basement or dark office; males were more likely than females to have jobs that required them to leave the "lab". In the examination of the combined communities, it was found that they recognised that ICT jobs were enjoyable, but difficult, paid well and required team work, which were all positive views. They also believed, however, that long hours inside at a computer were involved which may lead to health problems. They imagined ICT people to be unpopular males with few interests outside computing.

Group A sub-groups had uniform attitudes towards ICT people and jobs for all statements except with regard to future participation in ICT. Group B sub-groups had significantly different attitudes to a number of statements about ICT people and jobs. With regard to future ICT participation, at both schools, parents', non-DD boys', and non-DD girls' attitudes were diverse, with non-DD girls from both groups the least likely to agree that they would like an ICT job. These attitudes were inconsistent with one of the main goals of the DD program: to encourage future involvement in ICT among the participants (G6).

Once again, the data presents a mixed picture with a combination of stereotypical and non-stereotypical attitudes concerning ICT people and jobs present in the community.

SQ 3: What are community attitudes about the importance and enjoyment of computing?

Apart from the two ICT technicians who spent most of their time avoiding work, ICT expert characters on television appeared to find their jobs enjoyable and fulfilling. Other characters on the shows valued their contributions to the team. From the community questionnaires and interviews, positive attitudes about the importance of computing were found across Groups A, B, and C. The combined community believed that students were supported in their use of computers, particularly by their schools. In both Group A (Goldstine SC) and Group B (Bartik SC) non-DD students and teachers were positive about support from parents, and non-DD students recognised that teachers thought it was important to use computers.

All groups agreed that computers made learning more enjoyable, Group B non-DD students in particular. All these attitudes were consistent with the DD program goals. Attitudes towards computer use, and support for student computer use, were consistently positive across both communities.

SQ 4: To what extent was there a change in attitude among Digital Divas Intervention program participants? And SQ 5: To what extent was the change in attitude consistent with or different from the goals of the Digital Divas Intervention program?

The goals of the DD program (see Chapter Two) considered for this research were: to raise awareness and ignite girls' interest in ICT and ICT careers (G2); to improve their attitudes towards ICT (G3); and to increase the number of girls electing to undertake computing subjects in later years at secondary school (G6).

Changes in DD participant attitudes, either a statistically significant change ($p<.05$) or a trend ($.1>p>.05$), occurred at both Goldstine SC and Bartik SC. Four changes in attitude, which were all different from DD program goals, occurred among Goldstine DD students. The changes in attitude were that students no longer considered a job in computing (two statements) or including ICT as a VCE subject, and students agreed less strongly that computing was interesting.

Among Bartik DD students there were seven changes in attitude. Of these, four were consistent with the relevant DD program goals. These four changes were that Bartik DD students disagreed more strongly that boys were more suited to, or better at, various aspects of computing than girls, and had a greater understanding that those working in ICT can make a lot of money and do not work alone. The remaining three changes in attitude, divergent from the relevant DD program goals, were that students no longer considered including ICT as a VCE subject, were no longer sure whether computing was interesting, and disagreed more strongly that they would like to be thought of as geeks.

Also, it is noteworthy that both Goldstine and Bartik DD students changed their attitudes (in a negative direction) about future participation in ICT and how interesting students find computing. This adds further weight to the suggestion that other factors, discussed later in the chapter, were influential in the outcomes of the DD program.

SQ 6: To what extent was the change in attitude among the DD program participants related to community attitudes?

A pattern emerged from the data indicating that changes in attitude among the DD program participants were related to a diversity of attitudes across community sub-groups (parents, teachers, and non-DD students). When community sub-group attitudes were uniform, changes in attitude among DD program participants were less evident.

For items where Group A sub-group attitudes were uniform there were no changes in attitude for Goldstine DD students. Group A community attitudes were diverse for only three items:

- Group A sub-groups had diverse attitudes about wanting a job specifically in the computing industry. After participation in the DD program, Goldstine DD students no longer considered a job in computing after they finish studying or a job working with computers when they leave school.

- Group A sub-groups had diverse attitudes about whether computing is very interesting. After participating in the DD program, Goldstine DD students were significantly less likely to agree that computing is very interesting.

- Group A sub-groups had diverse attitudes about whether their school was enthusiastic about students using computers. There was no change in attitude for Goldstine DD students for this item, which does not follow the suggested pattern.

These results indicate a pattern whereby changes in Goldstine DD students' attitudes correlated with varied Group A sub-group attitudes. Where Group A sub-group attitudes were uniform, no change in attitude occurred. There was only one clear instance where this pattern was not followed. This suggests that community attitudes towards ICT were important to the outcomes of the DD program.

While there was support for the same pattern observed for Group A and Goldstine DD students, changes in attitude among Bartik DD students did not always correspond to diversity in Group B attitudes.

- For two items, Group B sub-groups had diverse attitudes about whether they would like a job specifically in the computing industry, and whether their school is enthusiastic about student using computers. Bartik DD students' attitudes did not change for corresponding items after participation in the DD program.

- For another two items, Group B sub-groups had uniform attitudes about whether boys are more suited than girls to work in the computer industry, and whether they would like it if people thought of them as a computer geek. There were, however, statistically significant changes in Bartik DD students' attitudes for these statements.

- For four items, Group B sub-groups had diverse attitudes about whether boys are better than girls at working with computers, people who work in computing work alone, a person who works in computing makes a lot of money, and whether computing is very interesting. After participating in the DD programs, Bartik DD students' attitudes had changed significantly for all these items. This provided evidence for the pattern that changes DD students' attitudes were related to a diversity of attitudes within the community.

- For the final eight items, Group B sub-group attitudes were uniform and Bartik DD students' attitudes did not change for corresponding items after participating in the DD program providing further evidence for the pattern suggesting that DD students' attitudes did not change when community attitudes were uniform.

Although not as strong as the Group A – Goldstine DD student relationship, the results from Bartik SC support the apparent pattern: when community sub-group attitudes are diverse, a change in attitude among the DD program participants is more likely; when there is a uniformity of community sub-group attitudes; changes in attitude among DD program participants are less likely. There were four instances where the suggested pattern did not hold, but the pattern was followed for all other items.

The conclusions to be drawn from this analysis are necessarily limited. Although the findings set out above are relatively clear, the underlying reasons for the identified pattern are not. When stereotypes are subscribed to by a critical mass in a community, children are easily socialised to believe the stereotype. When a diversity of attitudes is present, the stereotypes are not as powerful and allow for socialisation into different attitudes. Perhaps diversity of attitudes in the community can to some degree be read as permitting openness to non-stereotypical behaviour which is directly or indirectly internalised by students.

Other factors influencing the DD program outcomes

An important additional finding of this study is that the results presented above are perhaps insufficient in themselves to explain either the success or otherwise of the DD program or the role of community attitudes in achieving this success (the primary aim of the thesis). While a diversity of community sub-group attitudes across a school community may have provided an opportunity for a change in attitude among DD participants, the changes that were recorded were not always consistent with program goals, nor were they always consistent with community attitudes. This suggests that other factors influenced the DD participants.

After examining data released from the DD research team (specifically student and teacher surveys and interviews, and DD research team and Expert Diva observations and reflections), *it appeared the DD program made assumptions about its delivery in schools which may not have been accurate.* In Chapter Two the school ICT culture, support from Principals, and the DD program teachers at each school were discussed. To recap, while it was assumed that schools would be supportive of the DD program with a champion at management level, and this may have been the case at Bartik SC, it appeared that at Goldstine SC the Principal was too busy dealing with other matters to give the DD program the attention it required.

This is important because, while a diversity of attitudes among community sub-groups correlated with, and arguably contributed to, changes in attitude among DD program participants, it appears that the community members most closely involved with the DD program, the Principals, the DD program teachers, and even the Expert Divas, were likely to have had a strong influence, for good or bad, on the girls and subsequently on the overall success of the DD program.

It must be emphasised that skilled, enthusiastic ICT teachers were assumed to be teaching the DD program. While there was a very enthusiastic teacher at Bartik SC who was heavily involved in writing modules for the DD program, she was replaced by another teacher for half of the program while she was on maternity leave. At Goldstine SC, the teacher, Jody, was disorganised, not confident in her ICT skills, and did not appear to have the time required to devote to the program. Jody made a number of comments indicating that she believed that teenage girls would not find ICT interesting and was surprised when students were excited about the DD program modules. Despite being a woman and one experienced in working in the ICT industry, Jody may have inadvertently reinforced gender stereotypes about women in ICT.

That recruitment of DD students was left up to the schools involved must also be remembered. While it was hoped that students would be enthusiastic about participation in the DD program, at Goldstine SC some students were placed in the DD program class because they were disengaged and the school had hoped that participation in the DD program would help keep them interested in school. At Bartik SC, in some cases, students were placed in the DD program class because their first choice of class was unavailable and they had been allocated to the DD program class.

Another possibility is that the DD modules, designed to excite girls, were not as engaging as expected. It is also possible that the role models, presented in the form of guest speakers from industry as part of the modules, and Expert Divas in the classroom, did not present the models envisaged by DD program designers.

In addition, perhaps the DD program included other, implicit, assumptions that were also invalid. For example, the program appeared to assume that the students were old enough to understand job options and be thinking about careers when this may not have been the case (Nott & Arnold, 2011). On a related matter, it is possible that these students simply lacked the maturity to appreciate the messages being sent via the DD program.

Finally, Goldstine SC and Bartik SC occupied different places on the spectrum of socio-educational advantage in Melbourne; Bartik SC was more advantaged than Goldstine SC. Eccles (2006) points out, that while the development of children's achievement motivation,

and domain-specific self-concepts and subjective task values can be affected by cultural and family demographic characteristics in complex ways, these effects are almost always indirect.

Biographical data revealed that Group B (Bartik community) parents were slightly better educated than Group A (Goldstine community) parents and some Group B teachers admitted to never using computers at work or at home indicating they may have been less engaged with ICT than Group A teachers. Indeed, only a quarter of Group B teachers indicated they would like further training in ICT compared with two thirds of Group A teachers.

From the community questionnaires it emerged that, overall, Group B held slightly more stereotyped views than Group A about ICT. While not statistically significantly different, Group A attitudes were more consistent with DD program goals than were Group B attitudes. Prior to participation in the DD program, Bartik DD students also appeared to hold slightly more negative views of ICT than Goldstine DD students, for example, when asked what they might like about a job in computing, the most common response to this question, from half of the Bartik DD students, was that they could not think of anything, whereas the most frequent response for Goldstine DD students was that computing jobs would be enjoyable. In addition, initially Bartik DD students were not considering careers in computing while Goldstine DD students were at least not sure about them. It is possible that as Bartik DD students came from more privileged, better educated, and possibly more conservative backgrounds, working in ICT was not considered a suitable profession. Perhaps the reason there were more changes consistent with DD program goals among Bartik DD students than Goldstine DD students was because there was more scope for change.

Limitations of the thesis

The research for this thesis ran into some significant constraints. As there were a low number of respondents the available data limited the findings. Although all teachers at the schools were sent an explanatory email and links to the questionnaire, and letters were posted to all parents and students in the appropriate year level, the response rate was quite low. Thus a third group of participants was recruited (Group C: Victorian parents) via *Facebook* as explained in Chapter Four, but even here numbers replying were disappointingly low; because of this, the statistical analysis that could be performed was restricted. In some cases, the low number of responses contravened the assumptions of the tests (the Pearson chi-square test) and they could not be performed. In more robust tests (ANOVAs and *t*-tests) while the *p*-value was set at .05 for significance, in consideration of the low response rate, an indication of a trend ($.1 > p < .05$) was also included to allow for the identification of change in attitude.

Recruiting participants through *Facebook* introduced an additional limitation: the data pool for this group (Group C) was potentially biased because respondents needed to have some pre-existing computer literacy and only those parents with internet access and *Facebook* accounts could be recruited (Sue & Ritter, 2007). Data would not be collected from Victorian parents who did not hold *Facebook* accounts.

In addition, the fact that self-selection was involved could have resulted in those parents, and also the teachers and students, who were not interested in issues surrounding gender and computing, deciding not to participate in the study. This could mean that the attitudes of community members who are uninterested in computing, or not interested in the study, were not captured. For example, in all community groups, females answered the questionnaires more frequently than males, so the views of males may not have been captured to the same extent as females.

In this study, initially, only community members with direct contact with Years 8 or 9 students were surveyed. The rest of the community, however, also participates in the socialization of children. To help overcome this limitation the media review was included in this study as a reflection of these wider community attitudes.

Another factor to consider here is an indication from the literature (Phillips, 2010) that what is reported in a survey does not necessarily reflect reality. This suggests that there may be a discrepancy between what was reported in the questionnaires or interviews in this study and what is happening in real life. This needed to be taken into consideration when examining data collected.

Finally, with regard to the constraints of the study, it should be remembered that the data collected for this thesis provided a snapshot of two schools that participated in the DD program for one year only. While the findings provide rich data and insight, generalisations should only be made very cautiously.

Implications for future intervention programs

Two key implications for future intervention programs emerge from this study. First, the thesis provides further evidence for the view that interventions targeting only girls are insufficient to bring about change in student attitudes. To some extent, all sections of the community need to be targeted. An obvious problem here is that the authors and practitioners of specific real-world intervention programs are unlikely to have the necessary backing and resources for a comprehensive approach (which would ideally include, for example, media coverage and the involvement of celebrities), which puts much of the spotlight back onto schools. This leads to the next point.

The second key implication is that, perhaps regardless of the intervention content (e.g. modifications to the curriculum), school ICT culture and the suitability of intervention program teachers can influence the direction and degree of attitude change. This is not to say that content is unimportant, far from it; but assumptions about the delivery and reception of an intervention need to be more carefully examined before commencement. For example, when teachers are not as skilled, inspiring, or confident as hoped, negative attitudes about ICT may actually be reinforced rather than countered by the intervention.

On a general level, taken together, these observations suggest that all stakeholders – the ICT industry and educational institutions, parents, teachers, and the students themselves – need to be consulted in the development and implementation of intervention programs in order to increase the likelihood of success. But the more specific point is that programs should encompass a plausible, realistic understanding of actual likely practical implementation.

Implications for future study

As a result of this study, and in some ways mirroring the points made above, four related areas of future research have emerged. First, further investigation into the relationship between diverse community attitudes and the success of intervention programs in changing participant attitudes, not only in ICT but also in other areas such as engineering, mathematics and science, is needed to confirm the findings of this study.

Second, a more detailed and wider survey of the community could help pinpoint just where negative attitudes are held and indicate which attitudes should be focussed on to encourage more females into ICT. This need for more focused work emerges from the encouraging fact that it was found in this study that a number of community attitudes are already consistent with DD program goals. The requirement now is for a more nuanced understanding of just where the attitudinal roadblocks are, or where most progress is needed.

Third, and related to the above point, school ICT cultures and individual ICT teachers' attitudes with regard to gender and ICT stereotypes should be investigated further, as these factors influence the likely success of intervention programs.

Lastly here, and overlapping with all the previous observations, better information is needed about what goes on in, as well as what factors impact on, intervention programs. This reinforces calls for a compilation of 'lessons learned' from previous interventions. There are signs that this matter is being addressed, indeed, one can view this thesis as being a modest contribution to this goal.

Final words

As pointed out by Bernhardt (2006), technology, which affects most aspects of our lives, is not free from the prejudices of its creators. Representatives from all groups in society should be included in the design and creation of technology so that it is accessible to everyone.

The premise of ICT intervention programs, and one accepted by this writer, is that it would be preferable if more females were interested and successful in ICT, as this would help make a more equitable and better world. In order to achieve this, more should be done to, among other things, encourage girls to participate in ICT at school. To advance this aim is a challenge for society as a whole, as well as for educators in particular. At the heart of this challenge is a need to understand more deeply just what makes society (including but not limited to schools) 'tick'. This involves addressing those factors, such as stereotypes, which prevent all members of the community from reaching their full potential regardless of gender, as well as identifying features of society which seem conducive to achieving this potential.

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Appendix A

DD student and teacher survey instruments

COMPUTERS AND YOU

Digital Divas Student Commencement Survey

This survey is part of a large research study aiming to find out students' beliefs about using computers. We also want to know how computers are being used by students.

The survey is divided into FOUR parts. There are no correct or incorrect answers to the questions. We are only interested in your personal opinion. Your answers will be kept confidential.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 5490. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is **CF09/2617 - 2009001507.** You could also write to the secretary. That person's email address is: muhrec@adm.monash.edu.au

Postal address: The Secretary, Human Ethics, Monash Research Office, Building 3E, Room 111, Monash University, Clayton 3800, Victoria.

Part 1: About You

For each of the following questions, please indicate your response by filling in the spaces or by marking the appropriate boxes with a cross. e.g. ☒

1.1 Your name:

1.2 Your year level: ☐ 7 ☐ 8 ☐ 9 ☐ 10

1.3 Your home postcode:

1.4 The name of your school:

1.5 Do you regularly speak a language other than English at home? ☐ Yes ☐ No

1.6 Are you an Aboriginal or Torres Strait Islander? ☐ Yes ☐ No

For each of these questions, please cross a number from 1 to 5, where 5 = excellent, 4 = good, 3 = average, 2 = below average, 1 = weak

1.7 How good are you at computing? ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

1.8 How good would you like to be at computing? ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

1.9 How good do your parents think you are at computing? ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

1.10 Where would your computing teacher put you on this scale? ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

1.11 Where would your mother put you on this scale? ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

1.12 Where would your father put you on this scale? ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

Part 2: About You and Computers at home and at school

2.1 How many computers are there in your home? ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ More than 4

IF YOU HAVE A COMPUTER AT HOME, answer **all questions** below.

IF YOU DO NOT HAVE A COMPUTER AT HOME, go to Q2.17

2.2 Do you use the computer(s) at home? ☐ Yes ☐ No

2.3a Do you have your **own** computer at home? ☐ Yes ☐ No

2.3b If you have to share a computer at home, do you get as much time to use the computer as you would like? ☐ Yes ☐ No

2.4 Are you connected to the Internet from ANY of the computer(s) at home? ☐ Yes ☐ No

Part 3: Computers and YOU

Listed below are a number of statements. Your opinion about each is important to us.
For each statement please indicate one of the following responses:
Strongly Agree, Agree, Not Sure, Disagree, Strongly Disagree

		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
3.1	Teachers think it is important to use computers for learning	☐	☐	☐	☐	☐
3.2	If something goes wrong on the computer I panic	☐	☐	☐	☐	☐
3.3	People who work in computing work alone	☐	☐	☐	☐	☐
3.4	I am confident using the computer for communicating with people	☐	☐	☐	☐	☐
3.5	Boys are better than girls at fixing a computer	☐	☐	☐	☐	☐
3.6	I want to study computing as part of my VCE	☐	☐	☐	☐	☐
3.7	I think computing subjects are very interesting	☐	☐	☐	☐	☐
3.8	My parents encourage me to use computers	☐	☐	☐	☐	☐
3.9	I am confident that I can master anything on a computer that is needed for school work	☐	☐	☐	☐	☐
3.10	Girls are more likely than boys to ask for help when they are not sure what to do next when working on the computer	☐	☐	☐	☐	☐
3.11	Girls find it easier to work with a new program than boys	☐	☐	☐	☐	☐
3.12	I find it easy to teach myself how to use a new program	☐	☐	☐	☐	☐
3.13	Boys are more suited than girls to work in the computer industry	☐	☐	☐	☐	☐
3.14	I would like a job working with computers when I finish studying	☐	☐	☐	☐	☐
3.15	My school is enthusiastic about students using computers	☐	☐	☐	☐	☐
3.16	I feel nervous when I have to learn something new on the computer	☐	☐	☐	☐	☐
3.17	I would like it if people thought of me as a computer geek	☐	☐	☐	☐	☐
3.18	I don't understand how some people can get so involved with computers	☐	☐	☐	☐	☐
3.19	I enjoy thinking up new ideas and examples to try out on a computer	☐	☐	☐	☐	☐
3.20	I would like a job specifically in the computing industry after I finish studying	☐	☐	☐	☐	☐
3.21	If I can avoid using a computer I will	☐	☐	☐	☐	☐
3.22	Boys are better than girls at working with computers	☐	☐	☐	☐	☐
3.23	Girls are better than boys at setting up a new computer	☐	☐	☐	☐	☐
3.24	A person who works in computing often makes a lot of money	☐	☐	☐	☐	☐
3.25	I have to work hard to do well in computing	☐	☐	☐	☐	☐
3.26	I am good at fixing computer problems	☐	☐	☐	☐	☐
3.27	I feel confident using computers at home	☐	☐	☐	☐	☐
3.28	I would like a job working with computers when I leave school	☐	☐	☐	☐	☐
3.29	People who are really good at computing are popular	☐	☐	☐	☐	☐
3.30	I will work at a computer for long periods of time to successfully complete a task	☐	☐	☐	☐	☐
3.31	I like to play around with the computer	☐	☐	☐	☐	☐
3.32	Kids who are good with computers are admired	☐	☐	☐	☐	☐
3.33	Using a computer makes learning more enjoyable	☐	☐	☐	☐	☐

Listed below are examples of computer activities you might use *at home* for **school work** or **just for fun**. For each, indicate **Yes** or **No** if you use *at home* for **School work** and if you use it at home **Just for fun**.

	Activity at HOME for:	School work		Just for fun	
2.5	Games	☐ Yes	☐ No	☐ Yes	☐ No
2.6	Web browser (*e.g. Netscape, Groove, Firefox, Safari*)	☐ Yes	☐ No	☐ Yes	☐ No
2.7	Social networking (*e.g. Facebook, YouTube, online games*)	☐ Yes	☐ No	☐ Yes	☐ No
2.8	E-mail (*e.g. gmail, hotmail, yahoo*)	☐ Yes	☐ No	☐ Yes	☐ No
2.9	Word processor (*e.g. Word*)	☐ Yes	☐ No	☐ Yes	☐ No
2.10	Spreadsheet (*e.g. Excel*)	☐ Yes	☐ No	☐ Yes	☐ No
2.11	Presentation software(*e.g. Powerpoint*)	☐ Yes	☐ No	☐ Yes	☐ No
2.12	Photo/Video Editing (*e.g. Photoshop, Movie Maker*)	☐ Yes	☐ No	☐ Yes	☐ No
2.13	Web design (*e.g. HTML Coding*)	☐ Yes	☐ No	☐ Yes	☐ No
2.14	Entertainment Downloading (*e.g. Music, Movies*)	☐ Yes	☐ No	☐ Yes	☐ No
2.15	Blogging	☐ Yes	☐ No	☐ Yes	☐ No
2.16	Other computer software you use:	☐ Yes	☐ No	☐ Yes	☐ No

Software name(s):

2.17 How many hours per week do you use a computer at home?

☐ None ☐ 1-5 hours ☐ 6-10 hours ☐ 11-15 hours ☐ 16 or more

2.18 How many hours per week do you use a computer at school?

☐ None ☐ 1-5 hours ☐ 6-10 hours ☐ 11-15 hours ☐ 16 or more

2.19 What do you think you will be doing in the Digital Divas class?

2.20 Is there anything in particular you would really like to learn about in the Digital Divas class?

Part 4: Computing Careers and Jobs

4.1 Please draw a picture of someone who works in the computing industry and what they are doing:

4.2 Please describe the person and explain what is happening in the picture:

4.3 What do you think you would like about a job in computing?

4.4 What do you think you would NOT like about a job in computing?

Thank you for your participation

Post Digital Divas Student Survey

This survey is part of a large research study aiming to find out students' beliefs about using computers. We also want to know how you have found the Digital Divas program.

There are no correct or incorrect answers to the questions. We are only interested in your personal opinion. Your answers will be kept confidential.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 5490. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is **CF09/2617 - 2009001507**. You could also write to the secretary. That person's email address is: muhrec@adm.monash.edu.au
Postal address: The Secretary, Human Ethics, Monash Research Office, Building 3E, Room 111, Monash University, Clayton 3800, Victoria.

For each of the following questions, please indicate your response by filling in the spaces or by marking the appropriate boxes with a cross. e.g. ☒

Part 5: Thinking about Digital Divas

Your name:

5.1 Overall, did you enjoy being in Digital Divas? ☐ Yes ☐ No

5.2 What did you like most about Digital Divas?

Why?

5.3 What did you like least about Digital Divas?

Why?

5.4 What was the most interesting thing you learnt during Digital Divas?

Why was it interesting?

5.5 What was the most difficult activity?

What made it difficult?

Part 6: Computers and YOU

Listed below are a number of statements. Your opinion about each is important to us.
For each statement please indicate one of the following responses:
Strongly Agree, Agree, Not Sure, Disagree, Strongly Disagree

		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
6.1	Teachers think it is important to use computers for learning	☐	☐	☐	☐	☐
6.2	If something goes wrong on the computer I panic	☐	☐	☐	☐	☐
6.3	People who work in computing work alone	☐	☐	☐	☐	☐
6.4	I am confident using the computer for communicating with people	☐	☐	☐	☐	☐
6.5	Boys are better than girls at fixing a computer	☐	☐	☐	☐	☐
6.6	I want to study computing as part of my VCE	☐	☐	☐	☐	☐
6.7	I think computing subjects are very interesting	☐	☐	☐	☐	☐
6.8	My parents encourage me to use computers	☐	☐	☐	☐	☐
6.9	I am confident that I can master anything on a computer that is needed for school work	☐	☐	☐	☐	☐
6.10	Girls are more likely than boys to ask for help when they are not sure what to do next when working on the computer	☐	☐	☐	☐	☐
6.11	Girls find it easier to work with a new program than boys	☐	☐	☐	☐	☐
6.12	I find it easy to teach myself how to use a new program	☐	☐	☐	☐	☐
6.13	Boys are more suited than girls to work in the computer industry	☐	☐	☐	☐	☐
6.14	I would like a job working with computers when I finish studying	☐	☐	☐	☐	☐
6.15	My school is enthusiastic about students using computers	☐	☐	☐	☐	☐
6.16	I feel nervous when I have to learn something new on the computer	☐	☐	☐	☐	☐
6.17	I would like it if people thought of me as a computer geek	☐	☐	☐	☐	☐
6.18	I don't understand how some people can get so involved with computers	☐	☐	☐	☐	☐
6.19	I enjoy thinking up new ideas and examples to try out on a computer	☐	☐	☐	☐	☐
6.20	I would like a job specifically in the computing industry after I finish studying	☐	☐	☐	☐	☐
6.21	If I can avoid using a computer I will	☐	☐	☐	☐	☐
6.22	Boys are better than girls at working with computers	☐	☐	☐	☐	☐
6.23	Girls are better than boys at setting up a new computer	☐	☐	☐	☐	☐
6.24	A person who works in computing often makes a lot of money	☐	☐	☐	☐	☐
6.25	I have to work hard to do well in computing	☐	☐	☐	☐	☐
6.26	I am good at fixing computer problems	☐	☐	☐	☐	☐
6.27	I feel confident using computers at home	☐	☐	☐	☐	☐
6.28	I would like a job working with computers when I leave school	☐	☐	☐	☐	☐
6.29	People who are really good at computing are popular	☐	☐	☐	☐	☐
6.30	I will work at a computer for long periods of time to successfully complete a task	☐	☐	☐	☐	☐
6.31	I like to play around with the computer	☐	☐	☐	☐	☐
6.32	Kids who are good with computers are admired	☐	☐	☐	☐	☐
6.33	Using a computer makes learning more enjoyable	☐	☐	☐	☐	☐

5.7 What did you learn from the University student?

5.8 Did you learn about jobs/careers in IT? ☐ Yes ☐ No
Please explain:

5.9 Have you spoken to others about careers in IT? ☐ Yes ☐ No
If yes, provide details:

5.10 Have your ideas about girls and computers changed? ☐ Yes ☐ No
Why?

5.11 Has your confidence with computers changed? ☐ Yes ☐ No
Please explain:

5.12 Would you choose IT as a subject to study in VCE? ☐ Yes ☐ No
Why?

5.13 What have you told your friends/parents about Digital Divas?

5.14 Would you recommend Digital Divas to your friends? ☐ Yes ☐ No
Why?

5.15 What have you learnt that you are likely to use again?

Part 7: Computing Careers and Jobs

7.1 What do you think you would like about a job in computing?

7.2 What do you think you would NOT like about a job in computing?

Thank you for your participation

6475215842

Pre Digital Divas: Teacher Survey

This survey is part of a large research study aiming to find out the effect of the implementation of the Digital Divas Program.
The survey is divided into FOUR parts. There are no correct or incorrect answers to the questions. We are only interested in your personal opinion. Your answers will be kept confidential.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 5490. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is **CF09/2617 - 2009001507**. You could also write to the secretary. That person's email address is: muhrec@adm.monash.edu.au
Postal address: The Secretary, Human Ethics, Monash Research Office, Building 3E, Room 111, Monash University, Clayton 3800

Part 1: About You

For each of the following questions, please indicate your response by filling in the spaces or by marking the appropriate boxes with a cross. e.g. ☒

1.1 Name of your school:

1.2 Your gender: ☐ Female ☐ Male

1.3 Please cross which year level your Digital Divas program is aimed at: ☐ 8 ☐ 9 ☐ 10

1.4 Please list the positions of responsibilities you currently hold at your school (e.g., curriculum coordinator, year 8 coordinator, ICT coordinator, class teacher):

1.5 Including this year, how many years have you been teaching?

1.6 Including this year, how many years have you been teaching in your present school?

1.7 Including this year, how many years have you been teaching ICT?

1.8 What subjects other than ICT do you teach this year?

1.9 Please indicate all the year levels in which you have ever taught ICT: ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12

1.10 Have you ever worked in the ICT industry? ☐ Yes ☐ No
If Yes, please describe:

1.11 Before you started teaching, how many semester length units of ICT did you study at the tertiary level? _____

1.12 Was ICT education (e.g. computing method) a component of your teacher education program? ☐ Yes ☐ No

1.13 Since completing your initial education program, have you taken any subsequent tertiary study in ICT? ☐ Yes ☐ No

1.14 Since completing your initial education program, have you taken any subsequent tertiary study in ICT education? ☐ Yes ☐ No

1.15 Since completing your initial education program, have you taken any short courses or professional development (in-house or external) in teaching ICT? ☐ Yes ☐ No
If Yes, please describe:

Even though you have had some professional development in teaching ICT, would you like further professional development? ☐ Yes ☐ No
Please elaborate:

		High		Moderate		Low
1.16	How would you rate your computer skills?	☐	☐	☐	☐	☐
1.17	How would you rate your enjoyment of teaching ICT?	☐	☐	☐	☐	☐

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Part 2: Computers in Your School

2.1 Please indicate what you think is the priority given to computer education within your school? ☐ High priority ☐ Moderate priority ☐ Low priority

2.2 How are computers organised in your school? Please indicate one or more responses

- ☐ Laboratories
- ☐ Cluster/pods of machines in classrooms
- ☐ Students own or lease computers/lap-top programme
- ☐ No school computing resources
- ☐ Some other way. Please state:

_____

2.3 Please select at which levels ICT is offered as a separate subject/elective in your school: ☐ 7 ☐ 8 ☐ 9 ☐ 10

2.4 Please indicate which senior ICT subjects are offered this year at your school:

VCE Subject	Yes	No	Don't know	VET/VCAL Please list
Unit 1: IT in action	☐	☐	☐	_____
Unit 2: IT pathways	☐	☐	☐	_____
Unit 3 and 4: IT applications	☐	☐	☐	_____
Unit 3 and 4: Software Development	☐	☐	☐	_____

Part 3: Your views: Girls, boys and ICT

3.1 Who is more confident using ICT? ☐ Boys ☐ Girls ☐ No difference ☐ Depends

Please explain your response _____

3.2 Who is more competent using ICT? ☐ Boys ☐ Girls ☐ No difference ☐ Depends

Please explain your response _____

3.3 Who is more interested/enthusiastic about ICT? ☐ Boys ☐ Girls ☐ No difference ☐ Depends

Please explain your response _____

3.4 In ICT classes you have taught in the past, have you observed boys and girls behaving differently with respect to the hardware? ☐ Yes ☐ No ☐ Sometimes

Please explain your response _____

3.5 In ICT classes you have taught in the past, have you observed boys and girls behaving differently with respect to the ICT activities in which they engage? ☐ Yes ☐ No ☐ Sometimes

Please explain your response _____

3.6 To whom are the ICT tasks used in classes in your school more likely to appeal? ☐ Boys ☐ Girls ☐ No difference ☐ Depends

Please explain your response _____

3.7 It is generally believed that girls are less likely than boys to consider ICT as a career. What do you believe can be done to encourage girls' involvement and interest in ICT?

_____

Part 4: The Digital Divas Program

4.4 Please explain why you have agreed to implement the Digital Divas program?

_____

4.5 What would success in the Digital Divas program look like to you?

_____

Is there anything else?

_____

THANK YOU FOR YOUR HELP

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Post Digital Divas: Teacher Survey

This survey is part of a large research study aiming to find out the effect of the implementation of the Digital Divas Program.

There are no correct or incorrect answers to the questions. We are only interested in your personal opinion. Your answers will be kept confidential.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 5490. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is **CF09/2617 - 2009001507**. You could also write to the secretary. That person's email address is: muhrec@adm.monash.edu.au
Postal address: The Secretary, Human Ethics, Monash Research Office, Building 3E, Room 111, Monash University, Clayton 3800

For each of the following questions, please indicate your response by filling in the spaces or by marking the appropriate boxes with a cross. e.g. ☒

5.1 How many students were enrolled in your Digital Divas class? ☐☐

5.2 Which units/topics did the students enjoy the most/least?

Why?

5.3 Which units/topics did the students find most/least engaging?

Why?

5.4 With which units/topics were the students most/least confident?

Why?

5.5 What do you think was the most useful activity?

Why?

5.6 How useful was the University student?

5.7 Do you think the students understood the relationship between what they were doing in class and ICT jobs? ☐ Yes ☐ No

6538305471

5.8 Have any of the students asked for information about future ICT study? ☐ Yes ☐ No

Please give details:

5.9 In your opinion will more students go on to study ICT as a result of Digital Divas? ☐ Yes ☐ No

Why?

5.10 If you were to change the Digital Divas program what would you do differently?

Why?

5.11 Was the Digital Divas program a success? ☐ Yes ☐ No

Please elaborate:

5.12 How were the girls selected who took part in Digital Divas?

Please elaborate:

5.13 Please list all the modules you covered this semester:

Anything else?

Please write about any facet of your experience with Digital Divas that you would like to tell us about or to expand upon:

THANK YOU FOR YOUR HELP

Appendix B

Explanatory statements, consent forms, and survey instruments for community members

PARENTS

Suggested letter to parents from the principal:

Dear Parent or Guardian,

I have been approached by a PhD student from Monash University with regard to research into community attitudes about females and Information and Communication Technology. This research is associated with the Digital Divas program currently running in our school and I have offered the school's support.

The researcher is interested in parents' views. To participate in the anonymous online questionnaire, which will take approximately 15 minutes to complete, please click on the following link: www.survey.com. Completion of this anonymous survey implies consent to participate in the study.

The explanatory statement is attached. A hard copy of the questionnaire and a reply paid envelope are available upon request

If you need to contact the researcher, her details are:

Amber McLeod PhD student Faculty of Education, Clayton Campus Monash University [redacted]	A/Prof Helen Forgasz PhD student supervisor Faculty of Education, Clayton campus Monash University Wellington Road Victoria 3800 [redacted]

Thank you,

XXXXXXXX

Principal

Explanatory Statement for Parents/Guardians

Community attitudes toward girls and ICT.

November, 2010

My name is Amber McLeod and I am a PhD student in the Faculty of Education at Monash University, Clayton Campus.

Background of the research

Girls appear to lack interest in ICT by senior secondary school, and this is confirmed by higher education statistics, showing few female students enrolling in ICT courses. This translates into the workforce, in which currently, only 15% of Australian ICT workers are female. Despite many activities designed to encourage girls to continue with ICT, no significant improvement has been noted. It is suggested that the attitudes of the community toward girls and ICT have a strong influence on students' subject choices and future pathways.

The aim/purpose of the research

The aim of this study is to understand community attitudes toward girls and ICT

Possible benefits

The study will inform policy and practice through the provision of data on attitudes present in the community. If these attitudes are taken into account in future intervention programs this may impact positively on the numbers of girls choosing ICT studies and careers.

What does the research involve?

The study involves questionnaires and group interviews with students, parents and teachers in your school community in the year level that the Digital Divas elective program is run.

How much time will the research take?

Students, parents and teachers will complete one 15 minute questionnaire. They may also choose to participate in one group interview taking 30 minutes to conduct.

Can I withdraw from the research?

Being in this study is voluntary and you are under no obligation to consent to participation. You may withdraw at any time.

Confidentiality

All information will be recorded anonymously. In the writing up of the research, pseudonyms will be used, and no individual or school will be identifiable.

Storage of data

Storage of the data collected will adhere to the University regulations and be will kept on University premises in a locked cupboard/filing cabinet for 5 years.

Results

If you would like to be informed of the aggregate research findings, please contact me, as per my details below.

If you would like to contact the researchers about any aspect of this study, please contact the	You may also contact the Chief Investigator:	If you have a complaint concerning the manner in which this research <insert your project number here> is being conducted, please contact:
Amber McLeod Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	Julie Fisher Caulfield School of IT Faculty of IT Caulfield Campus PO Box 197, Caulfield East, 3145 Telephone +61 3 99032011 Facsimile +61 3 99031077 Email: [redacted]	Executive Officer, Human Research Ethics Monash University Human Research Ethics Committee (MUHREC) Building 3e Room 111 Research Office Monash University VIC 3800 [redacted]

Thank you.

Amber McLeod

Parent Consent Form

Community attitudes toward girls and ICT

NOTE: This consent form will remain with the Monash University researcher for their records

Researcher contact details:

Amber McLeod Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 Telephone: (03) 99059159 Email: amber.mcleod@monash.edu	Helen Forgasz Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 Telephone: (03) 99059194 Email: Helen Forgasz@monash.edu	Catherine Lang Swinburne Professional Learning Higher Education Division Swinburne University P.O. Box 218 Hawthorn, Victoria, 3122 Telephone: (03) 92145884

MUHREC number:

I,…….., have read the Explanatory Statement and understand the information provided by the researcher about the research project specified above. In signing this letter I give my approval:

to complete a questionnaire ☐ Yes ☐ No

to be interviewed ☐ Yes ☐ No

to be audio-taped during the group interview ☐ Yes ☐ No

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw only prior to the commencement of the observation/beginning phase of the study.

I understand that any data that the researcher extracts from the questionnaires / group interviews for use in reports or published findings will not, under any circumstances, contain names or identifying characteristics.

I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party.

Name of school ……..

Name of parent …….

Parent's signature ……..

Date ……

Community Survey: Parent

This survey is part of a large research study aiming to find out parents' beliefs about using computers. We also want to know how computers are being used by parents. There are no correct or incorrect answers to the questions. We are only interested in your personal opinion. Your answers will be kept confidential.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 5490. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is **CF09/2617 - 2009001507**. You could also write to the secretary. That person's email address is: muhrec@adm.monash.edu.au

Postal address: The Secretary, Human Ethics, Monash Research Office, Building 3E, Room 111, Monash University, Clayton 3800, Victoria.

For each of the following questions, please indicate your response by filing in the spaces or by marking the appropriate boxes with a cross. e.g. ☒

1. The name of your child's school: _____

2. About your family:

	Gender	Age	Year level	Computer skills					Enjoyment of computers				
				Very High	High	Moderate	Low	Very Low	Very High	High	Moderate	Low	Very Low
Child 1				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Child 2				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Child 3				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Child 4				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Child 5				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. About yourself:

3.1 Your gender: ☐ Male ☐ Female

3.2 Your age: ☐ Under 20 ☐20-29 ☐30-39 ☐40-49 ☐ 50-59 ☐60-69 ☐70-79 ☐80+

3.3 Do you regularly speak a language other than English at home? ☐ No ☐ Yes - which language?
_____

3.4 Highest level of education: ☐ Primary School ☐ Year 10 ☐ VCE ☐ Certificate (incl trade certificates, apprenticeships, etc) ☐ Diploma ☐Degree ☐Post Graduate

3.5 Your occupation:

☐ Not currently in paid employment	☐Technician and trades worker	☐ Sales worker
☐ Manager	☐ Community & personal service worker	☐ Machine operator or driver
☐ Professional	☐ Clerical and administrative worker	☐ Labourer

3.6 Industry in which you are currently employed:

☐ Not currently in paid employment	☐ Retail trade	☐ Administrative and support services
☐ Agriculture, forestry and fishing	☐ Accommodation and food services	☐ Public administration and safety
☐ Mining	☐ Transport, postal and warehousing	☐ Education and training
☐ Manufacturing	☐ Information, media and telecommunications	☐ Health care and social assistance
☐ Electricity, gas, water and waste services	☐ Financial and insurance services	☐ Arts and recreation services
☐ Construction	☐ Rental, hiring and real estate services	☐ Other services
☐ Wholesale trade	☐ Professional, scientific and technical services	

3.7 Your computer skills: ☐ Very High ☐High ☐Moderate ☐ Low ☐ Very Low

3.8 Have you ever studied computers? ☐ Yes Please describe (short course, professional development, etc) _____

☐ No Would you like to? ☐ Yes ☐ No

3.9 How many hours per week do you use a computer at home? ☐ None ☐1-5 ☐6-10 ☐11-15 ☐16 -20 ☐21-25 ☐26 -30 ☐31+

3.10 How many hours per week do you use a computer at work?	☐ None ☐1-5 ☐6-10 ☐11-15 ☐16 -20 ☐21-25 ☐26 -30 ☐31+
3.11 How many hours per week do you watch TV?	☐ None ☐1-5 ☐6-10 ☐11-15 ☐16 -20 ☐21-25 ☐26 -30 ☐31+

4. Your opinion about boys, girls and computers:

	Boys	Girls	No difference	Please explain your response
4.1 Who is more confident using computers?	☐	☐	☐	
4.2 Who is more competent using computers	☐	☐	☐	
4.3 Who is more interested/enthusiastic about computers?	☐	☐	☐	

4.4 Listed below are a number of statements. **Your opinion** about each is important to us.

For each statement please indicate one of the following responses:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Using a computer makes learning more enjoyable	☐	☐	☐	☐	☐
Computing professionals have a lot of outside interests	☐	☐	☐	☐	☐
Boys are better than girls at fixing a computer	☐	☐	☐	☐	☐
I think computing is very interesting	☐	☐	☐	☐	☐
Girls are more likely than boys to ask for help with computers	☐	☐	☐	☐	☐
Girls find it easier to work with a new program than boys	☐	☐	☐	☐	☐
Boys are more suited than girls to work in the computer industry	☐	☐	☐	☐	☐
My child's school is enthusiastic about students using computers	☐	☐	☐	☐	☐
People who work in computing work alone	☐	☐	☐	☐	☐
I would like it if people thought of me as a computer geek	☐	☐	☐	☐	☐
Boys are better than girls at working with computers	☐	☐	☐	☐	☐
Girls are better than boys at setting up a new computer	☐	☐	☐	☐	☐
A person who works in computing makes a lot of money	☐	☐	☐	☐	☐
People have to be very hard working if they want to work in the computer industry	☐	☐	☐	☐	☐
Computing jobs are good for people with families	☐	☐	☐	☐	☐
People who are really good at computing are popular	☐	☐	☐	☐	☐
Computing professionals work in teams	☐	☐	☐	☐	☐
I would like my daughter to have a job in the computer industry	☐	☐	☐	☐	☐
I would like my son to have a job in the computer industry	☐	☐	☐	☐	☐

4.5 Which TV shows do you watch that involve computer experts?

4.6 Can you name any females on TV who are computer experts or need computers for their jobs?

4.7 It is generally believed that girls are less likely than boys to consider computing as a career. What do you believe can be done to encourage girls' involvement and interest in computing?

4.8 If you are interested in participating in a 30 minute focus group about girls and computing careers with other parents from your child's school, please write your name and email address or phone number and you will be contacted shortly:

_____

Thank you for your participation

TEACHERS

Suggested email to teachers from the principal:

Dear Teacher,

I have been approached by a PhD student from Monash University with regard to research into community attitudes about females and Information and Communication Technology. This research is associated with the Digital Divas program currently running in our school and I have offered the school's support.

To participate in the anonymous online questionnaire, which will take approximately 15 minutes to complete, please click on the following link:

www.survey.com Completion of this anonymous survey implies consent to participate in the study.

The explanatory statement is attached. A hard copy of the questionnaire and a reply paid envelope, are available upon request

If you need to contact the researchers their details are:

Amber McLeod PhD student Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	A/Prof Helen Forgasz PhD student supervisor Faculty of Education, Clayton campus Monash University Wellington Road Victoria 3800 [redacted]

Thank you,

XXXXXXXX

Principal

Explanatory Statement for Teachers

Community attitudes toward girls and ICT.

November, 2010

My name is Amber McLeod and I am a PhD student in the Faculty of Education at Monash University, Clayton Campus.

Background

Girls appear to lack interest in ICT by senior secondary school, and this is confirmed by higher education statistics, showing few female students enrolling in ICT courses. This translates into the workforce, in which currently, only 15% of Australian ICT workers are female. Despite many activities designed to encourage girls to continue with ICT, no significant improvement has been noted. It is suggested that the attitudes of the community toward girls and ICT have a strong influence on students' subject choices and future pathways.

The aim/purpose of the research

The aim of this study is to understand community attitudes toward girls and ICT.

Possible benefits

The study will inform policy and practice through the provision of data on attitudes present in the community. If these attitudes are taken into account in future intervention programs this may impact positively on the numbers of girls choosing ICT studies and careers.

What does the research involve?

The study involves questionnaires and group interviews with students, parents and teachers in your school community in the year level that the Digital Divas elective program is run.

How much time will the research take?

Students, parents and teachers will complete one 15 minute questionnaire. They may also choose to participate in one group interview taking 30 minutes to conduct.

Can I withdraw from the research?

Being in this study is voluntary and you are under no obligation to consent to participation.You may withdraw at any time.

Confidentiality

All information will be recorded anonymously. In the writing up of the research, pseudonyms will be used, and no individual or school will be identifiable.

Storage of data

Storage of the data collected will adhere to the University regulations and be will kept on University premises in a locked cupboard/filing cabinet for 5 years.

Results

If you would like to be informed of the aggregate research findings, please contact me, as per my details below.

If you would like to contact the researchers about any aspect of this study, please contact the researcher	You may also contact the Chief Investigator:	If you have a complaint concerning the manner in which this research <insert your project number here> is being conducted, please contact:
Amber McLeod PhD student Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	Julie Fisher Caulfield School of IT Faculty of IT Caulfield Campus PO Box 197, Caulfield East, 3145 [redacted]	Executive Officer, Human Research Ethics Monash University Human Research Ethics Committee (MUHREC) Building 3e Room 111 Research Office Monash University VIC 3800 [redacted]

Thank you.

Amber McLeod

On the next two pages is a print out of the online teacher survey, which can be found at http://monasheducation.az1.qualtrics.com/SE/?SID=SV_a8KFIcIo4BLxBNq

Part 1

My name is Amber McLeod and I am conducting a research project with Associate Professor Helen Forgasz from Monash University and Dr Catherine Lang from Swinburne University towards a PhD.

This research is associated with the "Digital Divas" program run at your school and you have followed a link to this survey from an email containing an explanatory statement about the study. Completion of this voluntary, anonymous survey implies consent to participate in the study.

There are 5 pages of questions and it will take approximately 10 minutes. There are no correct or incorrect answers to the questions. I am only interested in your personal opinion. Thank you for your help.

If you have a complaint concerning the manner in which this research, number CF09/2617 - 2009001507, is being conducted please contact:

The Secretary, Human Ethics
Monash Research Office
Building 3e Room 111
Research Office
Monash University VIC 3800
Tel: 9905 5490
Email: muhrec@adm.monash.edu.au

Please enter the name of your school:

What is your gender?	What is your age?	How many years have you been teaching?	Please indicate all the year levels in which you have ever taught: 7	8	9	10	11	12
		.						

Please list your methods from your teaching qualification:	Please list the subjects you have ever taught:	Please list the positions of responsibility you currently hold at your school (e.g. Year 8 coordinator, class teacher):

	Yes	No	If yes, please describe:
Have you ever studies Information Technology at a tertiary level?			
Have you ever taken any short courses or professional development (in-house or external) in computing?			
Would you like some (more) professional development in computing?			

	Yes	No	By whom?
Have you been encouraged to use computers in your classes?			

	High		Moderate		Low
Please indicate what you think is the priority given to computer education within your school.					
How would you rate your computer skills?					
How would you rate your enjoyment of using computers in the classroom?					

	0 hours	1-5 hours	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	31+ hours
How many hours per week do you use a computer at home?								
How many hours per week do you use a computer at work (administration, class preparation)?								
How many hours per week do you use a computer in class?								
How many hours per week do you watch television?								

In classes you have taught in the past, have you observed boys and girls behaving differently with respect to:

	Yes	No	Sometimes	Please explain your response
the computer hardware?	○	○	○	
the computing activities in which they engage?	○	○	○	
any other aspect of computing?	○	○	○	

	Boys	Girls	No difference	Please explain your response
Who is more confident using computers?	○	○	○	
Who is more competent using computers	○	○	○	
Who is more interested/enthusiastic about computers?	○	○	○	
To whom are the computing tasks used in your classes more likely to appeal?	○	○	○	

Listed below are a number of statements. Your opinion about each is important to us.
For each statement please indicate one of the following responses:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Using a computer makes learning more enjoyable	○	○	○	○	○
Computing professionals have a lot of outside interests	○	○	○	○	○
Boys are better than girls at fixing a computer	○	○	○	○	○
I think computing subjects are very interesting	○	○	○	○	○
Girls are more likely than boys to ask for help with computers	○	○	○	○	○
Girls find it easier to work with a new program than boys	○	○	○	○	○
Boys are more suited than girls to work in the computer industry	○	○	○	○	○
My school is enthusiastic about students using computers	○	○	○	○	○
People who work in computing work alone	○	○	○	○	○
I would like it if people thought of me as a computer geek	○	○	○	○	○
Boys are better than girls at working with computers	○	○	○	○	○
Girls are better than boys at setting up a new computer	○	○	○	○	○
A person who works in computing makes a lot of money	○	○	○	○	○
People have to be very hard working if they want to work in the computer industry	○	○	○	○	○
Computing jobs are good for people with families	○	○	○	○	○
People who are really good at computing are popular	○	○	○	○	○
Computing professionals work in teams	○	○	○	○	○
My female students' parents want them to use computers	○	○	○	○	○
My male students' parents want them to use computers	○	○	○	○	○

Which TV shows do you watch that involve computer experts?

Can you name any females on TV who are computer experts or need computers for their jobs?

It is generally believed that girls are less likely than boys to consider computing as a career. What do you believe can be done to encourage girls' involvement and interest in computing?

Anything Else?
Please write about any facet of your experience of using computers in your classes that you would like to tell us about or to expand upon:

If you are interested in participating in a 30 minute focus group about girls and computing careers with other teachers from your school, please enter your name and email address or phone number and you will be contacted shortly:

STUDENTS

Suggested letter to students from the principal:

Dear student,

Monash University would like to do some research into community attitudes about girls and Information and Communication Technology. This research is associated with the Digital Divas program currently running in our school and I have offered the school's support.

Included are the explanatory statements for yourself and your parents/guardians, consent forms that must be completed by you and a parent/guardian, a copy of the anonymous questionnaire and an addressed, reply paid envelope.

If you and your parents/guardians agree to your participation in the study, please fill out the questionnaire please return it (with the signed consent forms) in the envelope provided by the xth of December.

If you need to contact the researchers, their details are:

Amber McLeod PhD student Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	A/Prof Helen Forgasz PhD student supervisor Faculty of Education, Clayton campus Monash University Wellington Road Victoria 3800 [redacted]

Thank you,

XXXXXXX

Principal

Explanatory Statement for Parents

Community attitudes toward girls and ICT.

November, 2010

My name is Amber McLeod and I am a PhD student in the Faculty of Education at Monash University, Clayton Campus.

Background of the research

Girls appear to lack interest in ICT by senior secondary school, and this is confirmed by higher education statistics, showing few female students enrolling in ICT courses. This translates into the workforce, in which currently, only 15% of Australian ICT workers are female. Despite many activities designed to encourage girls to continue with ICT, no significant improvement has been noted. It is suggested that the attitudes of the community toward girls and ICT have a strong influence on students' subject choices and future pathways.

The aim/purpose of the research

The aim of this study is to understand community attitudes toward girls and ICT.

Possible benefits

The study will inform policy and practice through the provision of data on Attitudes present in the community. If these attitudes are taken into account in future intervention programs this may impact positively on the numbers of girls choosing ICT studies and careers.

What does the research involve?

The study involves questionnaires and group interviews with students, parents and teachers in your school community in the year level that the Digital Divas elective program is run.

How much time will the research take?

Students, parents and teachers will complete one 15 minute questionnaire They may also choose to participate in a group interview taking 30 minutes to conduct.

Can I withdraw from the research?

Being in this study is voluntary and you are under no obligation to consent to participation. However, if you do consent to participate, you may only withdraw prior to the commencement of the observation/beginning phase of the study.

Confidentiality

All information will be recorded anonymously. In the writing up of the research, pseudonyms will be used, and no individual or school will be identifiable.

Storage of data

Storage of the data collected will adhere to the University regulations and be will kept on University premises in a locked cupboard/filing cabinet for 5 years.

Results

If you would like to be informed of the aggregate research findings, please contact me, as per my details below.

If you would like to contact the researchers about any aspect of this study, please contact the researcher:	You may also contact the Chief Investigator:	If you have a complaint concerning the manner in which this research <insert your project number here> is being conducted, please contact:
Amber McLeod PhD Student Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	Julie Fisher Caulfield School of IT Faculty of IT Caulfield Campus PO Box 197, Caulfield East, 3145 [redacted]	Executive Officer, Human Research Ethics Monash University Human Research Ethics Committee (MUHREC) Building 3e Room 111 Research Office Monash University VIC 3800 [redacted]

Thank you.

Amber McLeod

Explanatory Statement for Students

Community attitudes toward girls and ICT.

November, 2010

My name is Amber McLeod and I am a PhD student from Monash University, in the Department of Education.

The aim/purpose of the research

I am conducting research into students' attitudes towards girls and ICT studies and ICT careers. I would like to understand what encourages, or discourages, girls to study ICT subjects, and to pursue ICT careers.

What does the research involve?

Participation in this study will involve completing one short questionnaire, and, if you are interested, taking part in a group interview with other students from your year level.

Can I withdraw from the research?

Being in this study is voluntary and you are under no obligation to consent to participation. You may withdraw at any time.

Confidentiality
In the writing up of this research, no schools or individuals will be identifiable, as pseudonyms will be used.

If you would like to contact the researchers about any aspect of this study, please contact the researcher	You may also contact the Chief Investigator:	If you have a complaint concerning the manner in which this research <insert your project number here> is being conducted, please contact:
Amber McLeod PhD Student Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	Julie Fisher Caulfield School of IT Faculty of IT Caulfield Campus PO Box 197, Caulfield East, 3145 [redacted]	Executive Officer, Human Research Ethics Monash University Human Research Ethics Committee (MUHREC) Building 3e Room 111 Research Office Monash University VIC 3800 [redacted]

Thank you.
Amber McLeod

Parent/Guardian Consent Form

Project title: Community attitudes toward girls and ICT

NOTE: This consent form will remain with the Monash University researcher for their records

Researcher contact details:

Amber McLeod PhD student Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	PhD supervisor: Helen Forgasz Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	PhD supervisor: Catherine Lang Swinburne Professional Learning Higher Education Division Swinburne University P.O. Box 218 Hawthorn, Victoria, 3122 [redacted]

MUHREC number:

In signing this letter I give permission for my child to take part in the Monash University research project specified above. I have read the Explanatory Statement, and have a copy for my records.

I allow my child:

to complete a questionnaire	☐ Yes	☐ No
to be interviewed	☐ Yes	☐ No
to be audio-taped during the group interview	☐ Yes	☐ No

I understand that my child's participation is voluntary, that they can choose not to participate in part or all of the project, and that they can withdraw at any time.

I understand that any data that the researcher extracts from the questionnaire / group interview for use in reports or published findings will not, under any circumstances, contain names or identifying characteristics.

I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party.

Name of school ……..

Name of student ……

Parent/Guardian signature ……..

Date ……

Student Consent Form

Project title: *Community attitudes toward girls and ICT*

NOTE: This consent form will remain with the Monash University researcher for their records

Researcher contact details:

Amber McLeod Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	Helen Forgasz Faculty of Education, Clayton Campus Monash University Wellington Road, Victoria, 3800 [redacted]	Catherine Lang Swinburne Professional Learning Higher Education Division Swinburne University P.O. Box 218 Hawthorn, Victoria, 3122 [redacted]

MUHREC number:

I, ……., have read the Explanatory Statement and understand the information provided by the researcher about to the research project specified above. In signing this letter I give my approval:

to complete a questionnaire	☐ Yes	☐ No
to be interviewed	☐ Yes	☐ No
to be audio-taped during the group interview	☐ Yes	☐ No

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any time.

I understand that any data that the researcher extracts from the questionnaires / group interviews for use in reports or published findings will not, under any circumstances, contain names or identifying characteristics.

I understand that any information I provide is confidential, and I will not be identifiable in any reports on the project.

Name of school ……..

Name of student ……

Signature of student ……

Parent/Guardian signature …….

Date …….

Community Survey: Student

This survey is part of a large research study aiming to find out students' beliefs about using computers. We also want to know how computers are being used by students. There are no correct or incorrect answers to the questions. We are only interested in your personal opinion. Your answers will be kept confidential.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 9905 5490. You can then ask to speak to the secretary of the Human Ethics Committee and tell him or her that the number of the project is **CF09/2617 - 2009001507**. You could also write to the secretary. That person's email address is: muhrec@adm.monash.edu.au

Postal address: The Secretary, Human Ethics, Monash Research Office, Building 3E, Room 111, Monash University, Clayton 3800, Victoria.

For each of the following questions, please indicate your response by filing in the spaces or by marking the appropriate boxes with a cross. e.g. ☒

1. The name of your school: _____

2. About yourself

2.1 Gender?	2.2 Age?	2.3 Year Level?	2.4 Do you regularly speak a language other than English at home? ☐Yes ☐ No
☐ Male ☐ Female			If yes, which language?

For each of these questions, please indicate one of the following responses:	**Excellent**	**Good**	**Average**	**Below average**	**Weak**
2.5 How good are you at computing?	☐	☐	☐	☐	☐
2.6 How good would you like to be at computing?	☐	☐	☐	☐	☐
2.7 Where would your teachers put you on this scale?	☐	☐	☐	☐	☐
2.8 How competent is your mother with computers?	☐	☐	☐	☐	☐
2.9 How competent is your father with computers?	☐	☐	☐	☐	☐
2.10 How competent are your teachers with computers?	☐	☐	☐	☐	☐

	None	**1-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31+**
2.11 How many hours per week do you use a computer at home?	☐	☐	☐	☐	☐	☐	☐	☐
2.12 How many hours per week do you use a computer at school?	☐	☐	☐	☐	☐	☐	☐	☐
2.13 How many hours per week do you watch TV?	☐	☐	☐	☐	☐	☐	☐	☐
2.14 How many hours per week do you use the internet on your mobile phone?	☐	☐	☐	☐	☐	☐	☐	☐

2.15 List the main programs you use (e.g. You tube, Excel, Movie maker, games)_____

2.16 Do you use computers for homework? ☐ Always ☐ Occasionally ☐ Never ☐ If I have to

2.17 List the classes in which you use computers: _____

2.18 In the future, where would you like to learn more about computers (you may tick more than one box)

☐ VCE ☐ University ☐ TAFE ☐ Short course ☐ I don't want to learn anything about computers

3. Boys, girls and computers

	Boys	**Girls**	**No difference**	**Why?**
3.1 Who is more confident using computers?	☐	☐	☐	
3.2 Who is more competent using computers?	☐	☐	☐	
3.3 Who is more interested/ enthusiastic about computers?	☐	☐	☐	

3.4 Which TV shows do you watch that involve computers?

3.5 Can you name any females on TV who are computer experts or need computers for their jobs?

3.6 Listed below are a number of statements. Your opinion about each is important to us.

For each statement please indicate one of the following responses:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Using a computer makes learning more enjoyable	☐	☐	☐	☐	☐
Computing professionals have a lot of outside interests	☐	☐	☐	☐	☐
Boys are better than girls at fixing a computer	☐	☐	☐	☐	☐
I think computing is very interesting	☐	☐	☐	☐	☐
Girls are more likely than boys to ask for help with computers	☐	☐	☐	☐	☐
Girls find it easier to work with a new program than boys	☐	☐	☐	☐	☐
Boys are more suited than girls to work in the computer industry	☐	☐	☐	☐	☐
My school is enthusiastic about students using computers	☐	☐	☐	☐	☐
People who work in computing work alone	☐	☐	☐	☐	☐
I would like it if people thought of me as a computer geek	☐	☐	☐	☐	☐
Boys are better than girls at working with computers	☐	☐	☐	☐	☐
Girls are better than boys at setting up a new computer	☐	☐	☐	☐	☐
A person who works in computing makes a lot of money	☐	☐	☐	☐	☐
People have to be very hard working if they want to work in the computer industry	☐	☐	☐	☐	☐
Computing jobs are good for people with families	☐	☐	☐	☐	☐
People who are really good at computing are popular	☐	☐	☐	☐	☐
Computing professionals work in teams	☐	☐	☐	☐	☐
Teachers think it is important to use computers	☐	☐	☐	☐	☐
My parents encourage me to use computers	☐	☐	☐	☐	☐
I would like a job specifically in the computing industry	☐	☐	☐	☐	☐

3.7 Please draw a picture of someone who works in the computing industry. Draw them doing something.

3.8 Please describe the person and explain what is happening in the picture:

3.9 What do you think you would like about a job in computing?

3.10 What do you think you would NOT like about a job in computing?

3.11 Do you think your teachers or parents treat you differently when it comes to computers because of your sex? ☐Yes ☐No

If yes, in what way?

3.11 Do you think your teachers or parents treat you differently when it comes to computers because of your sex? ☐Yes ☐No

If yes, in what way?

3.12 If you are interested in participating in a 30 minute focus group about girls and computing careers with other students from your school, please enter your name and email address or phone number and you will be contacted shortly:

Thank you for your participation

Appendix C

Group interview transcript

Thursday 22nd September 2011, 11:00am Both parents are female.

Interviewer: Are there any adjectives that are on there that, well are there any adjectives that you think have been left out? Any adjectives that immediately come to mind when you think of IT experts that aren't on that list?

Parent 1: Men in black uniforms – I suppose, ha, ha.

Parent 2: Persistent.

Interviewer: Persistent, OK, mmm ..

Parent 2: Need to be persistent.

Interviewer: Are there any adjectives you are wavering on?

Parent 2: Ahh, to me there were a couple because my husband is in IT, so ... I, you know, when I think of IT expert I think of him, he immediately pops into my head, so um... He does, generally, normally I wouldn't consider IT experts to be a particular way because I know him -hmmm sort of falls in one direction. Yeah

Interviewer: OK.

Parent 1: I was thinking "logical".

Interviewer: Logical, OK, alright that was a good one ... Now you both have daughters in Year 8 or 9 at school, so with your daughter in mind, I want you to go through and tick the "My Child" column.

Parent 2: I have two daughters.

Interviewer: I have more bits of paper if you want to do two.

Parent 2: OK because they are very different.

Interviewer: You can put them next to each other, or combine them. Do either of you have a son?

Parent 2: Yes, but not that age yet.

Parent 2: Can I put an initial above each line so I know which one I am talking about?

Interviewer: Yes, that's fine.

Interviewer: Alright, so now looking at those two lists – you've got your expert and your child, you can sort of see visually from that how well your child matches up to your idea of an IT expert but have you thought in the past "My child would be suited to IT, or have you ever thought "My child would be suited to a particular career", or has it become obvious to you what your child ...

Parent 1: Yes.

Interviewer: So can you tell me about that?

Parent 1: My child she'd be interested in teaching younger people or being an optician – she's scientifically tendencies.

Interviewer: OK, and how about you?

Parent 2: I think one of them, the younger one, she wants to be a Vet - very, very, that's what she wants to do, she loves animals so that's what she wants to do and she's smart enough so she's doing well. The other one is much more creative and she is looking towards textiles, she's not sure what she wants to do yet but I can see her in computers.

Interviewer: OK.

Parent 2: Because she likes to design games and like Powerpoint, she makes all sorts of things in Powerpoint and very creative.

Interviewer: OK and I guess you can see that in your husband as well?

Parent 2: Yes, actually No, he's not creative at all.

Interviewer: He's not? So how much of an influence do you think your husband has been on that daughter in particular who's doing games?

Parent 2: Umm, I don't know to be honest, they both easily use computers, they – no one in our family is scared to give it a go and trying different things, but I don't know about the creative side, he's not creative in that respect.

Interviewer: OK, well I guess that sort of leads me on to what I really want to know, which is, as a parent how much influence do you think you have on your child's interests?

Parent 1: I think you have quite a big guiding light on that because it's what you've exposed your children to, so if they're not exposed to something they don't know they've got an interest, so I'd say it was high.

Parent 2: I agree, I think giving your child opportunities and letting them try different things or go different places and see what's available. But, we've always had lots of computers at home and always played ever since they were really small, so they are just part of our life.

Interviewer: So, you think that they are, you can see they are interested in computers but their interest came about because it was there and available.

Parent 2: Yes.

Interviewer: How about with you (Parent 1)?

Parent 1: Well, my oldest is 31 so she went through school with no computers.

Interviewer: Right.

Parent 1: Umm, and then we've got a couple that are a bit younger, so I think .. our interests ... I'm an ex Scout Leader, so we like doing outdoorsy type stuff, trying to give them the balance – but because nowadays with the fact that you have to be computer literate for school, even the basic stuff, umm .. I've sort of taken an interest, when I came back to work ten of years ago, I did just a basic IT Certificate just to say "OK, how do you turn the computer and where do you go from here. So, yes, there's exposure in that if the tools get to you, you get the information basically.

Interviewer: So, do you encourage or, let me think, do you ever do IT things with your kids that have nothing to do with school?

Parent 1: Oh yes.

Parent 2: Yes.

Interviewer: So what kind of things do you do?

Parent 1: Umm, we do a little bit of designing games, umm – as in sort of colour type things using tablets and things like that, bringing out that artistic side of that and some desktop publishing type of things. Umm, that sort of thing away from them just being on Facebook or Googling information or that sort of stuff, so ...

Interviewer: OK.

Parent 2: We do games, we do lots of games.

Interviewer: Do you play them with your kids, or do you play them individually?

Parent 2: No, no, we play them together. The girls want to play sport but he likes Mindcraft, he plays those sorts of games and my daughters, we play games together, so Zoo and word games and all sorts of things but we do a lot of Publisher and Word and those sort of documents because I come from a software background as well so we do all sorts of word games.

Interviewer: So, when you are talking about using "Word" or "Publisher", what are you making in those that's not homework?

Parent 2: We paint, we draw.

Parent 1: Story writing ...

Parent 2: Yes, my daughter likes to do that too.

Parent 1: My daughter really likes the diagram programs like "inspiration" where you can do mind-mapping and those sorts of things, so you can talk to the girl and change it and things like that.

Parent 2: I mean, a couple of things I've had to show her because she hasn't known how to do them, but once she knows, like once she's got it, she .., I just let them, like we do a lot of games. We like to play.

Parent 1: Things like the moviemaker and things like that.

Parent 2: Yes.

Parent 1: That are right into that, giving their personal experiences into them and …

Parent 2: They like doing videos and stuff.

Parent 1: Yep.

Parent 2: Oh, and Skype too, Skype accounts and …

Interviewer: Wow, that's good. Do you think your kids are unusual? Your girls, in having so much exposure in IT?

Parent 1: I think that, um, they are not unusual but they are more interested in wanting to know how to do it and they see the benefits of being, sort of computer literate.

Parent 2: I don't see them as being different because I think most kids now have exposure especially from Primary School, they all learn at school now, so I don't think it's unusual.

Interviewer: OK, now you said you have a son also.

Parent 1: Yes.

Interviewer: How old is your son?

Parent 1: He's 23.

Interviewer: OK, so he would have used computers at school?

Parent 1: Yes.

Interviewer: Did you notice any difference in attitude towards computers between your son and your daughters?

Parent 1: Probably he was a little more into the games, especially shoot 'em up games and things like that, but he is now an electrician with Metro, so he was always into that sort of hands on stuff but interesting in the programming and that sort of stuff as well.

Interviewer: Do you think you, I want to say "allowed him", but I don't mean that, encouraged him or perhaps unconsciously was more accepting of him using computers than of your daughters, or you think you had absolutely no difference in the way you …

Parent 1: No difference – having four kids I could say the oldest one is a Hippie, the next one is a Princess, and my son's the practical one and this one's going to be the academic one, so ... I think it goes a lot down to their personalities and what they are interested in.

Interviewer: Thank you, would you be happy if your kids did end up in IT jobs?

Parent 2: Yes.

Interviewer: You would? Because?

Parent 2: Because it's, um, it's always growing and they can continue to learn – it's not something that's stagnant and they can, um, there's so many different areas in IT that they can go into that there's always opportunities.

Interviewer: Mmm, OK, what do you think?

Parent 1: I'm the opposite, I would sort of prefer them to be away from gizmo dependent I suppose sort of getting back to the fact that what happens when the power goes off and I know my son is terrible, you know, the power went off one time – it was off for about three days - it was like "what do we do", he was so .. No, I feel that getting back to "real" sort of things .

Interviewer: OK, so when you think of an IT job – what do you think of what they do from day to day? What would be a day for an IT expert?

Parent 1: Having to put up with people's anger – like "my computer won't do this" and that, not necessarily .. but you know. But, basically having to educate people on how to do basic maintenance on the computer, how to ... the computer, like sort of maintain it so it works at its optimum. How to basically install and remove programs. Basically, if you are an organised person, you should be aware of what you've got on your computer, what's not necessary anymore and sort of be able to follow up and correct it, you know, clean things up and I think a lot of us because it's easier to let your email keep going until it starts screaming at you there's no more room on your email and things like that. Yeah, that sort of thing and um yeah, so basically an educator's role and also having to understand how the basic thing works so that when you do get glitches you know how to sort it out.

Interviewer: OK, so you're describing very much an IT support/technician type job.

Parent 1: Yeah.

Interviewer: What do you think about when you think about an IT Expert?

Parent 2: The range is huge. Network support, computer support. There's games, you know, making games. There's developing, programming, all sorts of different areas that you can go into, so it's like a language, learning a language and creating something from that, so there are so many different aspects I don't believe ... and different sorts of people do IT because there is all different realms they can go into.

Interviewer: Do you think of IT as a creative job, or not really?

Parent 1: I can't see that it isn't because my future son-in-law has been working for MyKey and so .. might be a very long contract ...and, um, but then again I look at him as a personality, very quiet, introverted type person, umm, so yes it is creative in that way, that you are problem solving. I think it could be very frustrating.

Interviewer: Do you think, this has nothing to do with it, do you think he's a quiet type person because he is in IT or do you think he was attracted to IT because he's a quiet type person?

Parent 1: I think he was attracted because he was a quiet person.

Interviewer: Right, so his job hasn't changed him you don't think, that was his personality.

Parent 2: That's funny, because my husband is completely the opposite to that, he's outgoing, he's funny, he's one of the funniest people you've met, but .., he's very much a people's person but he's been .... software and there's been lots of different people that I've come across in IT, so it's interesting. But it is very much the perception out there that IT person are very much dour and so ....

Interviewer: And there's a reason for the perception.

Parent 2: Yes.

Interviewer: OK, that's very interesting. Imagine that at your daughters' school – do they both go to co-ed schools?

Parent 1: Yes.

Interviewer: There is an all-girl computer class elective…

Parent 2: There is actually.

Interviewer: …and they – the idea is to give girls more confidence, encourage them to continue with IT, that kind of thing, would you encourage your daughter to take this class?

Parent 2: Yes, I would.

Interviewer: You would, why?

Parent 2: Because I think it is important for women to be out there in the world doing things that supposedly are "men" jobs. I think that women can do anything and I encourage my girls to be that way – just go for it. Especially if they are good at it – my oldest, Beth, she's really ... she finds it easy, so why not encourage someone to do something that they like and are good at, you know?

Interviewer: Right, so, I suppose for you because you can see your daughter in that role, that you think this would be a good idea, but how about you, Parent 1?

Parent 1: Only if she wanted to do it, and I really think she wouldn't because she's got enough confidence with the IT programs and stuff – that she's more interested in, basically how the sun goes round -- like science, maths, those sort of things – the actual hands-on type stuff – poking at cells in test tubes and that sort of stuff.

Interviewer: Yep, so for you, Parent 2, because you can clearly see this pathway, if you encouraged your daughter to take this class and she took this class – I don't know what they would do in it, but presumably some sort of programming, and she came home and she said "I hate it", what would you do?

Parent 2: I would say "fine" – she's allowed to have her feelings, so if she doesn't like something, I'm not going to make her do it even though I think it could be good for her. We'd discuss it obviously and you need to find out as well whether or not it was just that particular thing that she was doing that she didn't like, as opposed to the complete subject. So, you know, sometimes you can do a type of subject like science and you do biology and you really love biology but you hate physics. So it is that sort of thing that ..there are so many aspects and I would try and encourage her to continue if I felt that it was just one part of the topic, you know what I mean.

Interviewer: OK, and Parent 1, if your daughter had chosen the class and then came home and said "I hate it" what would you do, what would you say?

Parent 1: Well basically, I would encourage her to finish that year or semester level so at least you got to there not just stop and as Parent 2 mentioned there would be discussion about which topic and why it is distressing her because is it just so boring, or plain, or is it that she just doesn't

understand it. So if it is that she doesn't understand it, then you can sit down and sort of explore that area and if it is boring then you have to sort of flip it around to say "OK, this may seem very mundane but at the end of this can you see that once you have done this you can then use it as a tool for this, that" .... that sort of encouragement but if it came again the next year and she said "do I have to do that again?" it would be ...

Interviewer: What do you think about – I know your daughters aren't there yet – but what do you think about VCE subjects, IT subjects, do you know anything about them.

Parent 2: I don't know anything whatsoever.

Interviewer: Right .

Parent 2: Do you know what's available?

Parent 1: At the school she goes to they do have sort of occasional things – is it "Cisco" and those sort of things – I think that if, by the time VCE is coming along that there is sort of basically a path that if they decided they wanted to go on and I thought it was relevant, I would encourage her to do that, but if the path she wanted to go along was still say, "airy-fairy" and generalised, I would be saying get back to your basic subjects so you can still make your decisions later on.

Interviewer: Right, and do you think that when your kids finish High School, if they haven't decided on their own to go and do, I don't know, something like a Uni course or a TAFE course that involves IT, do you think their general IT skills will be enough when they finish High School?

Parent 2: Yes, mine will, my kids are very good so I wouldn't be concerned at all that they could get along well.

Interviewer: They've got enough to get along in society and be a vet or do teaching, or ...

Parent 1: I'd be more concerned about their level of grammar and spelling ... Yes, isn't it shocking .... and that they could add up things in their head and those sorts of things – the basic stuff. Because it does get overlooked because they are given a calculator from day one.

Interviewer: Mmmmm, gosh you're giving me some great stuff, you two. Alright, now I think that's all I had on that ... now what I've got here ... we're just going to watch a little bit of NCIS, I think that you both know about it, but I don't know if you did Parent 1 – you put down that when you were talking about TV shows you put down News Readers which didn't occur to me and a whole lot of people said that reporters, news readers, etc. use computers in their job and that didn't even occur to me – so that was great, but, have you seen this show before?

Parent 1: Absolutely.

Interviewer: So, we are going to have a look at a really short clip and it is showing the male and female computer experts and I want you to think about what kind of message do you get about IT jobs and IT people when you see a show like this on TV because obviously this is where people get their ideas from.

Parent 2: Yes, correct.

Interviewer: I put it on the big screen because my lap top isn't very good ...

VIDEO

Interviewer: So, what kind of message do you get about IT people or jobs from ...

Parent 1: (Laughter).

Interviewer: Well, for example what do you think of the female character.

Parent 2: I like her, Abby is good, she's got personality and she's an individual.

Parent 1: She's determined and dogged so she will get to the bottom of whatever.

Parent 2: And she's smart, she smart and it's obvious that she's smart and she doesn't care that everyone knows that she's smart and that's cool.

Interviewer: Do you think she is a typical IT female, do you think you would meet her if you went to an IT workplace?

Parent 2: No.

Interviewer: No? What kind of person do you think you would meet here?

Parent 2: A mixture of people, but I don't know, it depends - I suppose if you went to Google, or you went to one of those offices you might meet someone like that but, I don't know, the tendency is to be more business-like here.

Parent 1: Well in the show, Abby is a forensic person, she's using the biology that sort of thing and using her computer equipment as a tool whereas the Geek "Tim" is the computer programmer, he does the hacking, he goes in and finds out where things are coming, so their roles are completely different but then again complementary and this is what this is showing us, you know, that the two various areas can interact and they respect each other's fields.

Interviewer: So, do you think Abby is an IT expert?

Parent 1: Oh yeah she is, she's clever.

Interviewer: But she's got other areas.

Parent 1: That are her speciality.

Interviewer: OK and you called McGee a geek?

Parent 1: Yeah.

Interviewer: Do you think he is geeky?

Parent 1: I like him as a character, umm, he is very much focused on finding things through electronic methods and that he has difficulty relating to people on the same sort of level.

Interviewer: OK, and is Abby a geek?

Parent 1: In her own way, yes, but she's a Goth, she's an individual, caffeine swallowing, hyperactive person, but ... as I say, they are both driven by their passion I suppose in their own area.

Interviewer: OK – what do you think.

Parent 2: No, I don't think they are geeky, I think they are just people, you know, I don't like to label people like that anyway, but I can understand how people would refer to them as that way, you know.

Interviewer: What exactly ... is it good or bad to be a Geek?

Parent 1: I don't think there's any worry about it, it's just like saying someone's got black hair or brown hair, yeah, it's alright.

Interviewer: So it doesn't have negative connotations? So how would you describe a Geek?

Parent 1: I suppose someone who is more focused on, um, solving problems by getting into, you know, their field and being driven and focused on that and the rest of the world can go by and if they forget to eat and those sort of things, that's just what happens because they are very, very focused.

Parent 2: It's probably not a term that I would use, but, I suppose it would be someone who is more in their head as opposed to in the world, you know what I mean.

Interviewer: Is a Geek different to a Nerd?

Parent 2: No, I don't think so.

Parent 1: Not really. No.

Interviewer: Cause, I don't know if you remember the survey, there were some questions on there that say "People who are good at computers are popular" and lots of the kids, because kids also do this, said they are and there is another one saying "I would like to be good at computers" – yes, they would and I would like it if people thought of me as a Geek – they all said "No". So they all said "I want to be good at computers – people who are good at computers are popular but I don't want to be known as a Geek, which I thought was really interesting.

Parent 2: I can relate to that because that is exactly what my daughters, my eldest one is coming from. She is very social, she's very, umm, she's very at that place in life where she's into how people think about her and what they think, whereas my younger one doesn't care what anybody thinks, she's – like she wants to be a Geek.

Interviewer: How old is she?

Parent 2: One's thirteen and one's fourteen. So one's in Year 8 and one's in Year 9. The younger one is the one who is happy to be a Geek - she's – she wants to do well academically like your daughter and she just doesn't care what anyone thinks – she's just going to go for it. The other one, she's smart and she can do the same as the other one but she doesn't want to see herself in that way, so she's more social, she wants to be cool – she doesn't want to be ... and when you talked about the course, she was approached by the Principal to say "would you be on this course because you would be ideal" and I think she turned it down.

Interviewer: Hmmm.

Parent 2: So I can relate to it ...

Interviewer: So, do you think that is because your daughters have different personalities or was your daughter last year fine with being a bit Geeky but this year because she's older .. or is it personality?

Parent 2: Yes, definitely personality.

Interviewer: What do you think about the "I want to be good at computers because people who are good at computers are popular, but I don't want to be a Geek".

Parent 1: Well, the thing is you don't go out to be a Geek do you. You know, you don't do that – I think that, yes, they want to be good, but they want to be good at everything. It's the one that looks fabulous when it comes to formal, or the one that's best at sport, or whatever, so I think it's a case of this age group just wants to be cool, accepted and that's very much the thing, that's being accepted and not labelled negatively for whatever reason and unfortunately with schools bullying is such a big thing and because everyone's different, there's always something someone can pick at – Oh, you wear glasses, they call you "four eyes", you know, so those sort of things so I think it is more the acceptance stuff. To be labelled a "Geek" they are looking at the field with spyglasses but having said that my daughter just recently had a birthday party, one of the girls came along dressed as a "Nerd", with the glasses and bandaid on her, so I mean obviously they have different personalities, it's you know, how they feel in themselves. [31:05]

Parent 2: It's do with their inner confidence. Like [daughter 1], she doesn't care what anybody things, she'll do anything – you know what I mean, she'll just for it. [Daughter 2] is far more concerned with what other people think. So that in itself is confidence, self-image.

Interviewer: Alright, let me just check I've got everything I wanted, ummm ... Oh, I guess one more thing would be, what .. if you think about your child going into an IT job, so not just a job where you use computers, cause all jobs use computers, but one where you are an actual expert – which by the way, "How do you know when someone's an expert?"

Parent 2: You don't – a lot of people would like to be experts, but I guess it's how busy they are with regard to their job, like how much work that they get, so ... if someone's good then they are going to get more work, so ... therefore, I would consider someone who gets more work to be more of an expert than somebody else perhaps ...

Interviewer: Hmmm, do you think that has anything to do with which programs they use, or ...

Parent 2: No.

Interviewer: It doesn't have anything to do with that ... what do you think?

Parent 1: I think behind that is training, you know, formalised training and then... as a starting point, and then they themselves developing from there obviously they want what they are interested in, so if some particular program is something they really feel passionate about or whatever, then they become an expert because of the fact they want to know how it works. I mean, there are a lot of people who will just take a job because they just want money to pay whatever, and I respect those people because they've got those energies to go out there and do whatever they want and work

ahead whereas other people want to have their fun because they are passionate in their jobs. So, you know ... we're all different.

Interviewer: OK, what benefits do you think your child would have, having an IT job as opposed to any other type of job? Can you think of anything good?

Parent 1: Dollars, I suppose is one of them.

Parent 2: Yes, I think like I said earlier, the constancy of work, like there's a lot of work but in those different area, like it's always changing and growing areas and there are up and coming areas. There's always development and opportunities to grow and learn more and I think that's always good in a job because you don't become stagnant and bored. I think those are the main benefits.

Parent 1: I'm thinking back to four or five years ago when the University had their IT faculty – it was really huge doing ... offering a multitude of courses and then obviously it peaked in the market and because they cut back their staff, and the number of courses that were available, so I think that people are becoming more streamlined – there's always going to be a future in there, just as there's going to be a future in hospitals and funeral homes. You know, these are the things that we need, so it is a good industry to get into because as you say it is ever changing and if you want to be stimulated through your career, you want to be having something different every day.

Interviewer: Yes, the papers that I've been reading have been suggesting that in the early 90's it was the industry to go to and everybody was imagining there would be all these jobs, but the perception is now that that's finished and there aren't any more jobs.

Parent 2: Oh no.

Interviewer: But there are...

Parent 2: Yes, heaps of jobs.

Interviewer: And it's interesting because that's where you get the perception from, you know, if the Uni is cutting down their course, or... But I do wonder if that's got to do with..

Parent 2: Other areas and where they put their funding...

Interviewer: That, but also other courses including IT subjects or expecting that at school you would learn it, whereas in the past you had to come to Uni maybe to learn basic skills that we now think everybody has, I don't know, but…

Parent 1: And I suppose that now, a lot of those courses are now transferred to TAFE because it's just an extension of school learning and it doesn't have to be at the same level as the Uni.

Parent 2: We are just selecting electives for Beth for next year, for Year 10, and there was an option to do a VCE computer course but it didn't really tell you what it was, so .. and there was Computer Science, I'm not sure, and the other was Gaming, computer gaming …

Interviewer: So that's a VCE subject?

Parent 2: Yes, that's a VCE subject ... and also there was a VET, computer game one as well ... I'm not sure what they were – I should have brought that book with me, shouldn't I, yeah, no, but they were available.

Interviewer: But your daughter wasn't interested in those?

Parent 2: No, she's not about to choose those, because she's an extended Maths and Science and because of that they already do VCE maths ...

Interviewer: Oh, and they can only do a certain number of electives ...

Parent 2: Yes, only one.

Parent 1: The schools want the children to be balance, so for their elective they will say go do dancing, or art or something.

Interviewer: Really?

Parent 1: They get that done for them ...

Parent 2: At our's they just let them go for it – they had twelve choices other than the VCE subjects but because they were already in Maths they couldn't ....

Parent 1: So that shows that each school has different sorts of policies and directions ...

Interviewer: Do you think it makes a big difference what school you send your kids to ... what they end up as?

Parent 1: Absolutely.

Interviewer: Really?

Parent 2: I think it has a major influence ... I am lucky where my girls go that they have a really huge selection, a wide selection – it's one of the best in Melbourne, so they can go any way they like and they can mix a whole lot of different things together to get to really what they want to do, so ... they just take the core subjects and then go on from that.

Parent 1: Just for an example,[School name] which is a Catholic school up in Belgrave, they insist that at VCE you still do really just religious subjects and that limits ...

Interviewer: It does ...

Parent 1: And half the kids there are Buddhists - anyway, they are not Catholics, so ...

Parent 2: Can they do Buddhism?

Parent 1: No

Interviewer: They are Buddhists but they are learning Catholicism?

Parent 1: So the focus of that school, a lot of kids get to Year 10 and say "I've had enough; I'm going off to the local high school to do IT things or something"

Parent 2: Yes, well that's what happens, we've had an intake of a lot of the smaller schools that don't offer different things, so...

Parent 1: So, while I suppose it is scary for kids to go to schools where you've got thousands of kids wandering around it gives them a variety.

Parent 2: Ours has got different campuses which is great.

Parent 1: Which school?

Parent 2: [School name]

Parent 1: Oh yes.

Parent 2: Which is really quite good.

Interviewer: Alright, well I've really finished what I was going to say, I will just ask you to just look at your list again and with a different coloured pen, would you change anything now that we've discussed this?

Parent 2: Well, I'd probably add more traits that my husband has.

Interviewer: Like what?

Parent 2: In the IT Expert, "humorous" because I actually know quite a few very humorous IT people. Well, some are formal, so it's hard to ... come up with both.

Interviewer: Hard to generalise ...

Parent 2: Yes, some are cautious.

Interviewer: That's about right? OK do you have any more comments? My PhD is on community attitudes and how they affect girls because I am actually doing my PhD in conjunction with a project that has gone into schools in Melbourne and done all girl computer classes and the problem is that all girl computer classes and intervention programs have been going on for more than twenty years but it has made absolutely no difference to how many girls end up in IT jobs, so we're trying to find out why, because in all the intervention courses that they do, the outcomes are always really positive – the girls always say "Yes, I learnt a lot, I feel more confident, I'm more interested in computers" but they don't go into the Uni courses, they don't do it at VCE, they don't go into the jobs, so I'm suggesting that perhaps the community: parents, teachers, peers, the media, is counteracting all that good stuff, so they get all this good attitude and everything from their classes, they come out and then the community says "Oh no, no, girls don't do IT. So, have you got any comments about that.

Parent 2: Yes, I do. I know that Beth didn't want to do the course, and there was a course offered and she was approached but I don't think there was enough other girls for that course to go ahead, so I don't know .. I think she would have had it gone ahead, but I don't think that it did. But I didn't follow it up, so I'm not sure. And I think looking at the kids coming through, knowing the ones that have come through in the last couple of years, there might be more now than there would have been when she first came through ... so ...

Parent 1: I think the community very much stereotypes people – you look at the University, the general staff, they would be 95% female – why? Because it's secretarial work or whatever, although

there are a few guys here doing those sort of works but they are in the IT field – they are in the high end jobs like Finance Managers or something like that, but I think it comes back to that, when we train our children through school, it's their personality and their wanting to be accepted once they leave and whatever, so that is their driving force so that if your daughter wants to go to work and potentially find someone good she's going to spend the rest of her family with or hang out with people that she will be able to, um you know, meet other people, all those sort of things influence job choices and lifestyle choices, like .. personally, I started work, I did nursing training. I had children, you can't get child care other than standard hours, so couldn't do nursing because I needed to do night shift and there was no-one there, so I mean community and facilities dictate your decisions and we don't all have the freedom of being able to just chuck a bag over our shoulder and say "I'm off to explore the world or whatever". Yeah, we are very much manipulated.

Interviewer: Mmm, OK, well thank you so much for taking the time to come down here – you have given me so much stuff –

Parent 2: I hope you do really well with your, you know ...

Interviewer: Thankyou ...

Parent 2: You'll be fine – you will ...

Parent 1: OK, thanks again – nice to meet you.

Interviewer: You too – thank you very much, see you later, bye (44:20).

Appendix D

MUHREC approval

On 9 December 2010 14:49, MRO Human Ethics Team [redacted] wrote:

PLEASE NOTE: To ensure speedy turnaround time, this correspondence is now being sent by email only. MUHREC will endeavour to copy all investigators on correspondence relating to this project, but it is the responsibility of the first-named investigator to ensure that their co-investigators are aware of the content of the correspondence.

Assoc Prof Julie Fisher
Caulfield Sch of Info Technology
Faculty of Information Technology
Caulfield

9 December 2010

CF09/2617 - 2009001507: Digital Divas: Designing approaches to enthuse girls' interest in ICT studies and ICT careers

Dear Researchers,

Thank you for submitting a Request for Amendment to the above named project.

This is to advise that the following amendments have been approved and the project can proceed according to your approval given on 20 November 2009.

1. Increase the participants pool to include teachers, students and parents from two schools

Please note you are required to send an Annual / Final Report to comply with the Terms of Approval.

Thank you for keeping the Committee informed.

Professor Ben Canny
Chair, MUHREC

cc: Assoc Prof Helen Forgasz; Dr Catherine Lang; Mrs Annemieke Craig; Mrs Kathleen Scott Bennetts; Ms Amber McLeod
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Human Ethics
Monash Research Office
Building 3E, Room 111
Monash University, Clayton 3800
[redacted]
[redacted]
http://www.monash.edu.au/researchoffice/human/