FACTORS THAT SHAPE STUDENT DECISION-MAKING RELATED TO INFORMATION TECHNOLOGY STUDY AND CAREER CHOICES: A GENDERED ANALYSIS

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Abstract
This thesis presents a gendered analysis of factors that shape adolescent attitudes to Information Technology (IT) at key stages in their education. It draws on career decision-making literature, psychological self-efficacy literature and some of the more salient feminist literature. Results of interviews with students in junior, middle and senior secondary-schools in Australia are presented alongside those from students studying IT at two universities. This research provides relevant and current insight into reasons why females are not choosing IT courses to the same extent as males, that is not captured in the existing literature. The study found that many young women and men, while being almost equal in IT use and computer literacy, do not consider IT as a valid and independent discipline for future study or as a career. It found that IT rarely entered students’ schematic repertoire of possible future careers, a schematic repertoire strongly influenced by parental opinion at all stages of education. It found a surprising proportion of the university students interviewed currently studying IT, did not consider this degree as their first choice and were often not convinced that they would continue in the career after graduation. This thesis concluded that while IT is a varied discipline that is unique in its many applications, to many students the discipline is predominately aligned to hardware and associated objects. It found that there is a deficit in student knowledge of what an IT career involves beyond that of the most stereotypical portrayal of a programmer, and that this deficit of knowledge is evident in both genders. It is apparent from this study that the lack of women in IT is not necessarily a gender issue, but an issue embedded in the image of the IT discipline, an image that lacks the status of a professional career.
Declaration

This is to certify that:

(i) The thesis comprises only my original work towards the PhD except where indicated in the Preface,
(ii) Due acknowledgement has been made in the text to all other material used,
(iii) The thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

...................................................................................................................

Catherine Lang
November 2007

Preface

The following journal and conference papers also presented material from this research:


Acknowledgments

Enrolling in a PhD as a part-time student was a decision not taken lightly but a necessity for my professional career. I decided early that a research centre with an international reputation was my first priority. I was very fortunate to be accepted as a student in such a place, the Centre for the Study of Higher Education (CSHE), and would like to thank all associated with this Centre for making this journey a pleasure. In particular I am indebted to my PhD supervisor, Professor Kerri-Lee Krause for her constant encouragement, exemplary advice and thorough feedback at every stage of this arduous task. She saw me to completion despite demanding changes in her own professional career. I know that fellow PhD candidates not associated with CSHE were envious of the support and advice I was a fortunate to receive from Kerri-Lee. I would also like to thank Professor Craig McInnis for helping me start this journey and establish a sound base for the research, and Professor Richard James for support as secondary supervisor throughout the course of this doctorate. Finally thank-you to the Faculty of ICT at Swinburne University of Technology, my place of employment, for providing study-leave and the physical facilities required to complete this degree.

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Ethics Approvals

This research was completed after attaining the following Ethics clearances:
- University of Melbourne, HREC No. 040008, A & E 3.1, 29 March 2004
- Approval to interview university students was given by the Dean of the faculties involved.
Acronyms:

**DCITA**  Department of Communications, Information Technology and the Arts, Federal Government.


**ENTER**  Equivalent National Tertiary Entrance Rank

**IB**  International Baccalaureate (an alternative Year 12 qualification)

**ICT**  Information and Communication Technology

**IPM**  Information Processing and Management. VCE unit.

**IS**  Information Systems, a VCE unit and university discipline are.

**IT**  Information Technology

**MSN**  Microsoft network messenger tool for internet communication in real time

**MMV**  Multimedia Victoria, a state government department.

**TAFE**  Technical and Further Education.

**VCAA**  Victorian Curriculum and Assessment Authority

**VCE**  Victorian Certificate of Education.

**VET**  Vocational Education and Training.
CHAPTER 1: THE PAUCITY OF WOMEN IN IT: A SOCIAL AND ECONOMIC ISSUE

1.1 Introduction
The under-representation of women in the Information Technology discipline has developed into a social and an economic issue for western countries in the 21st century. There is a concern held by IT professionals that women are excluding themselves, or being subtly excluded by social norms, from the opportunity to influence and shape future applications of IT in business, health, industry and education through not being involved in the design and application stages to an equivalent extent as men (Jacktman 2007). The pervasive application of Information Technology (IT) in most professional disciplines and in wider society in general is contributing to a gendered knowledge and skills divide in our society that already has a division between knowledge-rich and knowledge-poor based on economic status (Lang 2003a). The following quote by Snow is as apt today when applied to the Information Technology discipline as it was 45 years ago when it was applied to the sciences in general.

It is one of our major follies that, whatever we say, we don’t in reality regard women as suitable for scientific careers. We thus neatly divide our pool of potential talent by two. C.P. Snow, Rede Lectures 1959 as quoted by Pearl (2002 p.2)

Despite over twenty years of programs and marketing initiatives to encourage women to study higher education IT courses in Australia, the proportion of women in these courses is still in decline. In 2005, 6.4% of all higher education students were enrolled in IT courses, and of this percentage only one third were women (DEST 2006). This trend is contrary to the overall increase of female rates of participation in higher education, where women are now in a majority on campus (54.5 per cent in 2005) as well as a majority in most disciplines (DEST 2006). The under-representation of women in Information Technology extends to the Australian IT industry where in 2001 only thirty per cent of the workforce with an IT qualification were women, representing a decrease of six per cent from 1996 (Byrne and Staehr 2003). The proportion has continued to decline with the Department of Information and Communication Technology website reporting that “Around 15% of all ICT specialists were women in November 2005. The proportion of women professionals ranged from 1.5% of
telecommunications tradespersons to 31.2% of computing support technicians” (DCITA 2006). The reasons that are presented to account for why women are not embracing Information Technology degree programs to the same extent as men, coupled with the declining percentage of women in the industry, remain largely under-theorized and will be subject to closer investigation in chapters two and three.

The context of this dissertation is an investigation into factors that may account for young women participating less in post-secondary IT courses and careers than young men. The study reported in this thesis is based in Australia but the under-representation of women in IT is a phenomenon present in almost all western countries. The research explored the effect of gender and age on student decision-making about possible career futures by drawing on the existing cost-benefit models presented in career decision-making literature and applying these to the relatively new field of IT. The research is timely because the continued decline in the popularity of IT degree courses and careers with young women is developing into a social and economic issue that may have long-term consequences for the Australian economy and society as a whole.

While particular attention was given to the reasons why women are not attracted to the IT discipline or related career paths to the same extent as men, this thesis will show that there are underlying factors unique to IT that encourage some males to pursue this career and inhibiting factors that had a negative impact on female student IT course selection. Data was gathered from students in secondary schools and universities at key decision-making points in the course of their education. These key decision-making points are explained and justified in the research methodology chapter (Ch.4). The generic term, Information Technology (IT) is used throughout this dissertation to encompass all derivations of information technology and computing courses at university and secondary schools. To prevent discordance to the reader, alternative use of the full words and the acronym will intersperse the discourse.

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1 Figure 9. Employed ICT specialist by Gender, at 30 November 2005.
1.1 Setting the scene

When Information Technology started as an independent discipline more often called ‘computing’ thirty years ago, it was claimed to be a gender-neutral field unencumbered by historic gender stereotypes (Seligsohn 1967).

Even the term ‘computer’ itself was coined to describe the function of women who performed calculations and who wired hardware for the first digital electronic computer. (Stewart Millar 1998 p. 19).

Seligsohn emphasised that the qualities of problem solving, attention to detail, accuracy and patience were needed in computer programmers and mused that “the feminine mind and psychological makeup may give the girl programmer an advantage over her male colleagues.”(Seligsohn 1967 p.186; Van Oost 2000). The estimate of twenty to thirty per cent of all programmers being female in the 1960s was considered high given the employment market of the time when traditionally women were depicted as the ‘homemakers’ in society.

Compared with other professions, this certainly is high, but if it isn’t higher it’s because girls are only gradually becoming aware of the wide-open door to career opportunity and satisfaction offered by the newest profession. (Seligsohn 1967 p.186)

Implicit in Seligsohn’s optimism is the prediction that once young women became aware of the career opportunities in the Information Technology industry, they would choose this career path perhaps to a greater extent than young men. This prediction has not come to fruition over the last forty years, and in recent times Information Technology courses in higher education are becoming even more male dominated than all other disciplines, with the exception of Engineering (Van Oost 2000). Almost 40 years later the assumption that it is merely a lack of awareness that prevents women from choosing IT courses and careers pervades the literature. This presumption in itself may account for the lack of success of a number of intervention programs to attract girls and women to IT. This thesis will show that this lack of awareness about what an IT career involves, beyond that of a computer programmer, is endemic in secondary school students and that this lack of awareness extends to both genders.
Some of the explanations for the under-representation of women in IT are problematic and often do not withstand scrutiny when applied more broadly beyond the Information Technology discipline. It is claimed for example, that the nature of the IT field is not attractive to females due to long working hours to meet deadlines, or late night stints debugging code or finishing projects for university credit or employers (Johnson and Miller 2002 p.10). It is claimed that an IT career does not provide an environment that is supportive of females because of the safety issue of walking to cars at night through unlit paths or car parks after long hours in the laboratory (Pearl et al. 2002). As well the inhospitable laboratory environment has been likened to a male locker room (Margolis and Fisher 2002). It is also claimed that the IT work environment is masculinised to the extent that it promotes long working hours and job mobility to the detriment of female participation and part-time work (Van Oost 2000). This thesis posits that these arguments are flawed, not least, because they can be applied to many professional fields and alone cannot be the reason women are avoiding Information Technology. These arguments did not prevent them entering Law and Medicine in increasing numbers towards the end of the last century to the extent that women are the majority in the student body in both these disciplines and have been since 1997 (DEST 2006).

Another view presented in the literature is that the small number of females in the Information Technology field is a product of a lack of role models and the perpetuation of the image of the discipline as being ‘male’. The lack of validation of seeing similar people to oneself, be it same gender or same ethnicity, is believed to contribute to feelings of isolation (Taylor 2002). Related is the perception that the current females in computing are somehow ‘different’ because they are going against society’s impression of what a female should be (Turkle 1995 p.56). While the lack of feeling that one belongs is not to be discounted or trivialised, there is a similar flaw in both these arguments as in the previous arguments when applied wider than the field of IT. The lack of role models did not prevent females breaking down barriers in Law and Medicine, where the claim that females do not feel comfortable in an area where they are constantly facing sexism and ‘old boy’ networks is also relevant (Lang 2003b).

Some of these claims are grounded in facts and truisms; working conditions in IT are masculine (Webster 2005), there is a lack of female role models (Boivie, Hodkin, Scott-
Dixon, Woloshyn and Smith 2005) and there is a perception of isolation associated with the type of work carried out in the industry (MMV 2004), but when the same claims are applied wider than the IT discipline they do not hold up to scrutiny. Clearly, there is justification for examining more vigorously the hypothesis that factors unique to IT may well play a role in shaping girls’ decisions regarding study and careers in the field.

1.2.1 Trends in enrolment

In Australia an analysis of higher education enrolment statistics (Figure 1) presents the proportion of women enrolled in the Information Technology discipline and the proportion of women in two disciplines that have historically been male dominated (Medicine and Law) as a stark comparison to the IT discipline. The enrolment figures in Medicine and Law appear to invalidate the argument that barriers exist to prevent females entering male dominated disciplines (Siann and Callaghan 2001). The percentage of women enrolling in Medicine and Medical Sciences in Australia has grown from 43 per cent of student body in 1990 to more than half (57 per cent) in 2003. A similar trend is evident in Law and Legal Studies, where female enrolments have outnumbered male enrolments since 1996. Female enrolments in IT courses on the other hand have decreased by 4.7 per cent in this time period. The proportion of females enrolled in Information Technology peaked at 27.7 per cent in the early 1990s, slumped to 22.6 per cent in 1997 and after rising to over 25% in 2001 fell to less than one-quarter of the total enrolments in the field in 2003. The apparent fluctuations in enrolments in the late 1990s can be explained by reclassification within the data collection methods used by the government that expanded the number of degrees included in the IT discipline and counted double degrees where IT was combined with Business, Health Sciences and others. It is also attributed to the ‘dot.com’ boom, which promoted IT courses as attractive and lucrative options to parents and students.
In the Australian secondary education sphere the masculinisation of Information Technology is also becoming more prominent. There is a declining proportion of young women studying IT courses at senior school level. The proportion of young women studying the Information Technology courses, called Computer Studies in NSW high schools, decreased by 7 per cent in the four years from 1995 to 1998 (Collins, Kenway and McLeod 2000).

Girls’ low participation in subjects that result in information technology literacy leads them to risk becoming members of the information poor and exclusion from the information society. It also excludes them from a range of emerging and important employment opportunities (Collins et al. 2000 p.7).

It should be noted that the trend of declining female participation in IT pre-dates the ‘dot.com’ crash, the event that is often attributed with declining student numbers in the discipline. This theory will be discussed in more detail later in this chapter.
The Victorian statistics for the senior secondary school courses classified in the IT sphere show a similar pattern to those of New South Wales. There has been an overall decline in numbers of enrolments in Information Technology units each year (from 64000 in 1994 to 54000 in 2003), and a decline in the proportion of young women enrolled in these subjects from 48.1 per cent of the student enrolments in 1994 to 32 per cent in 2003 (VCAA 2003). Figure 2 depicts this trend of declining enrolments in all VCE level units over an 11 year period. The numbers represent enrolments in Year 11 and Year 12 units, not students, and it needs to be noted that students can enrol in up to four units per year. While none of the IT courses in the Victorian Certificate of Education (VCE) is a necessary pre-requisite for higher education Information Technology courses, the enrolment statistics indicate that there is a gender difference related to student choices regarding Information Technology prior to the first year of university. Of all the students studying the final secondary school certificate in Victoria, only 5.8% selected either of the two IT courses offered, and only 1.8% of these students were female (VCAA 2006). This gendered differentiation in enrolment confirms that female students may be closing doors to potentially rewarding IT careers at an early age and indeed there is a perhaps a pool of talent not being tapped.

Figure 2: Victorian Certificate of Education IT subject enrolment trends. (VCAA 2006)
Within the IT discipline in higher education there are fluctuations in female enrolments between the various specialisation streams that may account in part for speculation in the literature around the reasons why the gender imbalance is occurring. The more abstract and technical specialisations have fewer female students than the creative and business-focused streams, which are purported to be the most female friendly because of the socio-technical content and application of these courses. However all IT-related specialisation streams have experienced up to a fifty per cent decline in the number of female students in this century alone (DEST 2006). It is predicted by many women in IT that until the discipline more generally reflects society’s gender balance, it will not gain its full potential and status within society. This view is reflected in Muller’s (2005) comment that:

> Until women and people of color are fully represented in the fields of science and engineering, society is losing out on the talents of a vast number of potential contributors. Academic institutions are losing out. Corporations are losing out. Individuals are losing out. We all lose out.

### 1.2.2 Intervention programs

There have been a number of local and regional efforts and intervention programs to attract women and girls to Information Technology that have had limited and localised success. Some implemented at secondary and tertiary level in Australia and overseas have produced short term increases in enrolment numbers (Jewell and Maltby 2001; Margolis and Fisher 2002), but few have led to sustained increases, as verified by the overall Australian enrolment statistics presented in the last section (Figure 1).

A government funded Australia-wide program to attract and retain women in Information Technology initiated in 1990 fell well short of its aim of forty per cent female enrolments in higher education Information Technology degree programs by 1995 (Byrne and Staehr 2003 p.109). At the Australian Women in Computing conference in 1997, a collection of data from participating institutions showed that only two universities had met the government target of forty per cent female participation, in only two of their degree programs. One of these degree programs was a Bachelor of Science with a strong library science component, a traditionally female career path in
Chapter 1: The paucity of women in IT

Australia (Librarian), the other a Bachelor of Business with an Information Systems speciality (Sonenberg and Nicholson 1997). The imbalance in female enrolments in Information Technology courses has not improved to any extent in the early years of this century. A report commissioned by the Department of Education Science and Training to analyse the performance of equity groups in higher education for the previous ten years in Australia recommended that “Women in the fields of Engineering and Information Technology should be retained as an equity group, with targets of 40% participation” (James, Baldwin, Coates, Krause and McInnis 2004 p.55-56). Despite over twenty years of programs to correct the apparent under-representation of women in this field, women still comprised of less than a quarter of all enrolments in Information Technology courses in 2003 (Figure 1).

Governments at state and federal level in Australia have funded a number of programs and initiatives to encourage females to consider Information Technology in their career choices. One recent example of a program is the 2005 “Participation Summit” held in September 2005 by the Federal Government

The Summit provided an opportunity for over 70 prominent industry leaders, academics, policy makers and educators to come together and consider the important issue of female participation in Information and Communications Technology (ICT). (DCITA 2005)

This one day event discussed the issue from the perspective of attracting and promoting IT as a suitable career option for not only young women but particularly for the group of youth labelled “Generation Y” (Sheahan 2005), who seem to be increasingly less attracted to careers in this field. “Increasing young people’s interest in ICT careers will lead to more university enrolments and ultimately to a more diverse, dynamic and skilled workforce” (DCITA 2005). Unfortunately little has been gained from the rhetoric apart from an acknowledgement that IT is now appealing less and less to young people of both genders.

At the state level two reports commissioned by Multimedia Victoria, a division in the Victorian government’s Department of Infrastructure, investigated student attitudes to Information Technology careers and courses. The first of these reported that most
students had a limited view of IT careers and perceived them with a technical focus rather than social or communication focus. It also reported that while students were aware of employment and career opportunities available in IT, this had no influence on course and career choice and most students pursued other careers based on personal interest, debunking the argument that students are not enrolling in IT because they do not know about opportunities in this field (MMV 2001; DCITA 2006). Only six per cent of all senior school (Year 12) students interviewed for the second report, (154 in total), expressed an interest of continuing in IT at university or technical further education institutions (TAFE), not one of whom was female (MMV 2004 p. 12).

Both the federal government summit and the state government reports turned the spotlight, be it all so briefly, on an issue that women in IT in Australia have been well aware of for many years. The website of the Australian Women in IT and Science Entity (AWISE), an umbrella organisation that was established to act as a communication network for women in IT groups, lists fourteen organisations Australia-wide working to promote, encourage and support women in Information Technology (AWISE 2005). The majority of these organisations are located on the eastern seaboard and are dominated by women in the fields of education and industry. Some of these groups exist as boards or committees inside professional bodies (ACS-W). Others have been established by government subsidy (Victorian ICT for Women Network). Many of these ‘Women in IT’ groups have existed in one form or another for many years. Australia is not unique in having a varied collection of ‘Women in IT” groups. The international women and computing literature, which can be traced back over twenty years, provides information about government, education and industry funded programs to attract females to the discipline since the 1980s (Craig, Fisher, Scollary and Singh 1998; Wardle and Burton 2002). The commonality in all these groups, which extends across nations, is that they are dominated by women in a discipline and career path that is dominated by men, an apparent anomaly that is explored further in both the literature and discussion chapters. A primary concern of many of these IT academics and professionals that drives them to extra-curricular commitment to promote women in IT to school students is the declining diversity of the “pool of talent” attracted to this discipline which is leading to a possible “latent IQ being overlooked” (Richardson 2003).
This dissertation is founded on the assumption that attracting a wider variety of students will enrich the IT discipline and its outcomes in terms of a greater contribution to society and the economy. The literature argues that the discipline is poorer because of a lack of diversity in the talent pool of people attracted to and entering Information Technology, and that under-representation of women results in a lack of the female perspective in Information Technology applications. There are many examples in the literature where a lack of attention to the female perspective has created flawed design and near disasters, two of which are presented here. Early voice-recognition software was initially calibrated for the male voice only and resulted in early video-conference systems not automatically focusing on female speakers in meetings (Margolis and Fisher 2002). Secondly, and perhaps with more dangerous implications, heart-valves designed by males in the first instance resulted in them being too large for females as well as some other ethnic groups (Margolis and Fisher 2002). The author agrees with the premise that women need to contribute to the IT discipline at all levels and that a greater diversity will ensure that design, use and creativity of applications will be an asset to all society and the economy.

1.2.3 Media influence

The influence of the media on the perceptions that females hold about Information Technology is largely under-investigated. It is assumed to be a powerful factor but there is little data to support this assumption as it relates to IT course and career choices. It is claimed that the power of the media is very important in helping young females identify with a sub-culture. For example the effect of popular film and television characters portraying female veterinarians, lawyers and doctors with equal status and power to their male counterparts appears to have had an influence on the career choices of young women (Stewart Millar 1998; MORI 2001). Computer magazines are predominately produced by males, for males, and portray the images of males using, designing and spending their leisure time on computers (Ware and Stuck 1985). Articles and interviews related to the discipline have become increasingly male focussed since the 1950s and 1960s (Van Oost 2000). Non-computer teenage magazines produced for boys have many more advertisements for computers than those published for the teenage girl
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market (Margolis and Fisher 2002 p.112) and teenage girl magazines have almost no representation of role models for young women in Information Technology at all (Lang and Hede 2004). The disparity in pictorial presentation of computers and IT in popular magazines for young men and women reinforces the gendering of the discipline and adds to the masculinisation of the career path. It would appear that there is sufficient evidence that the popular media perpetuates the gendered nature of Information Technology being male by portraying IT experts as boffins, geeks and social outcasts (Stewart Millar 1998 p.48). This thesis will show that the media does influence student interest in the IT discipline, and that there is a significant need for closer study of the respective roles of educational experiences and the media in shaping girls’ decision-making related to IT study and career choices.

1.2.4 Socialisation and I.T.

A controversial debate exists over whether the difference in the relationship to technology between men and women is socially constructed through gendered socialisation of children, or is a product of biological determinism, innate because of the sex of a person. Harding argues: “the effects of gender stereotyping accumulate from the cradle, scientific skills are seen as valuable to men for any occupation but detrimental to women because they detract from others’ perception of them as feminists”(Harding 1986 p.63). Biological determinists argued in the early nineties that clinical differences in the brain accounted for males and females being born with different abilities (males with spatial and analytical abilities stronger than females), and concluded that there will always be certain careers more attractive to each gender (Moir and Jessell 1992). This biological determinist view classified IT as a career more suited to the male brain with its spatial and analytical strengths because it had risen out of the Science and Engineering fields. The discipline has moved more into the business and communication fields in the late twentieth century and it is posited by this researcher that it should be more attractive to females. However it appears that historic perceptions and stereotypes prevail. Some young women see young men totally consumed with the technology and decide that they do not want that type of life or career. “I like doing it, but I don’t like doing it to extremes” is perhaps indicative of the attitude young, computer-savvy females develop towards Information Technology (Margolis and Fisher 2002 p.39). It is argued that the influence of “overt magnetic attraction”; the all-
consuming interest that some boys have with computers, while attracting young men to the discipline is equally as powerful as a deterrent to young women (Margolis and Fisher 2002 p.31). However, when women were required to use computers in their work they tended to develop a pragmatic attitude to them and become competent users (Durndell, Glissov and Siann 1995) rather than developing an emotional attraction to them, discounting the biological determinist view of male dominance of the technology. While much is written about women’s relationship with technology, little is written about their use of it. The findings of this thesis show that there is a socially acceptable difference in purpose of use of IT, particularly for leisure uses, that predominately resides with young women but also extends to many young men. IT use is firmly grounded in pleasure and leisure activities with the majority of young people of both genders, not as a pathway to a professional career.

The belief that it is necessary to have an emotional connection with the computer to be successful in the Information Technology field needs further investigation. It is increasingly relevant this century due to the growth and integration of IT in all aspects of western life. The Information Technology discipline has moved far beyond the technical programming aspects, although this is still a component, to being re-defined as a critical integrator in the business and social fields. The diversity of applications within the discipline further justifies research into the under-representation of women.

1.3 Is the IT discipline unique?
Information Technology is a discipline associated with rapid change, particularly in the economic and labour market, and this is reflected in student and public perception of a career in this field. In the economic markets IT experienced an unprecedented rise in investment and growth in the late 1990’s. This was widely publicised and IT was touted as the growth area for business and development. “According to those involved in the dot.com phenomenon, one year by the Julian calendar is equivalent to four years Internet time” (Islam 2001 cited in Budd and Harris 2004 p. 39). At the peak of the ‘dot.com’ boom in March 2000 the internet was thought to be re-inventing business practice and IT was the growth industry on the stock market. However this was followed by the second biggest fall in the Wall Street stock markets in history in April
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of the same year (Cassidy 2002). Trust and optimism declined and the perception of IT as a volatile field continues to this day with much negative publicity since the widely reported ‘dot.com’ crash in 2000 (Cassidy 2002).

There are gender implications related to the volatility of the IT career path. Socialisation of young women in western society is centred around them being careful and cautious (Turkle 1995; Margolis and Fisher 2002). An experimental study on risk aversion conducted in the USA found that young women were more risk averse than young men (Eckel and Grossman 2002). It could be extrapolated that the less cautious would have little desire to risk embarking on a volatile career path such as IT. However it should also be noted that secondary school enrolment statistics (Figure 2) clearly show that young women were turning away from IT courses prior to this much publicised downfall of the industry.

In the labour market the IT workforce is increasingly being seen as unique. The IT advisory company, Gartner Group, reported an increase in the flexible global workforce "Enterprises in developing countries and emerging markets are now reaching into developed economies, offering a talented workforce at a fraction of the price." (Wiggins and Morello 2003), and predicted an increase in uncertainty and job security in western countries.

... the movement of work overseas will lead to job cuts and layoffs in IT ... the backlash will be real. ... Stress and uncertainty will increase. ... IBM is now acknowledging the apparent necessity of moving service work to low-cost regions, and it is anticipating anger for displaced employees, as well as potential unionization for worker protection. ... the potential backlash would have no effect on their decisions to move forward with offshore outsourcing. (Wiggins and Morello 2003)

With almost daily reports of markets moving to other countries and the backlash from the ‘dot.com’ crash doubts have been created in the minds of young people and their parents about the stability of IT as a career path. The gender differences in risk aversion as well as gender differences in reactions to highly competitive stressful environments, with women choosing to avoid competition at a much greater rate than men (Gneezy,
Niederle and Rustichini 2003), may contribute to the masculinisation of the IT discipline. Coupled with this doubt about IT as a stable future, is the difficulty in definition of what an IT career involves beyond the stereotypical isolated programmer. This thesis will show that the implications of the volatility of the IT workforce is an influential factor that is considered more by males than females interviewed.

The ubiquitous nature of IT applications, which are now embedded in almost every other discipline and career, such as business, education, health and leisure, contributes to the confusion around what an IT career involves. The findings of this study will show that an inability to define the career path beyond the most stereotypical, such as being only involved in programming functions at keyboards, adds to its uniqueness and is a contributing factor to why many students do not consider IT as a possible future career.

1.3.1. Defining IT higher education courses
Prior to embarking on the investigation the discipline needs to be explained in greater detail. The higher education discipline referred to in this dissertation as Information Technology delivers degrees with many names, for example Bachelors of Computing, Computer Science, Information Systems, Business Information Systems, Information and Communication Technology, Multimedia, Network Computing, Software Engineering and any combination of the above are under the IT classification. IT is a relatively new discipline that is often embedded in other university faculties, not on its own. Tatnall and Davey (2004) documented the path of IT in Australian universities and recorded that the first university course in computing titled "The theory of computation, computing practices, and the theory of programming" was offered in the University of Sydney through their Department of Mathematics in 1947. The University of Melbourne established a Department of Information Systems in 1964 and other universities and colleges of advanced education followed through the next few decades. However the first Australian stand-alone Faculty of Computing and Information Technology was not established until 1990 at Monash University, Victoria. In many universities there is still no separate faculty and the discipline is taught in the Science, Engineering, Business or Mathematics faculties.
The many names associated with the discipline, its relatively new nature, and the continuing change in the applications of its content, mean there is a range of courses offered from abstract to applied, technical to socio-technical, those requiring greater mathematical and computational skill sets to those requiring greater literacy and communication skills. This range of specialisations contributes to the confusion in the general public and student population about what an Information Technology career involves.

More recently IT as a separate entity was removed from the junior school curriculum in secondary schools in Victoria in 2006, and embedded in the teaching and learning of all other discipline areas. The lack of individual identity within the junior school curriculum may add to confusion of definition. In many schools IT is either associated with compulsory skills classes for key-boarding and application packages like word processors and spreadsheet use, or middle school electives focusing on multimedia applications. In universities there are many discourses on what constitutes an IT career between the technical, creative and the socio-technical business fields. These many discourses and conflicting definitions of the nature of IT as a discipline are strongly dependent on who is providing the definition. The volatility and ubiquitous nature of IT ensures that it remains confusing and difficult to adequately label. This unique nature and relative newness of the discipline, coupled with the lack of clarity about what an IT career involved created this need to investigate how adolescents form attitudes to courses and careers in IT.

1.4 Conclusion
The question posed to contextualise the argument of this thesis is “How do adolescents form attitudes to IT that may influence their study and career choices?” Some of the concepts explored are the influence of self-efficacy beliefs in career decision-making; gendered confidence levels in the use of technology and the prevailing socialization of careers and their gendered labels in western society. Each of these factors is examined to determine the extent of their influence on career decision-making in students, with a particular focus on young women and IT careers. Through semi-structured interviews students were asked to put voice to their future career plans at three different year levels
in their secondary education, year eight, year ten and year twelve, chosen in particular because of the need for them to consider future subjects and courses at each of these critical stages of their secondary education. This enabled an analysis of the nature of decision-making associated with age as well gender differences at each of these stages. Current university IT students at two universities were interviewed to investigate what factors cemented their post-secondary education course choice. All the interviews were conducted in gender-based groupings to determine if factors that influenced female student IT choices differed from those that influenced male student choices. A detailed description of the full research method is presented in chapter four.

The lack of sustained results from the many intervention programs to attract women to Information Technology led to the conclusion that there is an uncertainty about the true causes of the gender imbalance in this discipline. This research is both relevant and timely because it provides an insight into adolescent career choice and decision-making with a particular focus on gender and IT in the twenty-first century. It covered some of the gaps in the existing literature and provided a snapshot of student attitudes to IT and investigated how their attitude to IT was formed and how this influenced student choice of course and future career. It found a pattern of factors specific to Information Technology that encouraged some males to choose this career path and a pattern of inhibiting factors that had a stronger negative impact on young women than young men. This research informs the ‘Women and IT’ literature by providing a localised investigation that may provide generalisable outcomes to be tested on a larger sample.

In particular this dissertation investigated the under representation of women in IT from the basis of existing career choice literature where there is a body of knowledge on the impact of gender in career decision-making but a paucity of evidence on how this applies to the new and evolving IT discipline. This thesis directly addressed the need for further research called for by the Commonwealth Government project report which suggested that research is needed into:
The reasons why girls participate less in those curriculum areas most associated with information technologies and what curriculum changes may best facilitate girls’ greater participation and success. (Collins et al. 2000 p.15)

This research determined some of the interactions, correlations and causalities that affect female student career choice with a particular focus on Information Technology careers.

1.5 Organisation of thesis

This thesis has ten chapters. The first chapter introduced the issue and placed it in the context of the twenty-first century in Australia by providing enrolment statistics to visually display trends of declining participation of women in IT. The argument was stated that due to the pervasiveness of IT in all aspects of life in the twenty-first century, the under-representation of women in this field has social and economic implications. The paradoxical decline of females in this increasingly ubiquitous and influential discipline is placed in the context of increasing participation of women in other disciplines and higher education in general. An overview of some of the issues believed to influence and account for the under-representation of women in IT, to be explored in more detail throughout the thesis, was presented. The volatile and confusing nature of the IT discipline was introduced to provide a context for the uniqueness and relevance of this current investigation.

Chapter 2 presents the theoretical underpinning of this study, in particular theories of self-efficacy and career decision-making models as they apply to choice of IT career as seen through the lens of gender. These two bodies of literature informed this study and are enhanced by some of the feminist literature that investigated socio-cultural factors that socialise young women for their expected role in society. The theoretical framework for the research question is developed throughout this chapter.

Chapter 3 investigates the Australian and international ‘Women and IT’ literature. Reference is made to theories that explored the masculinisation of the IT discipline followed by a discussion around the lack of sustainable impact on declining female student numbers of earlier Australian intervention programs. This summary of the current body of literature is presented through the lens of the nature of the discipline and
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includes a discussion on media representation of gendered messages about IT. Finally, self-efficacy, socio-cultural and student career choice literature is revisited to draw a picture of the many layered factors that influence IT career and course choice. The body of literature is used to develop the study design and main research questions.

Chapter 4 describes and gives justification for the research methodology employed in this thesis. It begins by presenting the research questions that were formulated primarily from the body of literature. The method selected for investigation is justified and an outline of the sampling methodology employed is presented. The chapter includes a profile of each of the schools and universities included in the sample to provide a richer picture of the students interviewed.

Chapter 5, 6, and 7 present the findings from the junior school, middle school and senior school students. Each chapter follows a similar order beginning with the extent of student IT use for school and leisure purposes followed by student consideration of IT in subject or career choices and who or what was the main influence on student course and career decision-making. The findings are presented through the lens of gender. The junior school students reflected on their primary school IT use in Chapter 5, and the senior school students discussed their higher education aspirations in Chapter 7. This chapter concludes with a discussion of similarities and differences according to age of student.

Chapter 8 presents the findings from the university student interviews. For ease of comparison these interviews have been grouped according to the degrees the students were enrolled in. These four groupings were technical degrees, business oriented IT degrees, multimedia degrees and double-degrees where students had combined and IT qualification with another discipline. Chapter 8 concludes with a discussion of the commonalities between the age groups as well and revisits the limitations of the study.

Chapter 9 provides synthesis and discussion of the themes that emerged from the findings presented in the previous four chapters. The lens of gender is used to compare
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the influence of factors that shaped student decision-making related to Information Technology study and career choices. This chapter summarised the responses to the research questions that provided the framework for the thesis and set the scene for the concluding chapter.

The final chapter of the thesis, Chapter 10, discusses the implications of this research in terms of increasing female participation in IT in the future. The research question presented in Chapter 1 is revisited and addressed in light of the findings. An informed comment is made on the precarious future of IT existing as a separate discipline in schools and universities based on this study. The discussion in this final chapter also places emphasis on where this study informs the current body of literature and concludes with suggestions for further research.
CHAPTER 2: SELF-EFFICACY AND CAREER DECISION-MAKING THEORIES: THROUGH A GENDERED LENS

2.1 Introduction

In my parents’ lounge room after Christmas dinner
I am talking to my brother the computer programmer.
He is explaining to me the principles of cyberspace.
“It is only relatively complex,” he says finally, peeling the icing off his fruitcake,
“It is mainly a system of binaries, permutations of zero and one.
So the data may be stored as, say, zero, zero, one, one, one, zero, zero, one.”
My mother sighs.
She is next to us, half-listening.
She is knitting a fair-isle sweater.
“I’ll never understand how you get your brain around it,” she says.
“It’s beyond me,” she says, and turns half her attention back
to her fair-isle pattern:
Purl purl plain, plain plain plain purl purl.

RELATIVE COMPLEXITY, Cate Kennedy (Senjen and Guthrey 1996 p.13)

This poem is one interpretation of the perception of the IT discipline being complex and difficult, understandable only to young males. It is reproduced here as an introduction to the discussion of the evolution and development of the theoretical framework underpinning the thesis. The framework draws together educational psychology theories of self-efficacy, socio-cultural theories with particular focus on the gendered aspects of career choice, and thirdly career decision-making theories and models including cost-benefit choice models. Drawing together literature from these three diverse areas allows an examination of their application to the new and varied IT discipline to be developed.

While educational psychology theories of self-efficacy shed light on the development of like and dislike towards aspects of IT, it is also essential to consider the career choice decision-making theories and models in helping to understand the cost-benefit dimensions of career choice in young women in the twenty-first century. A preliminary survey of the literature revealed no evidence of empirical research which combines these two literatures in a study of IT course choice and career decision-making; yet they
aptly complement one another for the purpose of this study. Lastly it is difficult to divorce any study from socio-cultural factors that condition young women for their expected role in society, consequently this thesis is informed by some of the more salient feminist theories as they apply to career choice and IT, to build a theoretical framework for the research question.

This chapter presents the theories of self-efficacy and gender as they apply to IT then a discussion of the influence of socio-cultural environment on gendered differences in career choice through the lens of women in IT. A critical evaluation of applicable career decision-making models informs the development of the theoretical base developed from the literature for this thesis. Chapter 2 lays the foundations for a critical analysis of the current “Women in IT” literature as presented in Chapter 3.

2.2 Self-efficacy

Perceived self-efficacy refers to beliefs in one’s capabilities to organise and execute the courses of action required to produce given attainments. (Bandura 1997 p.3)

There is strong evidence that perceived self-efficacy has a marked effect on choices made by individuals, particularly in their choices of education and career paths. Self-efficacy is “most central and pervasive” (Bandura 1997 p.2) in all aspects of the functioning of an individual. However, unlike self-esteem, which is a global feeling or attitude related to general well being and the opinion one holds of oneself in society (Zimmerman 1995 p.218), self-efficacy is context based and related to how capable one feels to perform a specific task in a variety of circumstances. Perceived self-efficacy in a particular task is dependent on the importance an individual places on that task. Self-efficacy has also been described as self-feeling that “in this world depends entirely on what we back ourselves to be and do” (James, cited in Pajares 2002). While much of the research reported in this chapter grew out of general education studies, the application of the theory to IT is important in the current environment of a growing under-representation of women in IT education and careers.
Many factors can influence choices made at different points in life. Self-efficacy is believed to be the most central factor of decision-making in the individual. Self-efficacy is developed over time and has a generative capacity, meaning it can be developed or changed by external influences such as education, parental influence and peer groups. The foundations for self-efficacy are laid in childhood with several impacting factors throughout life. The effects of family, peers, and society are influential in its development in particular areas. An awareness of how self-efficacy is developed can inform educationalists, particularly with respect to how it is developed in non-traditional education areas such as IT. The generative capacity of self-efficacy with particular reference to gender and IT is examined in more detail in the next section.

2.2.1 Development of self-efficacy: resilience and motivation

Differences occur between individuals in the areas, skills or tasks in which self-efficacy is developed, and how strong it is. This can be due to a mixture of natural endowment, socio-cultural experiences and fortuitous circumstances. It is the general view that ability alone is an insufficient predictor of success in students. It is more important to have strong self-efficacy and the ability to use talent, skills and knowledge under challenging or stressful situations (Bandura 1997).

Educational psychologists in the 1960s and 70s studied intrinsic motivational forces in students and the importance of a “healthy self-concept and positive self-esteem” (Pajares 2002). Self-concept is a holistic opinion of oneself, “as complete and thorough a description as is possible for one to give” (Reber 1995 p.701), and differs from self-esteem which is a judgment of one’s value and the more task-focused self-efficacy. According to Anderson self-esteem is affected by the role of parental, societal and life-stage influences (Anderson 1998). These researchers concluded that self-efficacy beliefs were very important in determining what individuals achieve with the knowledge and skills that they possess. It has been noted that if a strong self-efficacy construct exists, there is less likelihood of quitting and that students are more resilient to keep attempting a particular problem, skill or task until they succeed (Reeve 1996). Pintrich and Schunk (1996) explored this further and described the concept as ‘failure avoidance’, where students will not choose to do a task, or continue to engage in a task when they expect
to fail. While these studies recognise the importance of ability, they emphasise that it is the positive effect of self-efficacy beliefs that influence motivation and persistence and determine the level of success of students.

To build motivation and resilience when learning a new skill or application it is important for students to experience early successes to increase perceptions of self-efficacy and ensure that they do not become early “quitters” when tasks are challenging. Bandura quoted studies using different students with the same skills in mathematics performing differently in a test situation. Those who regarded themselves as capable in mathematics were more persistent and achieved better results than the students who doubted their mathematical abilities (Bandura 1997 p.37). The development of personal efficacy beliefs in relation to academic ability begins in the primary school classroom (Bandura 1997). Accrediting progress to ability rather than hard work creates a greater sense of efficacy. The importance of skill and knowledge development through “small steps” is emphasized.

Subject matters should be structured in easily mastered steps to learn basic principles, practiced by applying the knowledge. (Bandura 1997 p.208).

Studies have found that students with a strong belief in their ability display greater persistence in difficult tasks (Oettingen 1995 p.168). As previously mentioned, Bandura observed children with equal mathematical ability and differing self-efficacy beliefs completing mathematical problems. Those with high self-efficacy reworked more problems and persisted longer with difficult examples than the students with low mathematical self-efficacy, concluding that self-efficacy has a positive effect on persistence (Bandura 1997, p.37). Pajares applied self-efficacy concepts to the wider education institution and emphasized that school’s fundamental goal is to equip students with self-regulatory capabilities, meaning the ability to control and develop personal efficacy (Pajares 2002). This impacts on teaching methodology and approaches and how self-efficacy can be nurtured and developed in various topic and subject areas. The impact of developing teaching strategies that build self-efficacy, particularly its gendered application in the discipline of IT, forms the focus of the next section.
2.2.2 Generative capabilities of self-efficacy

Researchers in this field strongly believe in the generative capability of self-efficacy and have shown how it can be developed or generated through success in tasks and repetitive experiences (Bandura 1997; Reeve 1996; Pajares 2002). Given the nature of the IT discipline and a perception that hardware familiarity and software mastery are necessary before addressing creativity and problem solving activities, these findings are important. It is also believed that self-efficacy is more powerful than ability (Zimmerman 1995), another important theory when applied to women in IT and begs the question why very successful women shun this discipline. To shed further light on the research question requires a deeper investigation into the aspects that develop self-efficacy in an individual.

There are four sources of self-efficacy beliefs; mastery or performance accomplishments, vicarious experience, verbal social persuasions and physiological states (Pajares 2002). Mastery refers to the attainment of a high level of ability in a skill or task that is considered worthwhile (has weight or value). Regular small successes when learning new skills or material in a particular field is important to the building of self-efficacy beliefs. This is a technique that is used by educators to develop mastery and therefore a perception of self-efficacy in students. The context of the attainment of the skill or ability is also important. Lacking self-efficacy in an activity will have little effect on self-esteem if the person involved or wider society does not value that activity. (Bandura 1997, p. 18). He also placed importance on verbal reinforcement in educational instances (Bandura, 1997 p. 225). Pajeras also noted the importance of the exposure to verbal judgements of others within the social environment, and qualified this by stating that verbal judgements must be more than “knee jerk homilies” (Pajares 2002) but be expressions of genuine praise. The influence of verbal reinforcement in the IT classroom needs also to be investigated. This aspect of self-efficacy when applied to women in IT is reminiscent of the “I can but I don’t want to” findings in a UK study where there was no significant difference in gendered use of computers, but career aspirations between genders varied. (Durndell et al. 1995).
Chapter 2: Self-efficacy and career decision-making theories

Vicarious experience, the second source of self-efficacy beliefs refers to the influence of peer groups on the development of self-perceptions of competence (Bandura 1997; Pajares 2002). Seeing successful models in a particular activity is important for building one’s own confidence to attempt and master the same activity. Some educators emphasize the importance of verbalising the steps in a task while completing it, then encouraging students to do the same. They call this taking logic steps to increase one’s mastery and therefore self-efficacy (Pintrich & Schunk 1996). Zimmerman reported that subject matter should be structured in easily mastered steps to learn basic principles practiced by applying the knowledge, and also that modelling of cognitive strategies by verbalization is a useful tool (Zimmerman 1995, p.208). Applying this aspect of development of efficacy related to IT could be problematic in an IT classroom, where teachers are often under-resourced and young men have been known to dominate (Barker and Aspray 2006). An under-representation of female role-models in IT could be a contributing factor to females not considering this a valid course and career choice, a factor discussed in more detail in the next chapter.

The third source for development of personal self-efficacy involves observing and integrating information from a variety of sources, labelled social persuasions by Bandura (1997). Social groups, wider society and the culture of one’s social group can affect what information is selected as important by an individual and how it is weighted. This is important in the development of gendered perceptions in relation to IT because young women have a strong desire to be socially accepted in their early years, and if there is a gendered divide in the importance of IT competence in the social group, as appears to be the case in Australia, this will strongly influence the importance that is placed on IT competence. It also has wider cultural implications depending on the cultural environment a student is brought up in. Oettingen (1995) investigated cross-cultural perspectives on self-efficacy and classified these into four cultural dimensions of “Individualism versus collectivism”, which refers to whether the ethos of a culture is predominately to look after one’s own welfare or that of a larger group; “Power distance”, whether the culture has large differences of power between sub-groups or is relatively homogeneous in the sharing of power; “Uncertainty avoidance”, related to how strict or how tolerant a society is, and lastly “Masculinity versus femininity”, the
level to which a culture strives for the maximum difference between the genders. Cultures with the greater difference are classified as masculine (Oettingen 1995).

These external forces influence the source and weighting of self-efficacy beliefs in an individual, for example a culture that values “collectivism” will not value individual achievement over group successes; therefore self-efficacy for individual attainments will not be developed to the same extent as in a culture that values “individualism”. The importance placed upon skills and attributes will vary between individuals dependent on these external factors of social groups and culture. The research conducted for this dissertation will evaluate to some degree the variations in importance placed on IT skills between the genders at several life stages and is informed by these self-efficacy theories as they are influenced by cultural norms.

The fourth source in the development of self-efficacy beliefs according to current research is the physiological state of an individual; their ability to perform under duress (Pajares 2002). Self-efficacy can influence the amount of stress a student may feel when beginning a challenging activity with feelings of calmness, nervousness, hesitance or fear resulting in a physiological response. It is worthwhile to consider this aspect of self-efficacy in the computing environment and the situation that may occur when problematic hardware or software creates malfunctions. On the other hand when there is a successful outcome to an activity the next time this task arises an individual will approach it in a calmer and more confident manner (Pajares, 2002).

These four sources of self-efficacy development have considerable importance when applied to how young women are introduced to IT both in the home and in the classroom. Differences do occur between individuals in the strength of efficacy development in specific areas, skills or tasks. This research will investigate these differences with particular focus on gender and IT and determine if these differences are due to a mixture of natural endowment, socio-cultural experiences or fortuitous circumstances. It is the general view of researchers in this field that ability alone is an insufficient predictor of success. It is more important to have strong self-efficacy and the ability to use talent, skills and knowledge under challenging or stressful situations.
There appears to be a gendered differentiation in opportunities to develop strong IT self-efficacy that favours boys over girls. A closer investigation of this concept follows in the next section.

2.2.3. Peer group influences on self-efficacy

Peers are a potent force in the development of self-efficacy beliefs. While parents are the major source of encouragement and feedback in younger children, as children move into adolescence the importance of peer acceptance and approval becomes more noticeable.

A vast amount of social learning occurs among peers. Selective peer association will promote self-efficacy in directions of mutual interest. The social influences are undoubtedly bi-directional (Bandura 1997, p.173).

The importance of peer approval in certain activities is critical to the social and educational environment of young people. Studies have shown that this is of greater importance to adolescent females than males. In a study that investigated the “possible selves” of adolescents Knox, Funk, Elliot and Greene (2000) concluded that girls most feared “possible selves” concerned relationship functioning and boys most feared “possible selves” related to occupations; also girls had more feared possible selves in total than boys concluding that girls are generally more fearful (Knox et al. 2000) which could be extrapolated to indicate they are less likely to take risks.

The role of peer influence in the development of self-efficacy in relation to the current IT environment is likely to be stronger in young men than young women. Boys have a greater likelihood of being introduced to IT in the home through the computer games market (Huff 2002). This aspect of introduction to the hardware and familiarity with several applications of the software in a relaxed recreational environment appear to be contributing to young men developing a greater confidence and affinity with IT than young women. It also implies that young women will have less opportunity to develop self-efficacy in IT, both at home and at school which could have an impact on the feelings of self-efficacy that females hold in relation to IT. These factors warrant further investigation and will inform the research gathering aspect of this thesis.
2.2.4 Success attribution and genders

An element of building self-efficacy, particularly in areas that are considered non-traditional by women, such as IT, is the development of successful interactions and experiences. Researchers have found a connection between self-efficacy, student persistence at a task and success attribution, and in some instances, a gendered pattern of difference.

The success-oriented student is high in motive for success and low in fear of failure. A student who is a failure avoider, is high in fear of failure and low in motive for success (Pintrich and Schunk 1996 p.77).

Pintrich and Schunk classified students according to their expectancy beliefs as success-oriented or failure avoiders. Those who expect to succeed will persist, those who experience failure will avoid that activity in future. While Pintrich and Shunk did not investigate any gendered pattern in students who fit either of their categories, Reeve (1996) did in his investigation of “expectancy beliefs” by reference to an earlier study (Hackett 1995) about the avoidance of mathematics related activities by females due to their low confidence or self-efficacy. Reeve concluded that female students who avoided mathematics often had the lowest self-efficacy rather than the lowest ability (Reeve 1996), linking expectancy beliefs with self-efficacy. While Hackett and Reeve investigated expectancy beliefs in mathematics, it can be extrapolated that early student experiences with IT such as the confidence that males achieve through early game playing, coupled with the increasing masculinity of the discipline, may result in young women avoiding IT because of an expectancy of failure. Similar conclusions were obtained by another investigation into gender differences in the development of self-efficacy beliefs (Rayman and Brett 1995). This study stressed the importance of the intersection of psychological and social factors such as self-confidence and perceived ability and referenced earlier studies by Clance and Imes (1978) and Sassen (1980) which found that women tended to attribute their success to extrinsic factors such as luck, rather than intrinsic factors such as ability to a much greater degree than men (Rayman and Brett 1995 p.2). The importance of the persistence of females in non-traditional fields was emphasized using the science discipline as its example. These authors concluded that there is a strong link between perceived self-efficacy and its effect on confidence and persistence in the education and career choices of females in science (Rayman and Brett 1995).
Self-efficacy, expectations of success and internal or external attribution of failure lead to the gendered nature of expectancy beliefs and positive educational interactions. In a discussion of self-efficacy and educational development Zimmerman (1995) found that students with strong self-efficacy in an area, who believe the task is high in importance, will have greater persistence at the task and greater success than students with the same ability but lower self-efficacy beliefs. Perceived self-efficacy is positively correlated with students’ choice of majors in college and strongly influenced students’ attitudes to mathematical subjects (Zimmerman 1995). Zimmerman found that students’ attraction toward the subject was insufficient to motivate students to achieve if they doubted their mathematical capabilities and concluded that personal efficacy enhanced effort and persistence in academic activities.

Perceived self-efficacy fosters engagement in learning activities that promote the development of educational competencies ... affecting the level of achievements as well as motivation (Zimmerman 1995 p.208).

Conversely a European study reported the surprise that young women expressed when they succeeded in an IT class by not only creating working programs but really enjoying the experience (Corneliussen 2005). This research concluded that negative beliefs in IT self-efficacy can be countermanded by enjoyable and successful classroom interactions. Corneliussen reported these revelations after studying a group of young women who had to complete an IT component in their degree and found themselves in a core computing laboratory. When young girls were given ‘permission’ to enjoy the computer some even expressed a love for it after time emphasising the generative capacity of self-efficacy development (Corneliussen 2005).

An initial summary interpretation of this body of self-efficacy literature concludes that self-efficacy beliefs will determine how much effort an individual will expend on an activity, how resilient they will be in adverse situations and what weightings or importance they will place on particular activities. This is important to student experiences when being introduced to IT at home and in a classroom environment. Early successes and positive experiences with IT will strongly influence self-efficacy and persistence with IT courses and career decisions. The question of why there is an
under-representation of women in IT addressed through an examination of this self-efficacy body of literature is complemented by the socio-cultural literature particularly relevant to gender, IT and course and career decision-making explored in the next section.

2.3 The socio-cultural environment: habitus

The self-efficacy body of literature emphasised how the social setting and cultural environment of a home is filtered through parents to contribute to the formation of core beliefs in a child. This is labelled ‘habitus’ by Bourdieu and incorporates all aspects of the surroundings, setting of the home and atmosphere within a cultural unit (Hodkinson and Sparkes 1997). The habitus incorporates parental beliefs, which children usually adopt, particularly in their formative years. Some of these beliefs are intrinsically embedded in their upbringing, such as the value of a certain level of education or the importance of a work ethic. If an activity is valued by parents, then the child’s perceived self-efficacy related to this activity will be dependent on how well they master it. It can be assumed that if it were a high-valued activity, reading for example, the verbal reinforcement of parents would be considerable in substantiating the child’s feelings of self-efficacy (Pajares 2002).

It is apparent from research that self-efficacy expectations can become socialized within the family context to the extent that parents contribute to the development and consolidation of a child's self-efficacy (Schneewind 1995). Extrapolation of this knowledge to the application and use of IT in the home contributes to a gendered interpretation of technology. For example, in western homes boys and fathers play computer games to a much greater degree than mothers and daughters (Furger 1998; Barker and Aspray 2006). It is also the male parent who is usually responsible for technical equipment in the home, the female parent for nurturing. From a very early age young women are socialised away from the technical and indeed IT in general is perceived as the domain of the male in the home (Furger 1998). However, the association of technology in the masculine domain may be more than a construct of the socio-cultural environment and the causality of the gendering of the technology has been brought to question. There is a need to unpack cultural norms and stereotypical behaviours that begin in the home, particularly in relation to IT, to investigate the
causality of whether boys and men who are attracted to computer games "were predisposed to certain attitudes and interests, and that they chose to play computer games on that account" (Barker and Aspray 2006 p.41) or if the predominance of this activity in the male sphere is because of the cultural labelling of IT as male in the social thread of western society. This question remains unanswered in the literature and is beyond the scope of this thesis; however gendered attitudes to technology will be explored, with particular attention to how IT self-efficacy is generated and whether this is different for girls than for boys.

### 2.3.1 Gender and the need for connectivity

Gilligan’s seminal work on the psychology of gender argued that females and males have a varying psychological make-up and approach tasks in very different ways (Gilligan 1982). Her research showed that each gender had a different approach to decision-making and that prior psychological theories from Freud to Piaget did not account for gendered approaches to social relationships. She found that females had different portrayals of achievement than males, which led to different modes of action and different ways of assessing the consequences of choice (Gilligan 1982 p.63). Gilligan presented evidence to show that males defined themselves through separation and females through relationships and that this often led to females experiencing tension between “the importance of self-determinism and respect and the ethic of care” (Gilligan 1982 p.136).

> [It is the] ethic of responsibility that is the center of women’s moral concern, anchoring the self in a world of relationships and giving rise to activities of care (Gilligan 1982 p.132)

Not all researchers are in agreement with Gilligan’s research, particularly in that it challenged Kohlberg’s thesis of the ‘justice ethic’ that concluded mature ethical responsibility was focused around male traits of fairness, right and obligation (Kohlberg 1982). She declared Kohlberg’s findings to be faulty because they were derived from a totally masculine sample. There is a strong empirical and cross-cultural base underpinning Gilligan’s work that justifies its use in the context of the present thesis. This strong need for connectivity in relationships has an impact on the type of career a
young woman will choose. The ethic of care and moral concern can be practiced in the disciplines of Medicine and Law, two disciplines which have experienced an influx of female students in the latter part of the last century (see Chapter 1, Figure 1), whereas the same has not been true of IT.

The gendered division between the “justice ethic” and “care ethic” is not considered to be binary in application. Other researchers commenting on the public debate between these two former colleagues (Gilligan and Kohlberg) concluded that "most individuals use both orientations some of the time" (Flanagan and Jackson 1987 p.624). In a similar vein, Radford asserted that a person’s perception of where they see themselves as fitting along a “masculine - feminine continuum” affected the choices they made (Radford 1998b p.187). Consequently he posited that choices were often gendered due to individual makeup, inherited potential and developed by physiological, familial, educational, social and other influences. More importantly, Radford’s thesis that where an individual positions themself on the gender continuum affects how capable they feel in occupations where their gender is in the minority, has direct implications to women in IT (Radford 1998b p.187). He posited that in relation to career choice “women and men might simply prefer to do different things, and a democratic society might be expected to accept such preferences whatever their basis” (Radford 1998b p.179). This view fails to incorporate the influences of cultural capital and habitus on the degree of choice available to females in a given society. His argument is that while there are biological bases for cognitive differences that will never disappear, and there will always be occupations where males or females are under-represented, societal stereotypes can be countermanded by increased education and understanding.

There is no justification for holding that men or women ought, or ought not, to be nurses or engineers, although there are reasons why they may continue to choose differentially (Radford 1998b p.187).

Radford concluded that choices are gendered due to individual makeup, inherited potential and developed by physiological, familial, educational, social and other influences. Included in these other influences is a person’s perception of self-efficacy
and where they see themselves as fitting along a “masculine - feminine continuum” (Radford 1998, p.187). Radford’s view is grounded in a degree of gender-blindness that is in reality an affirmation of the status-quo of society and does not take into account the intricacies and power differentials that affect access to education and relative freedom in career choice between the genders.

Applying this to the current gender imbalance in IT courses in higher education where females are often in the minority, awareness that they are a minority gender may be one of the factors affecting the reluctance of many young women to consider this pathway and also contribute to a lack of resilience in females to persist in IT careers where they see they are the minority. This creates a downward spiral of minority gender, in this case females, disinclined to pursue careers and courses because these courses and careers are perceived as being masculine, and therefore to pursue this path would mean they needed to be ‘other’ than the norm. Giving some credence to this assumption is the positive outcome achieved through a reversal of this trend at one institution. It has been observed that a greater gender balance in the student cohort, achieved through several means discussed in the next chapter, is already having a positive effect in attracting more women into their IT courses (Margolis and Fisher 2002).

The socio-cultural environment of students, their habitus, is strongly influenced by their education experience, family, and peers and contributes to the building of self-efficacy, the foundations of which are laid in childhood. The gendered nature of IT use coupled with stereotypical perceptions of an IT career, influence student career decisions and leads to the following analysis of the career decision-making literature.

2.4 Career Decision-Making Literature
While psychological theories of self-efficacy and gendered implications of habitus have much to offer, it is important to balance these with consideration of factors that influence career decision-making, including economically driven cost-benefit models. In the USA this body of literature is focused around choosing colleges and majors and the factors that influence these decisions. Research originating in the UK tends to focus
to a much greater degree around choosing a career rather than selecting a higher education institution. Concurrently, there is a paucity of career decision-making literature grounded in the Australian environment, and given that the education model adopted in Australia is strongly tied to the UK system, and much of the socio-cultural influences on Australian youth derive in the USA, it is appropriate that international cases be used to underpin this present study.

Hossler, Schmit and Vesper (1999) conducted a longitudinal study in the USA that synthesised three theoretical perspectives of student choice models focussing on how students arrived at decisions about which college to attend. According to this study the three most influential factors in college decision-making could be classed as economic, status-attainment and information-seeking. The economic factors revolved around the costs and benefits (both monetary and social) of going to college, and it is noted that many of the pre-existing models of decision-making assumed that the students made rational cost-benefit decisions at this age (Hossler et al. 1999 p.144). The authors acknowledged that selecting a college was a complex process and the fact that many students usually only participated in it once impacted on the difficulty of developing rational choice models. Status-attainment factors differed from the economic factors in that there was no assumption made about rational decision-making, but involved the interaction with socio-cultural factors of the student’s habitus. Lastly information-seeking was a ‘perspective, gathering and processing information in a social setting ... an essential part of decision-making rather than a pre-requisite’ (Hossler et al. 1999 p.151). This longitudinal study focussed on the wider spectrum of which institution to attend and while there are some basic assumptions in the student choice models, the decision-making theory involved informs the current research into the more focussed spectrum of degree choice.

The influence of social capital and cultural capital are acknowledged in several of these choice models. Social capital is defined by Coleman (1990) as a “complex set of factors and relationships that exist in a close-knit group such as a family” (Hossler et al. 1999 p.151), an example being the time and energy invested in a child that leads to a love of reading. Cultural capital (Bourdieu, 1977; McDonough, 1997) is defined as the preferences and attitudes developed that are related to class, status and privilege and it is
distinguished from social capital by time and location, social capital being more focused on the local and in the present and similar in definition to habitus. The esoteric distinctions between the definition of social capital and habitus are not important to this thesis and habitus and social capital will be assumed to refer to the same concept from now on. The majority of the theorists in this body of literature recognise that decision-making and choice is strongly affected by the influence of both social and cultural capital. Cultural capital applied to student decision-making incorporates the effect of education and economic status of a student’s family. Social capital builds on the state of cultural capital and is more an internalised set of experiences, outlooks, beliefs that individuals accumulated from their immediate environment (schools, teachers, counsellors) (Hossler et al. 1999 p.151-152). It is also noted that social capital is available outside the home and students can influence each other’s behaviour because they act as a unit. This is an important aspect and relevant to decision-making around gender and IT. Social capital is bi-modal, meaning that family and students can influence each other's behaviours, allowing a cost-benefit analysis to take place to inform course and career selection, once more a relevant aspect that needs to be tested in the gender and IT sphere.

The conclusion reached by Hossler, Schmit and Vesper is that “gathering and processing information in a social setting is an essential part of decision-making rather than a pre-requisite” (1999 p.151). They derived a processing approach to decision-making and emphasized students as information gatherers and processors, interacting with and being influenced by their habitus:

> those aspects of culture that are anchored in the body or daily practices of individuals, groups, societies, and nations. It includes the totality of learned habits, bodily skills, styles, tastes, and other non-discursive knowledges that might be said to "go without saying" for a specific group (Hossler et al. 1999 p.151)

The influence of cultural capital and habitus are all extremely powerful in student decision-making process when applied to IT. It would appear that a certain economic status must be attained for IT to hold a position as a possible career choice, because building familiarity in the home is often the first stage of developing IT self-efficacy,
Chapter 2: Self-efficacy and career decision-making theories

notwithstanding the masculinisation of technology that exists in most western societies. Adya and Kaiser found that early access to computers may reduce intimidation females often feel when confronted with technology, and when coupled with a positive and supportive male parent, women are more inclined to consider IT as a career choice (Adya and Kaiser 2005). Their research supports the positive influence of cultural and social capital on IT use and future career choice in girls, while the influence of a ‘supportive male parent’ could be classified as a fortuitous circumstance along with economic status.

Researchers in the UK substantiate Hossler, Schmit and Vesper’s model and emphasized the importance of habitus on career decision-making. "Individuals make their own selections from the culture, both deliberately through discursive consciousness and unwittingly through practical consciousness." (Hodkinson and Sparkes 1997 p.32). They assert that “decision-making can never be context-free." (Hodkinson and Sparkes 1997 p 34), and coined the term “Careership” discussed in the next section.

2.4.1 Careership and happenstance

In the current discourse of career decision-making there are assumptions of the individual’s freedom to choose. In reality this is not often the case and choice of career or course can be influenced by external factors as well as habitus. UK researchers in this field presented a model of career decision-making, coined 'Careership' taking this into account and introduced the concept of ‘happenstance’ (Hodkinson and Sparkes 1997 p.32), an event or fortuitous meeting that influenced career choice. The Careership model was developed after reviewing UK and international literature (Canada, Japan, Sweden). The authors concluded that attributing the process of career decision-making to economic rationalism makes incorrect assumptions of individual free choice and rational action. In the place of the implicit deterministic economic rationalist theories, the Careership theory blends social and cultural factors with personal choices, incorporating serendipity (the happenstance component) to build in a more sophisticated model of learning (Hodkinson and Sparkes 1997 p.32). Unlike the USA models, the locus of their study is based around the decision-making process of career selection and
incorporates selection of youth-training programs as well as selection of university courses. The Careership model has three integrated dimensions of pragmatically rational decision-making, located in the habitus of the person making the decision; interactions with others in the (youth training) field recognising an unequal distribution of resources (talents) in the individual; and thirdly the location of decisions within the partly unpredictable patterns of turning-points and routines that make up the life-course (happenstance). This model avoided the twin pitfalls of implicit social determinism, assuming a person is locked into a particular pathway because of cultural or social capital, or of seeing (young) people as completely free agents (Hodkinson and Sparkes 1997 p.29) and is more encompassing of the impact of real-world situations and unpredictability around student career and course decision-making.

It is the integrations of pragmatically rational decision-making within a socially and culturally grounded habitus, with interactions within the education/employment field. (Hodkinson and Sparkes 1997 p.38)

The theory of “careership” appears to incorporate many of the elements important to career decision-making in young people and informs the present study because it incorporates many aspects of decision-making that affects whether women select IT courses. In particular the Careership theory states that decision-making is informed by personal and work experiences; partial information located in the familiar and the known; is influenced by family background, culture and life histories; is opportunistically dependent on contacts and experiences; is influenced by feelings and emotions; and is often neither technically rational nor irrational (Hodkinson and Sparkes 1997). An aspect of the Careership theory with important relevance to the present thesis is the finding that some young people reject careers because they did not fit their schematic view that exists within their social class, gender and ethnicity. "What can be 'seen' and therefore 'chosen' depends on the horizon for action" (Hodkinson and Sparkes 1997 p.36). Hodkinson and Sparkes introduce the concept that not all career choices are considered by young people because they are not considered as appropriate within particular social groups emphasising that students are not rational actors in the decision-making process. This is particularly relevant to girls and IT. They also introduce an important aspect to the career decision-making process, that of opportunistic events, ‘happenstance’ that resonates strongly in the study of women in IT. The Careership
theory emphasises a fluid and non-linear decision-making process where the students are influenced by events or people they meet at turning-points in their life. This is an aspect in the course and career decision-making process that is unaccounted for in the psychological self-efficacy literature and an important aspect informing the theoretical base for this thesis. An investigation of career decision-making literature found theorists with similar conclusions to that of Hodkinson and Sparkes, particularly that of gendered expectations of social roles. An evaluation of these theories and models forms the focus of the next section.

2.4.2 Circumspection and compromise

The process of narrowing career alternatives throughout adolescence as an individual matures and the influence of a growing understanding of society's expectations of appropriateness based on gender and current socioeconomic status is conceptualised in Anderson’s career choice model (Anderson 1998). Anderson (1998) like Hodkinson and Sparkes, investigated the psychological theories behind occupational choice. She concluded that the current research pointed to developmental processes through which an individual was seeking to implement their self-concept through their career choice. While she acknowledged that the development of educational and career choice is a complex process, she too recognised the environmental restrictions on choice. Anderson quoted Gottredson's (1981) model of career development which moved through the phases of circumspection, a ‘zone of acceptable alternatives’, and compromise, the reality of the situation and how it affected career choice decisions.

In this model it is surmised that the process of circumspection that results in a number of possible career alternatives is influenced by gender, social status and personal interest (Anderson 1998 p.146). The process of circumspection is in turn influenced by reality, the second phase of career choice decision-making labelled as compromise. Environmental and geographical factors are the final influence on the career choice decision-making process (Anderson 1998 p.148). An individual may have determined their ‘zone of acceptable alternatives’ but the reality of economic position or geographical location will influence the final career decision, for example they may choose an alternative close to home for economic reasons rather than a distant or more
Anderson’s model presumes a close connection between career choice and self-efficacy. Self-efficacy is assumed to be predictive of academic persistence, achievement and therefore a major influence on career decision-making. This study concluded that there is a reciprocal relationship between self-efficacy and interests in that “where individuals perceive themselves to be efficacious, interest will emerge” (Lent as cited in Anderson 1998 p.150).

Anderson observed that a fault of earlier career decision-making theory was the implicit belief that the process was linear, when in fact it often was not (Anderson 1998). Instead the circumspection and compromise model implied that the process could be iterative; meaning a consideration of possible careers could be modified and changed due to altered environments at various stages in a person’s life. Current research favours this developmental process where an individual is seeking to implement their self–concept through their career choice. This in turn is affected by the role of parental, societal and life-stage influences. Anderson’s study used a qualitative approach with hermeneutically based group discussion and interviews. While she acknowledged that the development of educational and career choice is a complex process, similar to the conclusion reached in the development of the Careership model, Anderson recognized the environmental restrictions on choice, but made no reference to opportunistic events or turning-points other than changes to life experiences embedded in the process of circumspection and compromise.

Anderson took gender into account when conceptualising the process of course and career decision-making, acknowledging the social and cultural expectations associated with different genders and how they would narrow ‘zones of acceptable careers’. Gender was perceived to be a limiting factor in the array of possible careers for some cultural groups. Cultural and societal factors also impact on career decision-making, a process that is neither linear nor necessarily logical in application. Several models have been developed using economic cost-benefit concepts to represent the career decision-making process in adolescence. These models are discussed in the next section.
2.4.3 Cost-benefit aspects of choice models

Cost-benefit choice models focus on how students with certain characteristics weigh costs and benefits in the process of making decisions about which university to attend. These models have grown from economic theory as is reflected in the language used but refer to more than monetary costs or rewards.

These models are useful in considering application of the decision-making process, and incorporate some aspects of circumspection and compromise, but have little mention of habitus and happenstance. An oversight associated with these models is the assumption of a rational process of decision-making and that good information is available. Costs can be direct (i.e. tuition fees) or indirect (loss of friendships, changes to where they live). Benefits can be financial rewards, quality of life and location. The Jackson Combined model (Jackson 1982 cited in Hossler et al. 1999 App Fig.A1) illustrates three stages of decision-making that lead to choice as firstly, preference; the interplaying factors of family background, social context, academic achievement and aspiration; secondly exclusion, the narrowing of the choice set and lastly evaluation; the development of a personal rating scheme to lead to the final choice. This model is not unlike Anderson’s circumspection and compromise theories, excluding the iterative nature of the decision-making process over time and presumes a linear process. In the Jackson Combined Model academic achievement has the strongest correlation with aspirations, exclusions are based on location and cost and are not always rational, narrowing down to the final selection. Social conditions can define the initial choice set and economic variables may influence what is excluded.

These economic cost-benefit models emphasise that the student is an information gatherer and processor starting in the early years of secondary school. This is an assumption that will be tested in this thesis where students will be interviewed at three stages of their secondary schooling. The model developed by Hossler et al. (1999) discussed in 2.4 appears to have been developed from economic choice models and resembles a market research approach with students seeking a match or a fit that suits them. The influence of self-efficacy as a factor is overlooked in the Information Processing Model. In seeking their match, students bring their cultural and social capital
to the decision-making process and gather their information before and during each processing stage, before making their final choice.

These cost-benefit models informed the research of Radford, Anderson and others with the underlying elements of ‘trade-off’s’ to suit economic and social situations. They inform the theoretical base of this present study by introducing a time aspect of student course and career decision-making to determine if students conduct an element of market research activity when investigating possible career alternatives early in their secondary schooling.

The importance of the social and cultural environment of students, the presence or absence of gender differentiations and expectations, and the time aspect of course and career considerations with particular focus on IT careers forms the focus of this thesis. This body of literature has also introduced the concept of serendipity and happenstance to be considered in the present study.

### 2.5 Relevance to IT and course choices

Radford’s argument that education can override stereotypes (Radford 1998a) has been challenged in this chapter and it would appear that a complex set of factors more than societal stereotypes are turning women away from IT careers. Gilligan explained female reluctance to embrace some careers because the act of choice was complicated by selfishness and responsibility and they wished to avoid both. Many females in her study viewed college as an institution where competition overrode cooperativeness (Gilligan 1982). This research is acknowledged as being quite dated, however more recent research investigating organisational culture reports similar selfish nature associated with IT businesses and organisations. Roldan, Soe and Yakura posit that organisations themselves are not gender neutral and in fact the “chilly” climate that devaluates female skills contribute to the female lack of attraction for IT careers (Roldan, Soe and Yakura 2004 p.108). Society has labelled IT as male (Wajcman 2000) and this has extended to these environments being unattractive to women, whether within organisations or education. Like Pearl, Pollack et al (Pearl et al. 2002) they
discuss the individualism in the culture that expects long hours of work and values competition yet devalues female skills of communication because they are accepted as natural to women (Roldan et al. 2004 p.110). It appears that this perception permeates business, society and educational institutions and affects the acceptance of IT being considered an acceptable career option for many young women, a concept discussed in more detail in chapter three.

Representing women as a passive group that are being kept out of the disciplines of science, engineering or technology because of barriers is no longer valid according to Siann and Callaghan (2001). They posit that the perception of IT as a masculine domain account for young women making positive choices to avoid the discipline, as opposed to being prevented from embracing it due to real or imagined barriers. Wajcman posits "neither masculinity, femininity nor technology are fixed, unitary categories, but that they contain multiple possibilities and exist in relation to each other" (Wajcman 2000 p. 460). However, technology and gender are mutually constructed, neither are fixed but historical, cultural and social perceptions ensure that the gendering of IT as male persists well into the 21st century.

The lack of development of self-efficacy in traditionally male dominated disciplines, particularly IT, and its influence on the choices made by females to avoid these disciplines are attributed to the perceived lack of human interaction in the discipline, lack of status of the field in general and the media image of IT experts as socially-challenged eccentric males. It is hypothesised that females have low expectancy beliefs in IT, and do not weight it as being important to them, so avoid it. It would appear that the IT discipline is affected by this negative perception and is caught in a downward spiral of gendered enrolments, the masculine environment contributing to an increasingly narrow band of students seeing it as an attractive course or career option.
2.6 Conclusion

It is apparent from the body of literature presented in this chapter that the influence of perceived self-efficacy and its effect on the choices made by young women to enter non-traditional career paths is central to the decision-making process around IT courses and careers. The foundations of self-efficacy developed in the family are affected by educational experiences as well as peer group influences. The interplay of self-efficacy development, the importance of habitus and cultural capital, the gendered nature of peer influence in adolescent females and the gender differences in success attribution are all important aspects of course and career decision-making. The cost-benefit nature of career decision-making cannot be isolated from cultural and social norms and the final decision may be influenced by personal factors, fortuitous circumstances or chance events.

The conclusion derived from the investigation of this body of literature is that self-efficacy is the primary influence determining which direction a girl or boy will follow. This is developed through socialisation dependent on cultural and social capital within the family unit, educational experiences and interaction with peers, gender and the habitus of an individual. Career decision-making literature indicates that decisions are not made in a linear way, not isolated ‘one-off’ decisions or necessary based on rational logic. The UK career decision-making literature introduced the concept of happenstance, sheer chance and fortuitous circumstances.

The research proposed for this dissertation will investigate the layering effects of IT self-efficacy development, habitus, and the process of circumspection and compromise around IT being considered as a career choice. It is interesting to note that only fifty years ago Medicine and Law were also considered non-traditional fields for women, yet, despite assumed lack of confidence and self-efficacy, peer-groups or role models, women persisted in entering these courses, to now make up more than half the student body in higher education institutions in Australia. It is puzzling why self-efficacy appears to continue to be such a strong influence in IT course and career choice in Australia, yet appears not to have affected a greater gender differentiation in other
disciplines. Students generally have to consider careers before entry to tertiary education. In determining what factors influenced student choice, this thesis will identify the broad array of factors and some of the causal mechanisms that influence student’s consideration of post-secondary career options, including an evaluation of economic and sociological characteristics in the Australian education environment.

The following chapter contributes to the present study by presenting an evaluation of current conversations in the body of literature addressing the under-representation of women in IT. Emerging theories of structuration and individual differences are analysed and a closer investigation of the unique nature of the IT discipline, introduced in chapter one, is expanded on. Chapter three concludes with the drawing together of the multi-layered factors that shape IT course and career decision-making choices through the lens of gender.
CHAPTER 3: EMERGING ‘WOMEN AND IT’ RESEARCH

Computers are incredibly fast, accurate and stupid; humans are incredibly slow, inaccurate and brilliant; together they are powerful beyond imagination.

*Albert Einstein, physicist and humanitarian (1879 - 1955)*

Around the world, women are not full partners in driving the creation of the new technology that will define their lives. This is not good for women and not good for the world … Women need to assume their rightful place at the table creating technology of the future.

*Anita Borg, PhD (1949 – 2003) Founder, Institute for Women & Technology*

3.1 Introduction

This chapter investigates the “Women in IT” literature and analyses some of the reasons presented to explain the current gender imbalance. It includes a discussion of theories that have emerged more recently to give explanation to the masculinisation of IT, followed by a discussion of the apparent lack of sustainable impact of some of the current and historical intervention programs addressing the gender imbalance in this field. The development of the discourse around the under-representation of women in IT is itself unique. Over ten years ago it was observed that much of the discursive constitution of IT was focussed on the technical aspects of the discipline, systems application and education, and not on the cohort of who is “doing” IT” (Yates 1993). The discursive conversation of women in IT sat outside accepted discipline research to the extent that the perception that “real IT women” did not conduct feminist research and if they did, it was marginal to the discourse (Yates 1993 p.4). “Women in IT” research continues to be marginal to the discourse of the discipline and most reports on interventions and research activities begin with a justification of why a greater gender balance is needed, as is done in this chapter through the introductory quotations, something that should by now be an accepted fact. Moreover the researchers in the Women in IT area are themselves predominately female, indicating that the conversation is rarely extending to the majority gender in the discipline.
The reasons presented in the literature for women not choosing IT in the same numbers as men can be divided broadly into two areas, those that place the onus on women for not considering IT as a viable career option, and those that place the onus on discipline-specific idiosyncrasies that contribute to the branding of IT as male, or are considered to make IT courses and careers more advantageous to men than women. A summary grouping of factors that can be considered as preventing or discouraging women from choosing Information Technology as a career path or presenting a set of circumstance that are more advantageous to men than women are as follows. The inhospitable nature of the field in both education and employment areas (Pearl et al. 2002) and the perceived isolated nature of programming (Durndell et al. 1995; Lang 1999) relate to the nature of the discipline. The reinforced imagery of computer ‘nerds’ and ‘geeks’ (Stewart Millar 1998) and the lack of female role models and mentors (Turkle 1995; Taylor 2002) relate to popular media representation of the discipline. Lastly the differentiation in educational experiences in mathematics, science and technology (Belenky, Clinchy, Goldberger and Tarule 1986; Bandura 1997; Lang 2002) between men and women is presented as giving males an advantage over women as is the familiarity with the technology developed over years through leisure activity of computer game-playing. Some of these have been introduced and discussed in chapters one and two, some will be elucidated in this chapter.

A critical evaluation of this current body of literature through the lens of gender, the nature of the discipline and a discussion of emerging theories follow. Literature focussing on socio-cultural effects of increased choice for affluent young women in westernised societies is introduced. The theoretical framework informed by this body of literature, presented in the concluding discussion, suggests a multi-layered array of factors combine to influence a gendered pattern of student decision-making related to IT study and career choice.

### 3.2 Emerging theories

The body of literature in this field is noticeably under-theorised, no doubt because of the infancy of the discipline in comparison to other disciplines and the variety of different specialisations within it. The Australian IT industry is relatively new, with the industry body, the Australian Computing Society (ACS) registering a professional code of
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conduct for its members as recently as 2000 (Burmeister 2000) allowing ACS members to be recognised as professionals “alongside doctors, lawyers, engineers and other professionals” (Burmeister 2000 p.109). Consequently the theories about the participation of women in IT borrow from existing sociological, educational and feminist theories. In the last few years a number of authors have presented an overview of the literature around the gendered state of the discipline. Cohoon and Aspray (2006) analysed fifteen years of women in IT literature in the USA and presented as facts a list of “Things we know” about the discipline. These facts included that computing is masculine, that gender mix varies within the different specialities of the discipline and that prior experience with programming has a positive effect on success and self-efficacy regardless of gender, acknowledging that prior experience tends to reside predominately with males (Cohoon and Aspray 2006 p.171). These authors expressed doubt about the extent of causality of these facts; for example whether the masculine nature of the discipline is a cause or effect of the under-representation of women. This point is explored further in this section. Discussions of the theories that place the blame with women or the discipline (deficit theories) are followed by an evaluation of the theories of structuration and individual differences, concluding with expectancy beliefs and the masculinity index.

3.2.1 Deficit

Craig, Fisher, Scollary and Singh (1998) applied Henwood’s binary classification to the current body of women in IT literature. The two parts of this classification are the “WOMEN IN technology” approach, which places the deficit clearly in the female arena by implying that it is their lack of knowledge about the discipline that is creating the gender imbalance. The second part of the classification, the “women IN TECHNOLOGY” approach explored the increasing masculinisation of technology in general, and implied that residual discipline characteristics account for the gender imbalance in IT. Craig et al (1998) presented an evaluation of Australian programs that fitted the “WOMEN IN technology” approach to attract young women into IT through education, marketing and mentoring and reported some local successes. They reported that few intervention programs addressed the embedded masculinisation of the discipline and concluded that the “women IN TECHNOLOGY” approach was problematic. The domain of IT was also explored by Spencer (2003) who refuted the
assumptions that it was a deficit in women’s knowledge that prevented them choosing IT, as well as the assumption that gender equity was a sufficient justification to promote programs to attract women. She challenged all involved in IT in Australian universities to address the narrow focus of the IT curriculum, where she posited that the deficit lay. Spencer claimed that few Australian degree programs reflected current IT applications in business and the workforce and “this marginalises the users of Information Technology” (Spencer 2003 p.65). A challenge by Spencer to reconstruct the domain of IT is put as a first step to equalising the gender imbalance, grounding the problem solidly within the discipline, or the “women IN TECHNOLOGY” arena. The placing of the onus of responsibility for the under-representation of women in IT within the discipline is clearly problematic because, as stated in the introduction, the majority gender of the discipline do not as a whole recognise or acknowledge this issue.

3.2.2 Structuration

The nature of the IT discipline was explored in a study that analysed responses of women in industry and borrowed from existing social theory. Beekhuyzen, Nielsen and vonHellens (2003) applied Giddens’ structuration theory to the existing dualisms in IT.

Structuration is an approach to understanding the social world that replaces the dualisms of social theory with the duality of reciprocal interdependencies. (Boland, 1996 as quoted in Beekhuyzen et al, 2003)

The duality of structure implies that human action is both enabled and constrained by structures and while Giddens made no reference to IT, these authors identified a number of dualisms in women’s talk of their IT experiences and how it often differed from the work experiences. Some of the dualisms investigated in this study are not limited to the IT discipline; the dualism of home and work (Beekhuyzen, Nielsen and Von Hellens 2003 p.77) and the dualism of career advancement and child-rearing, apply to many working women in all professional disciplines. While this is not refuted, currency and relevance of skills which is also cited as a deterrent for women in IT can also be argued as essential in both Medicine and Law. The dualism of division of labour into a “traditional hierarchy of skills, associated with gender, power and authority” implying that women rarely hold power and authority in IT (Beekhuyzen et al. 2003 p.77), also existed in other professions, particularly those that were male dominated (Medicine and
Law). These authors argue that the nature of the IT discipline which itself is fast moving and constantly changing makes it difficult for any emerging theory to be studied and analysed through longitudinal observations (Beekhuyzen et al. 2003 p.78). In essence they conclude that,

... the way women talk about their work reinforces widely held impression of the IT industry and the use of structuration theory helps show how this talk is not always consistent with the women’s lived experiences. (Beekhuyzen et al. 2003 p.80)

They observed, like Wacjman (2000), that the field of IT is increasingly being constructed to be a masculine domain and women continue to be socialised away from it, yet those women who are in the field are having positive work experiences that overcome perceived dualisms. While they suggest mentoring as a way to attract more young girls to IT “there is no clear Australian evidence connecting mentoring to improvements in recruitment of students to specific areas of study” (Beekhuyzen et al. 2003 p.79). The constantly changing nature of the IT discipline, the diversity of experiences of men and women currently working in IT, and the infancy of the field makes it difficult to apply existing social theories to it. It appears that the structuration theory requires closer examination in its application to Information Technology.

Webster examined biographies and case studies of women working in IT in the UK (Webster 2005) and found that as well as being only 17% of the workforce in 2001 (Webster 2005 p.2) they also tended to be young with no children or domestic responsibilities that would impinge on them working long hours. Webster found that "long hours are often self-imposed by the employee … who seem able (and apparently willing) to provide the total availability needed by their employers” (Webster 2005 p.2). This may also be the case with young women establishing their careers in other professions (Law, Medicine) however Webster’s study analysed the culture of the IT discipline and found it promoted an unpredictable work environment where the skills of the women were undervalued and promotion based on individuality was the norm. Webster reflected that the individual nature of the IT discipline tended to encourage
gender blindness where male traits were the norm, to the extent that women were disadvantaged in the predominately male IT work culture of:

... centralised decision-making, authoritarian, bullying management styles, conventional fiscal performance measures, increasing emphasis on self-direction, self-management and self-advocacy … problematic with those who lack strong self-confidence … women in particular! (Webster 2005 p.11).

These studies indicate that the nature of the discipline is a contributing factor to the increasing gender imbalance of the IT discipline because of a culture where male traits are the benchmark for work habits, performance and promotion and females will always be regarded as ‘other’ to the norm. This factor is explored further in the next section.

### 3.2.3 Individual differences

Further argument for the power of socialisation in shaping the evolving IT discipline is the emerging theory of individual differences (Trauth 2002). Trauth employed empirical data to theorize the relationship between the social shaping of IT and gender identity. She argued for the “primacy of sociological and structural/institutional influences over biological and psychological ones, while still acknowledging the role played by individual characteristics” (Trauth 2002 p.99). This theory sits between the perspectives of essentialism; the belief that biological factors are the primary reasons for essential differences between the genders and their adoption of or attraction to IT, and the social constructivist perspective of gender differences that claim "inherent IT capability and interest spans the gender continuum" (Trauth 2002 p.104). According to Trauth, the essentialist perspective focuses on the presumption of inherent differences between the genders, while social constructivists see IT as a male domain that is opposite to the female identity. Essentialists base their argument upon bio-psychological differences, which they regard as fixed. Men as a group are influenced by the usefulness of IT, women by social factors, and by inference women and men should be treated differently; separate but equal (Trauth 2002 p.100). Trauth emphasised the lack of cross-cultural identification with what is male and what is female in the research to date. “There are as many different ‘women's experiences’ as there are types of women” (Trauth 2002 p.102). Her study explored how the IT profession operates at an individual
level and concluded by rejecting the essentialist argument, even though it deepens understanding of social construction theory.

The individual differences theory appears to be an extension of the essentialist argument in that individual differences are a product of gender and socialisation within and between cultures. Trauth’s individual differences theory could almost be classified as a non-theory due to the extremely generalist nature of its application. The theories of individual differences and structuration are further informed by an examination of expectancy beliefs in the hegemonic discourse of IT as presented by Corneliussen (Corneliussen 2004) and the cross-cultural masculinity index (Charles and Bradley 2006) discussed in the next section.

3.2.4 Expectancy beliefs and the Masculinity Index

Computing culture is masculine. Whether it has to be masculine, and whether the culture is a cause or a consequence of its gender composition, are different questions. (Cohoon and Aspray 2006 p. 171)

The IT discipline is considered masculine and the reasons why extend beyond the proportional representation of women in the workforce. The culture of IT organisations has been characterised as a “chilly climate” (Roldan et al. 2004). This is in reference to a non-gender inclusive organisational culture and work habits and practices that are not gender neutral. Behaviours in computing laboratories have been compared to those in male locker rooms (Margolis and Fisher 2002) and are perhaps affected by the history and development of the discipline which evolved from the historically masculine disciplines of mathematics, engineering and science. Many IT faculties and schools tend to still reside in these higher education faculties today. Cockburn claims that women are in a no-win situation in the IT discipline. They are disadvantaged due to the “masculine appropriation of technology and its associated skills” and the “cultural exclusion of women effective in both training and employment” (Cockburn 1991 p.157). Wajcman extends the argument by claiming the hegemonic male culture creates a male standard in the workforce, which females will never match but are consistently measured against
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(Wajcman 2000 p.453). Wajcman observed that “neither masculinity, femininity nor technology are fixed, unitary categories, but that they contain multiple possibilities and exist in relation to each other.” Her argument is that gender relations shape the design of technologies rather than the design of technologies shaping gender relations, termed “mutual construction”. This mutual construction of relationship with technology is influenced by history, culture and societal perceptions (Wajcman 2000 p.460) and appears to be verified by the application of the masculinity index derived by US researchers as follows.

The universal acceptance that computing is male extends across cultures. The gender of IT graduates of twenty-one western industrialised countries assessed for male-female ratio and were normalised to take into account any national idiosyncrasies. All showed a factor of males being over-represented in this discipline, however there were variations in the degree of male over-representation in countries, from the lowest of 1.79 in Turkey, to the highest of 6.42 in the Czech Republic (Charles and Bradley 2006 p. 190). Australia rated at 2.86 in this study, more than the USA (2.10) but less than the UK (3.10), the two countries that have had the greatest influence on our education and work culture. Charles and Bradley ascribe the reasons for variations between nations to the degree of choice students have in their education, which allows gender essentialist norms and stereotypes to affect career choice decisions during secondary education (Charles and Bradley 2006).

For women in affluent societies, freedom of choice thus implies both the right to be free from overt discrimination (should they elect to pursue a traditionally male-dominated field of study) and the right to choose poorly paid female-labelled career paths, if they so desire. (Charles and Bradley 2006 p.196)

Norway’s male over-representation factor is very similar to that of Australia (2.75). According to Corneliussen the gendered nature of computers there is inter-woven with culture: “men are expected to have more interest, men are expected to be fascinated by the technology” (Corneliussen 2004 p. 175). Both men and women use this hegemonic discourse as a frame of reference when encountering IT (Corneliussen 2004 p.174) so it is easier for men to associate with computer competence, while women have to work
against the hegemonic discourse and prove their competence (if they chose to do so). In this research Cornelliussen provided a seven point classification system for young men and women according to where they position themselves in relation to IT, borrowing on Virginia Woolf’s “Room of one’s own”. She used a classification system of men and women positioning themselves within or without the “room for men” meaning the computer room. Her overall treatise is that society makes it easier for young men to position themselves within the computer room, which echoes the ‘boy’s club’ analogy that Margolis and Fisher reported in their study at Carnegie Mellon University in the USA (Margolis and Fisher 2002).

Adding to the current hegemonic discourse of the culture of IT, Pearl and colleagues (2002) argue that one possible factor contributing to its masculinity is the apparent inhospitable education and employment environment. While not disregarding this factor already discussed in the introductory chapters, there is some evidence that this is not necessarily a major factor discouraging women from pursuing IT careers (Lang 2003b). The argument presented to discount this factor, and that of the lack of female role models and mentors, is that neither of these variables stopped women from entering and succeeding in other traditionally male dominated fields such as Medicine and Law. Both Medicine and Law are acknowledged as having high status and a stereotypical image of working with people, medicine as helping and caring, law a strong professional image. These attributes appear to be lacking in stereotypical portrayals of IT, despite its increasingly ubiquitous application in business. This suggests a need to investigate the current perceptions of IT and stereotypical portrayals in the media as being a career path that lacks human interaction and populated by people with marginal social skills.

3.3 The media: explicit and implicit gendered messages
The depiction of the IT professional in the media has a problematic history. “Using good female role models with the aim to present an effective and dynamic portrayal” was the second action outcome of the Australian Women in IT conference concluding discussion (AusWIT 2003). An investigation into the image of IT in the UK reported that “people rated IT as the least sexy of all careers, lower than funeral directors” (Alex Allan, quoted in MORI 2001 p.12). In current use, the adjective ‘sexy’ has the same
meaning as attractive and this implies that IT is one of the least attractive disciplines. In determining the source of this image the following was posited as one of several influences:

The image of the ICT industry amongst the general public may well be shaped by media influences. The two sectors most commonly mentioned as desirable to work in are portrayed in popular television dramas, such as Ally McBeal, This Life, E.R., Casualty, etc. There is a lack of similar positive role models for the ICT industry on popular media (MORI 2001 p.5).

This study reported “ICT is one of the least likely industries to be viewed as a possible employment area by women (5 per cent vs 26 per cent for medicine, 14 per cent for law)” (MORI 2001 p.4), the two sectors referred to in the preceding quote. It was implied that the negative portrayal of Information Technology in the media has a direct causal effect on young women not considering this field as a suitable employment area. The UK figures are convincing, and while not all lawyers and doctors are portrayed in a positive light in the media there may be enough interest, status and drama in the portrayals to influence the career choices of young women. An Australian study similarly reported that there was a lack of knowledge about ICT careers in 17 to 19 year olds and that many stereotypically believed the career path to be too boring to consider as a future career option (MMV 2004). A lack of awareness of what IT work entails, due to the absence of portrayals in the media, could also explain why it is not viewed as an employment area by young women.

### 3.3.1 Isolation

The perceived isolated nature of programming is considered an inhibiting factor when students are deciding on future careers. While many disciplines require hours of solitary work, the stereotypical perception in the media that all interaction in the IT discipline is limited to computers, whether right or wrong, has been shown in several studies to be an inhibiting career-choice factor for females. Jewell and Maltby reported that females rated the IT field to be of medium difficulty (Art being the lowest in difficulty, and Law the highest) and the lowest in people involvement (Jewell and Maltby 2001 p.315). The
authors remarked that both boys and girls in their survey perceived IT as a “sedentary, perhaps isolated, occupation. This is a plus for the majority of males” (Jewell and Maltby 2001 p.315), indicating that while the perceived isolated nature of the career path is a deterrent for many women, it is an encouraging factor for some men and is what attracts them to the discipline. A major research project commissioned by the Victorian government to better understand the factors that were inhibiting uptake of IT careers found that most students, both female and male, had a limited view of IT as hardware focussed rather than involved in social communication. It found that a binary state of mind existed in students in reference to IT jobs. They were perceived as technical, not creative, and solitary, not team oriented (MMV 2001). In addition to the factors like an inhospitable work environment and lack of female role models, the perception of the isolated nature of an IT career acts further as an inhibiting factor to women when contemplating possible career paths.

3.4 Discipline specific idiosyncrasies

Factors that are considered inherent in the discipline of Information Technology and contribute to its attractiveness to men more than women are: the advantages boys and men have in their use of technology because of their early introduction to and preoccupation with computer games (Stewart Millar 1998; Huff 2002); teaching methods in the field being more suited to men than women (Belenky et al. 1986; Bandura 1997; Margolis and Fisher 2002); the different relationship with technology that women have compared to men (Lang 1999; Margolis and Fisher 2002).

3.4.1 Computer games

Huff argues that a lack of equivalence in access to IT is an ethical issue and places the blame for the lack of equivalence clearly on the computer games market, written for males by males, giving them an unfair technological familiarity with both software and hardware from a very young age (Huff 2002 p.112). Young men are more attracted to playing computer games and, when young women do play games it is often for different purposes. Young women tend to prefer more passive purposeful games and game playing is not a major part of their leisure activities (Lang 1999 p.81). A recent survey in the UK of the use of the internet by gender found only a ten per cent difference between women and men in use of computers either at work or at home (men 52 per cent, women 42 per cent) and in use of the internet (39 per cent men and 29 per cent
women) (MORI 2001). This ten per cent difference in use, while favouring men, does not translate to a major inequality as referred to by Huff, nor to a technological advantage for males. It is beyond the scope of this research to enter into an ethical debate, but literature and computer magazines clearly indicate that the games market is male-dominated and this appears to give young men studying higher education IT courses an advantage over young women, a conclusion reached by reviewing over fifteen years of women in IT literature in the USA (Cohoon and Aspray 2006).

3.4.2 Education experiences
Some feminist researchers claim that women learn in different ways to men. The same researchers posit that university Information Technology faculties, dominated by men, by implication teach in ways more suited to men than women (Belenky et al. 1986). Belenky, Goldberger, Clinchy and Tarule conducted their five year study on different stages in learning, named the “five ways of knowing”. They labelled the staged development of knowledge from the lowest to the highest as “silent knowledge, received knowledge, subjective knowledge, procedural knowledge, and constructed knowledge” (Belenky et al. 1986). They concluded that females have a predisposition towards connection and conversation in their knowledge, and that female ‘constructed knowers’, the most developed of the five ways of knowing, are inhibited by social expectations of female behaviour of passivity. According to this research many more men than women appear to be at the constructed knowledge stage, with the majority of women not progressing beyond the subjective knowledge stage (Belenky et al. 1986). The impact of this on education experiences, according to these authors, is that institutions of higher education, which were traditionally designed for men, and usually, led by men, have an expectation of male ‘ways of knowing’ (Belenky et al. 1986). The majority of IT faculties in higher education institutions are also typically dominated by male academics, adding to the apparent advantage offered to male students in terms of provision of male role models and, arguably, a gendered culture that is more familiar to males than to females.

As discussed extensively in Chapter 2, Bandura observed different attitudes to learning and experiences in education due to gendered self-efficacy beliefs. According to Bandura, boys tend to overestimate their ability in a task, and when things do not go as
well as anticipated, often blame an external factor. Girls on the other hand tend to underestimate their abilities and blame themselves first before any external factor (Bandura 1997; Pajares 2002). In a male dominated profession it can be extrapolated that without gender-sensitivity awareness training male teachers may favour the learning styles of male students (Lang 2006). A cross cultural comparison of the gender of maths and IT teachers in Australia and Singapore showed that Asian secondary school students were exposed to female maths and IT teachers to a greater extent than Australian students. While no direct link could be proven, this study reported that female enrolment in higher education IT courses in Singapore was consistently at the 40 per cent mark, almost double that in Australia (Lang 1999 p.69). However, it needs to be noted that a lack of choice may also influence this high proportion of female students. There is a quite structured curriculum in secondary schools in Singapore, a product of which is not allowing students much choice early in their education (Lang 1999), therefore limiting the opportunities for young women to make gendered selections away from IT, a concept discussed in section 3.5.

Gender awareness education programs appear to improve the educational experiences of women in IT. As part of a program to increase female enrolments in IT at Carnegie Mellon University (CMU), gender awareness education programs were delivered to CMU academics and secondary school Information Technology teachers from feeder schools to this university. The result of the program was an increase of more than 30 per cent in female enrolment in computer science courses over the next five years (Margolis and Fisher 2002). The authors observed that differential educational experiences in the IT classroom, quoted as “bastions of poor pedagogy” by the American Technology Commission (Margolis and Fisher 2002 p.37), have a greater negative effect on female students than male students and that poor pedagogical practice eroded self-efficacy in females, the greatest “at risk” group when teaching is poor. The lack of ‘real world’ applications, particularly in programming classes was also emphasised in this study. Interviews showed that women were attracted to contextual computing; in other words they valued applications with relevance in the wider world of business, medicine, music, or languages for example, to a much greater degree than abstract computing.
3.4.3 The attraction of technology

It is a common perception that men are more likely to develop an all-consuming interest in technology (cars, trains or computers for example), to a much greater degree than women. There is qualitative data supporting this disparity in passionate interests. Margolis and Fisher found that men interviewed in their study described themselves as having an “epiphany” like experience when they discovered computers and programming, usually at quite an early age. Women reported liking working with computers, but did not report the same level of emotional experience (Margolis and Fisher 2002 p.18). As previously stated many women, when surrounded by men with this all-consuming interest, doubt their own ability with technology. More women than men believe that to succeed in IT, a particular gift or talent is required (Jewell and Maltby 2001). These studies concluded that these perceptions are influential in turning women away from IT courses.

The literature provides sufficient evidence to indicate that young men attracted to the IT discipline have a different attitude to computers and technology than young women. While this cannot be concluded as a causal effect in deterring young women from entering the discipline it can be surmised to contribute to an environment where young women feel that they are not the norm. Young women did not let the fact that they were a minority prevent them from entering other professional tertiary disciplines like Medicine and Law, yet the IT discipline in higher education is increasingly attracting young men to a much greater degree than young women, compounding the differentials in student experience in the classroom.

3.5 Choice and Barriers

Despite the evidence provided thus far from a wide body of literature, the argument that there are barriers preventing females from entering IT has been questioned in recent research. A UK investigation established that girls were not entering Science, Engineering and Technology courses due to personal choice factors, and not because of barriers that existed preventing them from choosing these courses (Siann and Callaghan 2001 p.91). Siann and Callaghan determined that personal factors were influential in career choice decision-making and defined these factors as being either “differential”, involved with matching aspects of the person with the attributes of the job environment;
or “developmental”, a product of life-choices of the individual and their sense of self-conception. They concluded that economic rewards, employment environment, job status and image are all important in course selection for girls, and in the case of IT, the image associated with the field was a major deterrent for career choice (Siann and Callaghan 2001). This research adds to Charles and Bradley’s (2006) thesis that the availability of choice during secondary education is a factor contributing to women in westernised nations turning away from IT.

This may account for the less than positive effect of many localised intervention programs to increase the participation of females in IT. An Australian study reported that 10 years of intervention and marketing programs Australia wide had made no significant change to female participation in IT in general (Byrne and Staehr 2003). However there are pockets of individual success. One program at Central Queensland University in place since 1992 (Clayton and Lynch 2002) reported ten years of participation statistics showing a steady and continued growth in female enrolments in higher education IT courses from just over ten per cent in 1992 to mid twenty per cent in 2002. This program was labour and cost intensive involving pre-tertiary marketing strategies, mentoring of students and awareness training for staff (Clayton and Lynch 2002). The steady increase of students, much like the program reported in the following section, did not extend beyond the institution involved.

Individual localised success stories are reported from other countries. Carnegie Mellon University (CMU) in the USA, previously referred, increased female enrolments from 7 per cent in 1995 to 42 per cent in 2000. The program developed a series of multi-pronged initiatives, including focused recruiting strategies, changes to the academic course content and course structure, and a gender awareness education program for academics. The student IT experience was changed significantly by the program and is reflected in the greater gender balance in enrolments. Blum and Frieze (2003) did not ascribe a percentage to what would constitute a critical mass, however Valian (1999) placed this at around 25%. Below this proportion women are perceived as not the norm because of their gender, above this proportion they are more likely to be perceived to belong in the general cohort (Valian 1999). It appears that a critical mass of female enrolments has been sustained at CMU over the following years creating a culture of diversity in the faculty. This critical mass of female enrolments is cultivated and
supported by a student run organisation called Women@CMU that provides mentoring and activities to normalise the experiences of women in the computer science department (Blum and Frieze 2003). In contrast to this success story, Wardle and Burton report that over a seven year time span, the goal of 45 per cent female graduates in computing in US higher education institutions be achieved by 2000 was not attained. In fact the enrolment was only 28 per cent females (Wardle and Burton 2002 p.27). A US presidential IT advisory committee was formed in February 1999 and concluded that the problem was multi-dimensional.

In Australia the problem is emphasised by the statistics. The gross number of women has increased in most higher education areas, yet in the IT field the number has decreased from 22,364 in 1995 to 21,154 in 2005 (DEST 2006). Each of the previously stated success stories has had some local impact, as have the many other programs reported over the last twenty or more years. Many of these programs involved marketing initiatives, awareness programs, videos, mentoring and summer schools or after school programs for girls in IT, but as yet, none have achieved sustained growth or enabled equality in enrolments to be achieved. There is also a dearth of evaluation of existing programs over a longer time period to determine why sustainable growth of enrolments has not been attained.

3.6 Layered effects of multiple factors
The current study draws on several strands in the existing literature; the career choice literature theories, the educational psychology literature with particular focus on the development of self-efficacy, the feminist literature that has particular focus on education and career choice, and also the body of “Women in IT” literature that has developed over the last twenty years focussing on the paradoxical phenomenon of why women are not readily embracing careers in IT. This literature search has helped identify a broad array of factors that influence student post secondary decision-making about careers and higher education. Some of these factors appear to have a direct influence on these career and education decisions, while some are influences embedded in the socio-cultural make up of the student.
Gender factors appear to be particularly important to the selection of an IT course or career. Males and females in the same cultural environments will have different expectations and experiences according to their gender. The social and cultural capital of an individual will differ within and between family units and therefore affect career and education decisions between and within genders. As presented in chapter two, these relationships are a “complex set of factors and relationships that exist in a close-knit group such as a family” (Coleman 1990, cited in Hossler et al. 1999 p.151). For example within a family unit implicit and explicit career and education expectations of sons and daughters may vary and imprint on the psyche of young people therefore affecting attitudes to and experiences of technology. In 1998 Furger reported the common trend of female students referring to household computers as “brother’s computer” or “father’s computer” … “All too often girls find themselves on the fringe, watching and waiting for a turn as the men and the boys of the house stake their claim on the family computer” (Furger 1998 p.16). Coleman used the example of expending time and energy to promote a love of reading within the family unit when defining social capital. According to Furger, the time and energy spent to promote a love of technology may or may not occur and often is gendered in its application (Furger 1998). There is a common theme in definitions of social and cultural capital to some extent. Bourdieu defined cultural capital as the linguistic and cultural competence middle class children acquire from their parents ensuring their success at school (Bourdieu 1977 & McDonough 1997 cited in Hossler et al. 1999 p. 152). This too can be applied to IT competence and literacy in those homes where economic situation allows for them to have computers. The cultural capital of students in these homes is the developed IT competence and capabilities that are acquired, whether of a gendered nature or not, however the technology seems to reside with the males. Cultural expectations of gender roles are more homogenous in western societies than other societies when applied to education achievements and outcomes (Astin 1998; Astin, Keup and Lindholm 2002), but while they are considered relatively more homogenous than perhaps Confucian-heritage societies, the expectations of gender roles are persistent.

The literature search has resulted in identification of four key factors that separately or together influence student IT career and education decision-making.
These are:

1. The wider cultural environment in which students have grown up; the culture of their country and its society, also termed their cultural capital;

2. The habitus of the students, also termed their social capital, which is more personal and directly influential than the cultural capital. This incorporates the influence of their family, peers and social network;

3. The individual’s developed perception of their possible selves influenced by their likes and dislikes. This is imprinted throughout education and social experiences and strongly influenced by self-efficacy (Bandura 1997) development throughout life stages; and

4. The influence of happenstance. Students are not necessarily rational decision makers and at any stage in their education can be affected by random events, termed ‘turning points’ or ‘happenstance’ (Hodkinson and Sparkes 1997) that can affect their decisions to pursue a particular career or education course.

Focus is placed on these common themes that influence student IT career and decision-making as seen through a gender lens. Over twenty years ago researchers were observing patterns of difference in gendered career and course choices, and theorising that this was a product of educational experiences, social and cultural factors.
The recorded evidence appears to suggest that sex differences in educational achievement, at the upper-secondary school level, while influential in determining courses undertaken at the post secondary level and in determining employment and career opportunities available on the completion of study, show different patterns across countries and some differences over time. This seems to indicate that such sex differences in achievement arise at least, in part, from societal and cultural factors. (Keeves 1988 p.484)

The body of literature presented thus far confirms that in the twenty-first century an array of factors contribute to IT course and career decision-making. The unique nature of this new and emerging career path is a final complication in the gendered pattern of career choice in IT. The four key factors interact with and build upon each other. They emphasise the base of culture and the overlays of family expectations, educational experiences and individual characteristics that all influence whether a woman chooses an IT career path or not. The common themes in the literature are that no individual can separate from their cultural and social environment. The situated cognition of the individual underlies every decision and is influenced by their habitus. “In choosing any action an individual uses his/her own schematic repertoire. No-one can step outside their habitus, so decision-making can never be context-free” (Hodkinson and Sparkes 1997 p.34). Gilligan refers to this as the schematic portrayal of “possible selves” (Gilligan 1982), where an individual can envisage their future career path within a defined boundary affected by the social and cultural baggage that they carry. The educational experiences of students have implicit and explicit influences on decision-making; in particular the gendered development of self-efficacy in relation to IT is of particular interest to this thesis.

This body of research raises questions about the causality of the gender imbalance in computing, for example whether students are attracted to computers because of personality and socialising characteristics that are embedded in cultural and social gender schematics or whether the masculinisation of the discipline itself is the factor that makes it a more attractive career path to one gender over another. A large amount of the “Women in IT” research to date has been atomistic and atheoretical, grounded in practical problems associated with one institution which may or may not be transferable
to other institutions. This may account for the lack of sustained influence of many of the interventions and marketing programs to attract females to computing over the last twenty years.

### 3.7 Conclusion

The “Women in IT” theorists acknowledge the role of such factors as habitus, possible selves, turning points or life stages, schematics and situated cognition in shaping young women’s IT related study and career path choices. The career choice literature introduces decision-making theories, stages of decision-making, gendered decision-making and employment idiosyncrasies to the argument. The feminist literature presents gendered influences on choice schematics, age and gender processes related to self-efficacy development, and the education literature provides further insight into self-efficacy and student experiences.

This thesis will build on the body of literature to determine what influences student course and career decision-making and assess the differences between males and females at several stages in their secondary education. Moreover it will investigate the influence of habitus and happenstance and the approximate timeliness of decisions. Conceptualising this study in the wider framework of career choice, self-efficacy and “Women in IT” literature, this current study will provide a greater insight into what factors influence student post-secondary education and career decision-making with a particular focus on gender and IT.

The following chapter presents the study design and research questions investigated for this thesis which involved interviewing secondary students and university students to determine the factors that influence their course and career decision-making choices at selected stages in their education. Justification for the research design and sampling procedures employed is included in chapter four which concludes with an explanation of analysis procedures.
CHAPTER 4: RESEARCH DESIGN

4.1 Introduction
The previous chapters have provided the theoretical scaffolding for the research design for this study. The key questions derived from the presentation of the issue in chapter one ask what factors contribute to adolescent decision-making about study and careers in IT and in particular, whether there a set of factors that have a differential effect on each gender, for example attractive to males yet inhibiting to females. Chapter two presented the issue through the lens of educational self-efficacy development, sociological theories of habitus and theories from the career decision-making body of literature. The third chapter added to the theoretical foundations through the analysis of theories presented over the last twenty years in the women in IT literature. The conclusion reached from this investigation of current literature is that four key factors appear to influence student course and career decision-making around IT; the wider cultural environment (cultural capital) of the student; the more personal and immediate effects of habitus (social capital); the differential development of gendered self-efficacy around technology; and lastly the effect of ‘happenstance’ and an absence of rationality in the decision-making process. The process of study and career decision-making in relation to IT appears to be strongly affected by characteristics unique to the discipline, such as the stereotypically gendered lens that is promoted strongly in popular media.

This chapter will describe the design of this study. Firstly the key research questions are articulated followed by a rationalisation for the type of research and sampling procedures employed. A justification is provided for the interview questions used as well as an explanation of the adjustments that were made during the study to accommodate differences between the research plan and the reality of data collection. For ease of interpretation, the two studies have been classified as Phase 1, the secondary school students and Phase 2, the university students. The chapter concludes with a rationale for the data reduction and analysis methods used that provide the results presented in chapters five and six.
4.2 Research questions

The literature identifies the multifaceted nature of the issue of why relatively few women elect to enter into IT study and career paths. In order to investigate this phenomenon it was decided to conduct a study in two phases. Firstly interviews were conducted with secondary school students at different stages in their education, junior school, middle school and senior school, to obtain a cross-sectional picture of gender differences in use of and attitude to IT. Secondly, current university students were interviewed to gain some insight into the type of student who had already made the choice to study in the IT discipline at higher education.

The following research questions which emerged from a close study of the literature underpinned the investigation:

1. What factors influence secondary school students in Year 8, Year 10 and Year 12, and first year university students when considering IT courses and careers?

2. To what extent do these factors differ according to age, i.e. Year 8, Year 10 and Year 12, and first year university?

3. Do these factors differ according to gender?

4. Are there discipline specific factors that act as attractors and detractors?

5. What are the implications of these findings for schools, universities and the IT industry in terms of increasing female participation in IT study and careers?

The design of the research methods used to obtain a cross-sectional picture of gender differences in use of and attitude to IT study and careers is provided in the next section.
4.3 Design of study

These research questions needed to be investigated in more detail and after a search of the literature in this genre the decision was made to employ qualitative research methodologies in the form of semi-structured interviews to allow for a greater insight into what students were thinking at the time of data collection (Lancy 1993; Miles and Huberman 1994; Lewis 1995; Fink 1998; Strauss and Corbin 1998; Eisenhardt 2002; Gherardi and Turner 2002; Maxwell 2002; Schofield 2002; Van Maanen 2002). This form of interview is used to enable greater depth of inquiry into themes by using follow up questions where necessary. It allowed for less rigidity in potential responses to questions than a quantitative survey may have done.

Quantitative research may oversimplify what is patently complex..... whereas the qualitative researcher insists that not all of the reality that constitutes education is in fact reducible to variables. (Lancy 1993 p.25).

To gain a greater understanding of the decision-making process and the factors, events or happenstance that influence decisions, it was also decided to interview students in small groups of four or five at a time, and that these groups would be single sex. This method was deemed more suitable than conducting individual interviews because in the small group environment, the emphasis in the interview would shift from the interviewer to the interviewee (Lewis 1995; Gibbs 1997; Mackenzie 1998). The small group interview therefore satisfied two purposes in the methodology, firstly to encourage participation within the group free of any constraints that may be caused by the presence of the opposite gender and secondly to provide for comparisons of responses from each gender. This method of data collection had been determined as more effective than survey or questionnaire because it also provided the opportunity to clarify and probe responses within the small group environment in the least threatening environment to students (Lancy 1993; Wiersma 1995). It would also allow for a greater number of voices to be heard given the time constraints of the research.

While a list of core questions would be used, the group interviews were intended to be semi-structured to allow for discussion to be guided by the issues of the group, within
the framework of the core questions. It was planned then that the role of the interviewer was to guide the course of discussion with semi-structured questions and at the same time encourage any quiet group member to participate, since:

… some young people need company to be emboldened to talk, and some topics are better discussed by a small group of people who know each other. (Lewis 1995)

The guiding questions would allow for a degree of commonality in the overall content of data collected to ensure that each group discussed who or what influenced their study and career decisions (Wiersma 1995). The semi-structured open-ended questions are presented in full detail later in this chapter.

Audio-recording of interviews allowed for descriptive validity in the research (Maxwell 2002). As recommended in the literature, having an aural account as well as field notes better enabled accurate reporting of mood, feeling and dynamics within the groups. It was anticipated that audio-recordings would allow for tone to be interpreted, therefore enhancing the ability to draw inference from what is said during the analysis and transcription period, and allowing for richer descriptions of the data (Lareau 1989; Maxwell 2002).

In the research planning stage and following the recommendations in the literature (Lewis 1995) the intention was to interview two single gender groups of students at three stages in the secondary education; junior school, middle school, senior school, at each of the secondary schools in the sample and two groups of each gender at each of the universities. This was to allow for a greater richness of raw data as well as to overcome individual anomalies of particular groups and allow for greater validity in any emerging trends or patterns, "Morgan believes that one group is never enough as you may be observing the dynamics of that group and little else” (Morgan 1998 cited in Lewis 1995 p.42). The justification for selection of these year levels, these secondary schools and the universities in the sample is explained in the next section.
4.4 Sampling decisions and procedures

It was decided to use purposive sampling of the university and secondary school sites as a method to control unconnected variables and enable maximum information to be gathered. (Lancy 1993 p.10). Unlike quantitative studies, the aim of this research was not to gain “accurate statistical evidence on the distributions of variables within the population” (Eisenhardt 2002 p.13), but to investigate and explore reasons and factors that influenced decisions about courses and careers. Multiple cases were selected within each category to allow findings to be analysed within categories (i.e. junior school students, middle school students, senior school students) as well as between categories (secondary school students, university students). If a relationship is supported, the qualitative data gathered will provide a good understanding of the dynamics underlying the relationship, the "why" of what is happening (Eisenhardt 2002 p.13). Eisenhardt, like Lancy, supported the use of purposive sampling as method to control "extraneous variation and ... define the limits for generalising the findings.” (Eisenhardt 2002 p.12).

Employing purposive sampling techniques to the first phase of the study (Phase 1), it was decided to limit the sample to secondary schools in the geographical area of Melbourne and to schools where more than 70 per cent of the senior school (VCE) student cohort was offered a university place in 2002 for 2003 university entry, the year prior to the planned data collection year. These criteria were relevant firstly to reduce any geographical complications attached to responses from country secondary school students about attending university that may confound the body of data. Secondly, to ensure that expectations within each school sampled were that the majority of students continue their study in higher education, in other words that the school culture was one of high academic achievement over vocational or other outcomes. To reduce a third potentially confounding factor of single-sex educational environments it was decided to include only co-educational schools.

After applying these filters of location, student university expectations and co-educational environment, the list of acceptable secondary schools was limited to six government schools, and fifteen independent schools in the Melbourne region. To reflect a representation of the typical university entrance cohort, twice as many government schools as independent schools were initially approached to accurately replicate the spread of offers for university places between government and independent
schools. In this sample year (2002-2003) 51.7% of applicants offered higher education places were from Government Schools, 21.9% from Independent schools and 25.26% from Catholic schools (VTAC 2005). Initially five of the government schools were approached, excluding one that practiced selective entry, and three schools from the list of independent schools, selected due to their similar geographic location to the government schools, which was east of the city centre. Not one Catholic School in the geographic region met the initial sampling criteria of over 70% of students being offered university entrance places, so none are included in this research. A short description of each of the schools in the sample is provided in the appendices (Appendix 1).

This purposive sampling procedure allowed for a comparison of within-school ideology (government and independent) as well as between schools for each of the year levels of students selected for interview, allowing for analysis within each case for similarities and differences, as well as across-case comparisons and between like-cases of site and year level. The seeking out of sites based on typicality (typical for students to continue on to higher education) facilitated the search for patterns, trends and themes within the sites and between the like cases.

The second phase of the data collection (Phase 2) involved interviewing current university students who were already enrolled in an Information Technology degree. This was considered relevant because these students could be considered as representing the outcome of positive choice in favour of IT and provided an insight into factors that produced this outcome. In this phase it was decided to sample two universities in Melbourne that differed in culture, mission and student demographics; one was an established research institution, the oldest university in the city, the other a younger university that had a strong technical industry connection. While the entry score needed to get into the Research University was considerably higher than that of the Technical University, indicating a greater competitiveness for places at the Research University, theoretically the universities compete for students in their IT courses. These two universities sampled also have the potential to draw their students from the eastern suburbs of Melbourne, where the majority of the secondary schools in the sample were located. Table 1 provides a demographic comparison of the universities. The data was
gleaned from the university web-sites, and if referenced would identify the universities, so have been omitted from the table.

<table>
<thead>
<tr>
<th>Year established</th>
<th>Number of Undergraduates *equivalent full-time places EFTs</th>
<th>Numbers enrolled in IT courses</th>
<th>Competitive Entry score(^2) for Bachelor degree courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research University 1853</td>
<td>23037 (across three faculties)</td>
<td>2061</td>
<td>Computer Science: 97.45 Information Systems: 77.45 Science (Information Systems): 85.05 <strong>AVERAGE: 86.65</strong></td>
</tr>
<tr>
<td>Technical University 1992 Established in 1909 as a Technical College</td>
<td>7912 (in one faculty)</td>
<td>1149</td>
<td>Information Systems: 71.70 Computing 70.8 Multimedia 76.3 Software Development: 70.5 <strong>AVERAGE: 72.35</strong></td>
</tr>
</tbody>
</table>

Table 1: Demographic comparison of two universities in study (URL reference on application to supervisors)

The purpose of this sampling strategy was to provide for possible significant differences or contrasts in types of students, their motivation, aspirations, pathways to university and commitment to study. The sampling diversity in Phase 2 also allowed for the possibility of a more diverse student cohort to be obtained through interviews with both male and female students enrolled in a variety of IT specialisations from each of the university degree courses. These university students had already chosen IT higher education courses and were able to reflect on how they came to their decision. It was anticipated that the interviews would ascertain what factors were predominant in influencing their choice of course.

It was difficult to be precise about sample numbers in Phase 2 of the study due to the voluntary nature of student participation. It was planned that a sample size of eight to ten students of each gender be recruited. The intention was to allow for four group sessions at each university intotal. As stated at the beginning of this chapter, group interviews of this size were thought to be most effective to ensure diversity in response and that each voice was heard.

The initial question format was piloted with a small sample of secondary school and university students to ascertain the clarity of wording and suitability of items. This approach was adopted to allow verification as well as variations of interpretation of the questions. While the researcher believed that there was sufficient preparation from the literature to guide the interview questions, until they were tried with a small sample of current students, they could not be verified as relevant to Australian students in the twenty-first century. Initial modifications from the pilot were incorporated in the guiding questions, the main modification being to avoid vague language and employ more clarity in these questions, as explained in the following example. It became quite obvious after the pilot interview with university students that one of the initial questions “What are your perceptions of the importance of the future use of IT for careers, leisure?” was problematic. Students did not readily speculate about future IT use and the interviewer had to spend some time elaborating the question. The question was also not particularly focussed on the student experiences of IT and, while some of the responses were interesting, they were not particularly enlightening for this research. After the pilot the question was removed and replaced with a more personal “Where is your course or degree taking you?” When testing the questions with younger secondary school students, the wording of some of the earlier questions were also modified to ensure the responses were open-ended, for example changing the question “What are your favourite leisure activities?” to “Tell me about your favourite leisure activities”. This encouraged the students to reflect and elaborate in greater detail rather than just to list activities.

Ethics approval for the research was obtained from the University of Melbourne (HREC No. 040008), Department of Education & Training (SOS 002591), as well as approval sought and obtained from the Deans of the relevant faculties in the two universities in the sample. The process of sampling in each of the phases of the study is elaborated in detail in the next two sections.
4.4.1 Phase 1: Secondary school students
After obtaining permission from the Department of Education & Training, a necessary step before government schools could be approached, a letter was sent to the principals of the secondary schools that met the sampling criteria to request their participation in the research. Using the VTAC 2002 data published in 2003 (The Age, June 2, 2003) the number of schools that met the selection criteria of being located within geographical region of Melbourne, where more than 70% of students received university offers, were co-educational and had non-selective entry resulted in five government and sixteen independent schools eligible. Unfortunately there were a number of refusals both from the independent and the government sector, one citing lack of time or resources to support “research projects carried out by persons and institutions outside the school” another citing a degree of research weariness; “We have a large number of similar requests each year and meet as many of them as we can”. Of the initial eight schools approached, five declined. To keep a proportional representation of government and independent schools, the requirement of 70% of VCE students receiving university course offers was lowered to 65% for government schools and the list of eligible schools in the sample increased. After several more approaches and refusals, eventually three government and two independent schools agreed to participate in the research.

4.4.2 Participant selection
The next stage involved consulting the school principals or nominees to decide what recruitment processes were most suitable to be used in their schools. The discussion was around whether to use posters placed strategically throughout the school supported by verbal encouragement from form or year-level coordinators and newsletter announcements, or whether to employ a random selection of every \( n \)th student in each of the desired year levels who would then be approached individually (by letter from the investigator or by the subject convenor) and asked to participate. While the latter method was perceived to be the ideal by the investigator because of the random nature of the sampling, it was perceived as too time consuming and did not eventuate in the reality of the selection procedure, as is discussed later.

It was anticipated that interviews with students would determine conviction of attitudes to IT and, in the case of the senior students, factors that influenced their tertiary course
choices. The question-set used to guide the interviews was based on those asked in the pilot, with slight modifications according to the responses. It was stressed to the principals and deputys that students need not be currently studying an IT course or subject, and in fact, that a wide selection of students would add to the richness of the data.

The students approached were at three different stages of their education. Junior school students (Year 8) were in their second year of secondary school and about to experience their first course choice beyond the core curriculum by choosing middle school elective subjects. Middle school students (Year 10) were generally in their fourth year of secondary school and about to embark on their VCE (Victorian Certificate of Education), the two year program that determines suitability for university entrance via an ENTER score obtained from their results, and choose subjects that may affect eligibility for some courses. The senior school students were in their senior school of study at secondary school and beginning the process of choosing a university degree course or future career option. A target of 60 students was set to be interviewed, 30 male and 30 female, with at least ten from each of the year levels in the sample. This number was chosen to allow for differentiation in responses and to allow for a reasonable cross-section of students as explained in section 4.2.

After discussion with the principals or their nominees the strategy of poster advertising was deemed to be too unspecific. The first school approached determined that the school newsletter would be a good vehicle for recruiting participants; however, this resulted in no responses. The IT convener then intervened and promoted the study during form group meetings by handing out the explanatory letter and consent forms (Appendix 2) to all students in one class at each of the three year levels. This was a more successful outcome and consent forms were returned by enough students to conduct a group interview for each gender at the three required year levels. At the second school in the sample there was the same lack of response from the newsletter item and intervention from the Careers Teacher enabled the study to go ahead, in this case she visited classes in each of the desired year levels and encouraged students to participate by handing out the letter and consent form. The deputy principal at the third
school made the unilateral decision to support the research and reworded the newsletter item as follows:

The College, having sighted the requisite ethics documentation from the University of Melbourne, is happy to assist Ms. Lang with her research. To this end we have asked your child to participate, together with three or four other students, in a discussion about career choices with Ms. Lang to enable her to gain a picture, albeit perhaps prematurely, of our students’ feelings about future careers. The discussion will take about a period. If you have any objections to your child’s participation please let me know.

This ‘opt out’ strategy (students or parents needed to notify school if they objected) was so successful that there were no objections allowing the Deputy Principal to then randomly select students to participate from each of the requested year levels. Following this successful and less time consuming experience, the principals of the final two schools in the study adopted the same method. In the final two schools, the Principal, Deputy Principal, IT teacher, or Careers Advisor intervened by delegating or carrying out student selection. They managed parental consent issues and timetabled the interviews throughout the day. In each of the schools a room was allocated to the investigator and students were released from class at intervals of 45 minutes to one hour throughout the day. Final year students (Year 12) were interviewed either in their lunch break or during a free study period to ensure that there was minimal interruption to their studies. All students received a free pen and a confectionary item to thank them for attending.

### 4.4.3 Interview questions

In Australia the school year begins late January and finishes mid December. The timing of the interviews was set to be mid-year between May and August which allowed time for the students to have settled into their current year level. The junior school students interviewed were generally in their early teenage years and were able to reflect on their experiences in the first and second years of secondary school. In particular, these students were asked to reflect on their primary school IT experiences and compare these with the secondary school experience. The middle school students were beginning to
narrow career choice options by selecting or deleting specific subjects from their studies. According to the literature the socialization of the genders is well in effect by mid-teenage years (Siann 1994; Bouchard and St-Amant 2000). This is the time when there is a consolidation of differentiation in interests and entertainment. The middle school students were able to reflect on their IT experiences in early secondary school as well as discuss their ambitions and potential future careers. The interview process was structured to determine if a gendered change in attitude to IT was evident. The literature suggests that there is an early divergence between males and females in their relationship to and interest in the use of IT (Margolis and Fisher 2002). As previously stated, the senior school students were in the process of selecting university course preferences, which usually are submitted to the central selection agency (VTAC) by the end of August.

The set of questions used to guide the interviews were:

<table>
<thead>
<tr>
<th>Question to prompt useful response</th>
<th>Underlying themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell me about the subjects you are currently studying, what are your favourites and why?</td>
<td>Educational experiences, self-efficacy</td>
</tr>
<tr>
<td>Where is this leading you do you think? <em>Modified for junior school students to:</em> What do you want to be when you finish school?</td>
<td>Cultural capital, habitus, Individual and family expectations</td>
</tr>
<tr>
<td>Tell me about how you use computers? -For school? -For fun? Leisure?</td>
<td>Educational experiences, self-efficacy</td>
</tr>
<tr>
<td>How did you use computers in primary school? (used for junior school students only) Have you ever considered going into an IT course (omitted for junior students)</td>
<td></td>
</tr>
<tr>
<td>Would you or have you ever considered a career in IT?</td>
<td>Schematic repertoire Influence of habitus, happenstance</td>
</tr>
<tr>
<td>What or who has been the main influence on your thinking about courses and careers.</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Secondary School Student questions
Most of these questions resulted in discussion. All were open ended, few required further prompting, and on the whole, group interviews proceeded as anticipated.

### 4.4.4 Sampling

Table 3 below summarises the numbers of students interviewed at each school, and an average of the percentage of students offered university places in the four year period of this study. The independent schools have a much higher percentage of students offered at least one tertiary place than the government schools in this sample. As stated earlier, schools were selected from data published in ‘The Age’ newspaper mid 2003. This data was based on 2002 statistics. When subsequent year’s statistics were published the percentage of students who received higher education offers differed, sometimes quite noticeably, indicating that at least one of the schools in the sample would not have met the same sampling criteria in 2004 as it did in 2003. All the other schools included had only slight changes in the percentage of students offered university places.

<table>
<thead>
<tr>
<th>School</th>
<th>Year Level</th>
<th>Gender</th>
<th>No. in Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Secondary College (Elm)</td>
<td>8</td>
<td>F</td>
<td>5</td>
</tr>
<tr>
<td>Average 67.7% senior school students offered university place in four years from 2002 to 2005.</td>
<td>8</td>
<td>M</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>M</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>F</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>M</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>F</td>
<td>3</td>
</tr>
<tr>
<td>Government Secondary College (Gum)</td>
<td>8</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>Average 66% senior school students offered university place in four years from 2002 to 2005.</td>
<td>8</td>
<td>M</td>
<td>4</td>
</tr>
<tr>
<td>Included in sample after rejections from 4 schools</td>
<td>10/9</td>
<td>M</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>10/9</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>M</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>F</td>
<td>4</td>
</tr>
<tr>
<td>Independent School (Oak)</td>
<td>8</td>
<td>M</td>
<td>4</td>
</tr>
</tbody>
</table>
| Average 81% of senior school students offered university place in four year period.  
No female students in Year 10. This school has only recently included females on this campus. | 8          | F      | 5            |
|                                             | 10         | M      | 5            |
|                                             | 12         | M      | 4            |
|                                             | 12         | F      | 3            |
| Independent School (Olive)                  | 8          | M      | 4            |
| Average 93% of senior school students offered university place in four year period | 8          | F      | 4            |
|                                             | 10         | M      | 4            |
|                                             | 10         | F      | 4            |
|                                             | 12         | M      | 4            |
|                                             | 12         | F      | 4            |
| Government Secondary School (Beech)         | 10         | M      | 4            |
| Average 60% of senior school students offered university place in four year period. | 10         | F      | 4            |
|                                             | 12/11      | M      | 4            |
|                                             | 12         | F      | 4            |

Total number of group interviews = 27  
Total number of students in sample = 113
The interviews in the schools were conducted in small groups, with girls and boys separated by year level and gender. In total 27 interviews were conducted, in five separate schools, involving 113 students. As can be seen from Table 3, only one group of each gender was interviewed at each year level. Schools were reluctant to interrupt their programs for more than one day so logistics overruled sample size projection. This was perceived to have no major impact on the richness and relevance of the data gathered. Each of the schools has been given a pseudonym to protect confidentiality of the students interviewed.

### 4.5 Phase 2: University students

As previously stated, the students who were currently studying an IT course at university constituted Phase 2 of the research were able to reflect on their senior secondary school experiences and provide some insight to the question “What type of person finally chooses an IT degree course at university?”

The first strategy employed to recruit the university students to the interviews was posters placed in key locations on campus. Lecturers of first year core subjects were approached and asked to announce the study at the start of first-year core lectures and to encourage students to participate. The response to the posters calling for volunteers to participate in interviews was very low so announcements were then placed on the electronic content management system that each university used to communicate with students. These methods resulted in only two responses in the first week. Consequently the decision was made to compensate the students for their time by offering a free ticket to the cinema as a reward. This was reasonably effective in the technical university where the researcher is a member of the faculty, but not a sufficient enough enticement for students from the research university. Further personal visits were made there to advertise the study by announcing it to students at the end of two first year lectures and distribute individual printed invitations to participate in interviews.

Eventually enough students were recruited and interviews began in early May 2004. Due to the lukewarm response, and the variations in timetables of students, many interviews were carried out individually, a few were carried out in pairs and only two
were group interviews. The target of 8 to 10 students of each gender from each university was met with the exception of only 7 males from the research university. The interviews were still exploratory in nature, guided by the key questions, but rarely did the issues of the group guide discussion, only once or twice did the interviews gain their own momentum. The demographics of the university students interviewed are shown in Table 4.

<table>
<thead>
<tr>
<th>University</th>
<th>Gender</th>
<th>Course enrolled (Bachelor of ....)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>F</td>
<td>Computer Science &amp; Software Engineering</td>
<td>1</td>
</tr>
<tr>
<td>Technical</td>
<td>F</td>
<td>Multimedia</td>
<td>2</td>
</tr>
<tr>
<td>Technical</td>
<td>F</td>
<td>Information Systems</td>
<td>1</td>
</tr>
<tr>
<td>Technical</td>
<td>F</td>
<td>Information Systems / Business</td>
<td>1</td>
</tr>
<tr>
<td>Technical</td>
<td>F</td>
<td>Information Technology</td>
<td>6</td>
</tr>
<tr>
<td>Research</td>
<td>F</td>
<td>Information Systems / Commerce</td>
<td>3</td>
</tr>
<tr>
<td>Research</td>
<td>F</td>
<td>Information Systems</td>
<td>8</td>
</tr>
<tr>
<td>Research</td>
<td>M</td>
<td>Information Systems / Geomatic Engineering</td>
<td>2</td>
</tr>
<tr>
<td>Research</td>
<td>M</td>
<td>Information Systems</td>
<td>5</td>
</tr>
</tbody>
</table>

| Total Females from Technical University | 11 |
| Total Males from Technical University  | 8  |
| Total Females from Research University | 11 |
| Total Males from Research University  | 7  |

Table 4: Summary of university, gender and course

The procedure used when planning the small group interviews was to devise the following list of questions to garner a history of the current student experience with IT and a perspective on their opinions and values in relation to IT. The literature tells us that self-efficacy beliefs affect motivation and educational interests and that habitus and situated cognition affect the development of a schematic repertoire of possible selves which impact on course and career choice. It was anticipated that the interview responses would inform the underlying themes described in the literature in Chapters 2 and 3 and summarised in the second column of the Table 5.
<table>
<thead>
<tr>
<th>Question to prompt useful response</th>
<th>Underlying themes</th>
</tr>
</thead>
</table>
| Can you tell me what led you to enrol in this degree course, what is your story? | Schematic repertoire  
Cost-benefit choice model used |
| What were your favourite school subjects? | Educational experiences,  
self-efficacy |
| What would you consider to be your major areas of interest? |  |
| Which secondary school subjects were your best achieving subjects i.e. where did you get your highest marks? |  |
| Tell me about your favourite leisure activities? | Culture  
Individual and family expectations |
| What are your current use(s) of IT? At home, school, or for leisure? |  |
| Where is your degree taking you? |  |
| What are future career plans (if any) and why? | Schematic repertoire  
Influence of habitus, happenstance |
| Have your career plans changed in last two years? If so, why? |  |
| How would you describe the student experience of IT at secondary school? | Educational experiences |
| Is there any difference to the experience of IT in higher education? |  |

Table 5: Questions for university student interviews

Student career choices “are influenced by their experience of and capabilities in school subjects, and/or longtime leisure/social interest, and/or personal traits or talents.” (MMV 2001 p.22). According to this study some links are likely to be assumed between favourite subject and career choices, favourite leisure interests and career choice and even personal talents and career choices. The methodology employed in this research allowed students to reflect on IT experiences as well as enabled the outcomes to be analysed in response to the main research questions.

4.6 Data reduction and analysis procedures

During each interview minimal notes were taken. This was to ensure that interview subjects relaxed and allowed the interviewer to make eye contact more readily. The use of a digital voice recorder allowed for a greater level of validity because the interview could then be listened to several times after the event (Lareau 1989). At the close of each interview field notes were recorded. In some cases this occurred immediately after the interview, in phase one of the data collection when students were often sent to the
interview room in quick succession, this occurred at the end of the day. The combination of field notes and audio-recording allowed for a lasting impression to be obtained. As much as possible the interviews were transcribed within 24 to 48 hours to further embed the tone of the responses in the transcription. This became unmanageable as the study progressed and in some cases there was a lapse of a week or two between interview and transcription occurring, however having audio recordings ensured that the tone was ascertained and correctly captured.

The initial interviews from phase one were transcribed in full using the grounded theory style of analysis recommended by Strauss & Corbin “The actual transcribing ... should be selective. ... The very first interviews or field notes should be entirely transcribed and analysed before going on to the next interviews” (Strauss and Corbin 1990 p.30) This line by line analysis and initial coding gave guidance to interview transcription in later stages of the data collection. These interviews were transcribed in minimal format from the first listening of the audio-recordings, with subsequent listening allowing for validity and accuracy of tone.

This inductive coding methodology employed the grounded theory format of fully transcribing the first few interviews and employing manual line by line coding then using of selective transcription methodology on subsequent interviews (Miles and Huberman 1994). Data reduction progressively occurred via notation of concepts in the margins provided the key themes in the responses to emerge (Strauss and Corbin 1998 p. 101). Manual line by line coding (Strauss and Corbin 1998) was chosen in preference to current software packages. This allowed for a more tangible involvement with the data than that provided by software packages. As categories and themes emerged similarities and differences within and across gender and age groups also emerged. The open coding methodology (Strauss and Corbin 1998 p.102) was complemented by extensive use of matrices in the data reduction process. Colour coding of responses according to gender, course and year level resulting in the creation of several visual displays that were extensively consulted throughout the analysis process. Analysis of matrices of data organised across gender and year levels allowed themes and concepts to emerge (Lareau 1989; Miles and Huberman 1994).
The transcriptions were completed analysed and coded in a non-linear way, for example, all interviews of males from the universities were analysed as a group according to each university then according to degree course enrolment, followed by those from the female university students. This allowed the researcher to get a rich feel for and understanding of the themes emerging from each of the genders at each of the stages of their education. The same process was applied to the secondary school student interviews; all junior school males and females interviews were transcribed and coded before moving on to the middle school and so on.

The researcher listened to interviews at least twice, and full transcriptions and matrices consulted and analysed according to different groupings and emerging themes on a number of occasions. This allowed for any trends and gestalts related to gender, type of school, degree course enrolled in or year level to more readily emerge. Employing this method of analysis to the interviews allowed patterns to emerge in the student responses and a conceptualisation of how each gender considered IT a possible career option or not, at each of the stages of the data collection.

### 4.7 Limitations of this study

The findings from this qualitative research will not be generalisable because of the non-random selection methodology employed. Sample sizes varied between genders, between schools and between universities. The voluntary nature of participation contributed to the non-random nature of the sample. All the schools and universities were located in the city of Melbourne. A wider more random selection of students may indeed produce more robust conclusions. Finally the lack of comparability of students in the various degree programs was not balanced between the universities in the sample. Only one degree, The Bachelor of Information Systems, was common to both universities.

The semi-structured group interview methodology also had the shortcoming that in some instances a dominant voice controlled the majority of the conversation. While the researcher tried to counteract this situation as much as possible by encouraging all group members to participate, in some cases this was not as successful as others. These
results do however provide an insight to factors that shape student study and career options, particularly in relation to gender and IT.

### 4.8 Conclusion

This chapter has revisited the research questions that underpin the thesis. The design of the study was explained, with a justification for using qualitative research methods to obtain the most appropriate data to respond to the research questions. A justification has also been provided for the purposive sampling of schools and universities including a description of how sampling and questions were refined in the process of gathering the data.

The findings of the research are presented in the next four chapters according to chronological order of age of student. Presenting the data in this way allows for greater clarity in understanding how attitude to IT as a possible study or course option for the students in the sample developed over time. It also allows for factors and themes to emerge across age and between the genders.
5.1 Introduction

The results of the interviews with the secondary school students are presented in the following three chapters, with each chapter presenting responses from students in one year level. This chapter presents responses from the junior school students, the majority of whom were in their second year of secondary school. Chapter 6 presents the findings from the middle school students, the majority of whom were in their fourth year of secondary school and chapter 7 the senior school students, most of whom were in their sixth and senior school of secondary school, called Year 12 in Victoria. As explained in the previous chapter it was deemed that these stages of secondary education had the potential to be the most informative to enable a snapshot of factors that influenced student attitude to IT education and careers.

Students in junior school study a broad range of subjects, usually eight or nine in each semester. At all schools in the sample there was a core curriculum of Maths, English, Science, Art and Technology, one or two Social Studies subjects and a language subject. The students interviewed were beginning to contemplate choice of elective subjects. Of the five schools in the sample, three were solely government funded schools and two were independent private schools. For the sake of anonymity, the schools have been identified with pseudonyms. Elm, Gum, and Beech Colleges were the names given to the government schools, Oak and Olive Colleges were the names given to the independent schools. A summary background of each of the schools is given in Appendix 1. The junior school students at Beech College were not interviewed due to complications in organising the interview schedule. This was not considered of major importance and has not impacted on the outcomes of this study because sufficient data had been collected from students in the other schools to provide an insight into the IT use and career choice factors for students at this year level.

All the interviews were conducted with small groups of students of the same gender to enable free-flowing comments as justified in the previous chapter. At each of the
interviews open-ended questions were used to initiate discussion amongst the students. The dynamics of groups varied, as is to be expected. The more vocal members led some groups but a feature of the focus group methodology was to draw out the quieter members to contribute to the responses in each discussion, and this was the reality in most cases. Students are identified by their given names only; anonymity is preserved through the use of pseudonyms for the schools.

Interviews from each school were transcribed as soon as possible after the visit, then inductive coding methodology (Miles and Huberman 1994) was applied to analyse the data from each of the year levels enabling a horizontal evaluation of attitude to and use of IT according to age as well as gender and school type. This has led to a final grouping of responses to the questions into the following areas of research interest informed by the literature chapter, of:

- Extent of use of IT: feelings of self-efficacy related to IT use for leisure and study applications.
- Consideration of IT as a future study or career choice.
- Influences on study and career choices.

Gender was the primary unit of analysis throughout the study, at all times influenced by culture, education, family and individual factors as predicted at the conclusion of the literature chapters. The interview process provided an insight into whether females and males at key stages of their secondary education had different attitudes to the use of IT. The interview data also provided a valuable snapshot regarding the currency of IT as a potential career path among interviewees.

In the interviews with junior secondary students, differences in use of IT at secondary school compared to the primary school classroom were also discussed due to relatively recent recollection of their primary school experiences. This area was not explored with middle school or senior school students because of the chance that their memory, being more distant, may be less accurate when reflecting on primary school experiences. In
the following subsections the responses from the male students are presented first, followed by those of the female students, and finally a comparison of the two. It seems fitting given the ages of the students to refer to them as boys or girls, not young men or young women.

5.2 Extent of use of IT by junior school Students

This section presents the findings from the junior school student responses to questions about their favourite subjects, how they use IT for study and leisure purposes and a reflection on their primary school education IT experiences. Responses give insight to IT related self-efficacy as well as IT educational experiences in general.

5.2.1 Favourite subjects – IT and others

The majority of the boys interviewed responded to the question asking them about their favourite subjects with a list of the subjects they were studying. Further prompting was required to get them to state which was their favourite and why. Not one of the boys interviewed mentioned IT as a favourite subject and very few mentioned it at all in their list of subjects being studied. At least one-third said that Sport or Physical Education was their favourite subject because it was outdoors and active. Another third liked the practical subjects where you could make something (technology, woodwork, visual communication).

Sport, doing world football codes, which is just all football, soccer, Gaelic football and all that. Woodwork, making things, just finished making a box, pretty fun. (Steven, Gum College)

My favourite would be PE, it is just more exciting than other subjects, and it feels good just to be outside instead of in a classroom sitting down, more active. (Jeremy, Oak College)

My favourite is probably PE as well for most the same reasons, but Tech Studies is pretty good too, like Woodwork, Metalwork, get to make stuff. (Tim, Oak College)

The importance of teachers to subject enjoyment was only mentioned by students from Elm College. These students’ responses to the question about favourite subjects was lukewarm,
ah they’re all alright
some
yeah, most of them,
and had to be teased out with a further question about what makes a subject “alright”. This elicited the response “Teachers”, followed by more personal comments from some of the boys “all teachers hate our grade”, then “our Geography teacher is cool”. Maths was not a popular subject for a quarter of the sample and only featured as a favourite for one student.

Mine [favourite subject] is probably Maths, I like doing all the problems, all that sort of stuff. (Nicolas, Oak College)

Half were strongly influenced by interest or an apparent ability that was difficult for them to explain.

I am always interested in Science ... more interested in the physics and chemistry side of it. (Ryan, Olive College)

I like English because ... reading is like … I just really like reading. (Dylan, Oak College)

The majority of the junior school boys interviewed tended to like subjects that involved some degree of activity; others enjoyed subjects because of an interest in the subject content. It is notable that IT was not included in any responses. Oak College, which required students to purchase their own laptop computer, did not teach IT as a separate subject in the junior school, however, even the students who felt competent and capable in their use of IT (as will be described in the next section) who did have an IT subject in their curriculum (Olive College), did not mention IT in their favourites list.

Like their male counterparts, the junior school girls also tended to mention practically-oriented subjects as their favourites like Home Economics.
You get to have fun and cook.

yeah, [laughter]

We have different dishes each week and we get to eat them, it’s different, like, from normal subjects, like Maths and English.

I always like sport, like, I do sport out of school, like, I just like running. (Elm College)

At Gum College the Science class was very popular with three of the five girls because they were working with chickens “we get given chicken eggs and we get to see them hatch and everything” (Gum). At Olive College the favourite was Drama, also for reasons connected to the opportunity to engage in practical activity.

It is fun to get up on stage

You get to express yourself – no right and wrong answer, open to interpretation

I like it because you get to be in school productions. (Olive College)

Art figured highly in favourite subjects of the girls from Oak College, although this was qualified by one girl: “last year I wouldn’t have said that, it depends on the teacher” (Oak). Only one girl mentioned IT in her list of favourite subjects,

It’s called ‘Gifted Projects’; we’ve been chosen especially to do the class, and we do things involving the community through computer technology. (Gum)

One other girl from Gum was also in this class, but did not consider the subject one of her favourites. Interestingly the girls from Gum College mentioned a hatred for Maths; “because it is boring and not difficult” (Gum College). These girls added further confirmation of their preference for subjects that were interactive and encouraged them to be involved.

There appears to be little gender differentiation between the likes and dislikes of these students in junior school. The overriding criterion for enjoyment in a subject in the majority of students interviewed is that it involve some type of hands-on activity or
physical activity, be that within the science classroom with chickens, home economics with food or creating objects in technology classes. Even when IT was a separate subject it was not considered in the list of favourites. The one exception to this pattern was where there was connectivity in the curriculum with the direct application of IT in a community project which made this subject attractive to one girl. Margolis and Fisher (2002) emphasised the importance of connectivity in the IT curriculum at tertiary level to make it more relevant and enjoyable for female students. This appears to be verified by the students in this sample.

### 5.2.2 IT use for school-related purposes

The use of the computer for school work was mentioned as a secondary use in interviews with the junior school boys. Most of the boys immediately mentioned game playing, e-mail or, to a lesser degree, on-line chat when responding to the question “How do you use computers?” All of the schools in the sample had a number of IT resources available for students either in dedicated IT classrooms, in the library, or in various subject rooms.

The boys from Olive College seemed bored with the IT curriculum and were the most critical of their IT teachers.

> I think the teachers that go into computing are teachers that can’t teach into anything else.
>
> She doesn’t really teach us anything she just gives us a booklet.
>
> Most of the time we are teaching more than they are teaching us.
>
> There are a few good ones, but they come in the upper grades.

The boys at Elm College thought their compulsory IT subject was relatively easy, but they were not quite so negative about the curriculum. They particularly enjoyed the web-page development part of the curriculum and did not mention their teachers.
When the girls were asked about the extent and purpose of their use of IT, school work was the first response in three out of four group interviews. Of the five girls from Olive College three of the group did not enjoy using computers, although were aware of their usefulness. The following dialogue was typical of the responses to the question.

I am not good with them.

Me neither.

I get so angry at them, because I can’t do anything, and they always stuff up, always.

I get so frustrated, whenever I stuff up the computer my brother is always helping me, but it is just so agonizing stuffing them up.

I try not to use them at all, just like for all the school work…They are quite useful for school work. (Olive College)

Two girls in this group did not join in this conversation and when prompted admitted to “loving computers” and “liking computers”. They used them for “games, typing, speak to friends over the internet”, and were confident in their ability with the computer.

Oak College girls used their compulsory laptops every day for school work. Some used IT at home for communication with friends but they seemed less focussed on the use than the girls of the same age at other schools. Their main comment was on how heavy they were to carry around.

School work was mentioned first as the main use of computers by most of the young women interviewed, in contrast to the boys interviewed who mentioned game-playing before any other use. The majority of the girls also frequently used the computer for leisure, mainly for communication via internet chat and e-mail, music downloads and sharing photos on-line. Despite an obvious ability and confidence in IT use for these activities, a large proportion of the girls underrated this skill and reported that they were ‘no good’ with computers. The contrast in responses from the girls and the boys is evident in that none of the boys were as negative or self-deprecating of their computer use as the girls. The two girls who enjoyed using IT were quiet in this aspect of the
interview, apparently aware that they were not the norm and not willing to draw attention to themselves because of this. The collaborative identification with a sub-group within their gender who are not computer literate appeared to be the norm for the girls interviewed.

5.2.3 Extent of engagement with IT for leisure

The literature refers to how an individual’s situated cognition influences course and career choice (Hodkinson and Sparkes 1997). No decision is context-free. In order to examine ways in which students’ IT use for leisure purposes may play a role in attitudes to IT and potential course and career choices, the interview questions explored ways in which students engaged with technology out of school hours. The majority of junior school boys interviewed were frequent users of IT, both for school work and leisure. In all interviews with the boys the use of IT for leisure activities was discussed in greater detail than school work or curriculum applications.

Almost two-thirds of the boys were frequent players of computer games. They also used the computer for watching movies and for communication via e-mail and internet chat.

I normally watch Japan Anime movies … on my laptop … download them off the internet … [I also] like talking to people, to my friends on MSN … don’t have many games. (Oak College)

At each of the schools there were different levels of computer use within the groups and no particular pattern or frequency of use emerged in any single group. The single overarching similarity though was that only one boy expressed an aversion to using computers for leisure activities, as noted later in this section. All other interviewees responded favourably in relation to leisure-time use of IT. Jacky at Elm College was keen to show his knowledge of the hardware and in response to the question “How do you use computers?” Jacky responded:
Clock computers, it like increases the MS speed, it makes the computer faster, Yeah I sometimes do that.

He also played computer games daily, for 4 to 5 hours.

When I get home after school I play to about 6 o’clock. Then like when I finish watching TV and dinner I play to about 10 o’clock. (Jacky, Elm College)

Other students in the same group had greater parental supervision of their computer use. One boy had monitored game playing and use “Usually I have to ask my parents. Now [during school term], I am not allowed to go on the internet or play games except if I am doing homework or else I am not allowed to go on” (David, Elm College). At Gum College David and Jake admitted very frequent involvement with IT and gaming.

I am on MSN most of the day, every day … pretty obsessed actually, I am not really on weekends, I go and play basketball, I go out for sporting commitments. (Jake, Gum College)

One student at Olive College mentioned their home network of computers with some pride in his voice. The exception to frequent computer use was Steven of Oak College whose leisure activities did not focus on IT and his use was limited to that required in class.

Mine [laptop computer] is really like a lemon, keeps breaking down ... I just like watch TV or go outside and ride a bike and stuff. (Steven, Oak College)

Notably Steven was the only junior school boy interviewed who expressed an aversion to using the computer for leisure activities; however this aversion appeared to have been influenced by faulty hardware.

The junior school girls interviewed used IT in their leisure time to talk to friends, download music and surf internet sites. There was some mention of playing games on the computer. The girls at Gum College were the most frequent users out of all the girls interviewed. This was the only group that (when asked “Tell me about how you use computers”) responded with leisure applications first of all, not school work use.
I use it for like social, yeah MSN, but I see it for homework because you get high grades and that with it, and some homework, I use it with my pictures and that, and I like fix them up, and music, download my music from there and games. (Natasha)

Mainly the internet, cause you can get them free from there, and school work, and movies and games and stuff like that. (Lucy)

I use the computer but like I don’t know, I just don’t really like sitting in front of the computer screen I like being outside. (Sarah)

Yeah, downloading a lot of music, my mum hates it. (Mitzi)

The girls were all frequent daily users of IT for communication; however, in further discussion they admitted that their mobile phones were of primary importance, with email and internet chat coming second as a communication tool.

The overriding gender difference in responses from the boys and girls about computer use for leisure is that two-thirds of the boys regularly play computer games, as opposed to only one of the girls. Two of the boys could be classified as high-end computer users with their focus on the hardware side of IT. Not one of the girls mentioned their knowledge or use of specific computer hardware. The girls tended to see the computer as a communication tool, but second to their mobile phones.

5.2.4 Recollections of primary school IT use

The junior school students interviewed were in their second year of secondary school so it was relevant to ask them about any perceived differences in computer use in secondary school to primary school. Educational psychology literature around self-efficacy (Zimmerman 1995; Pajares 2002) informed the assumption that the purpose of computer uses was integral in developing a positive or negative attitude to IT. This question allowed a gendered comparison of how attitude to IT is developed over time during the transition from primary to secondary school. Almost all the students of both genders remembered using computers in primary school for curriculum driven game applications that had a veneer of fun built into the learning process.
I remember there would be certain times and we would be in a group of two and we’d play Carmen San Diego and try and solve it. (Jason, Gum College)

In primary school we were taught like games, like new games to help us with the topic like if we were doing the gold rush then they would download games on to the computer about that, and we would also use MicroWorlds. When we went to secondary school they teach us all the graphic things like Photoshop and Flash and … they sort of skipped a lot of things I think. (Hannah, Olive College)

Only one boy from Oak College recalled learning how to touch type through a computer program at primary school, a motor-skill development. Both the girls and boys recalled the computer being used as a ‘reward’ or a ‘treat’ for students who had finished their work early for example.

There were nostalgic comments from both sexes “We don’t get to play many games [in class] anymore” (Olive boy) and “I thought it was more fun in primary school because we did more interesting things” (Elm girl). More than half the students mentioned a small number of computers being housed in each classroom and not in specific laboratories, so they were more readily available to be used as part of a reward or to enhance teaching a particular part of a topic via a game.

The contextual use of IT in the primary school environment; for learning about geography, spelling, maths for example, and the ready access within the classroom was reflected on favourably by the students. In comparison they are more critical of IT use in secondary school “everything is blocked at school, no games” (Elm); “we don’t get to play many games any more” (Olive) were typical responses from the boys, and the girls bemoaned [they have] “blocked out MSN at school, blocked out girl magazines [websites]” (Oak). There were no discernible gender differences in access or purpose of use at primary school with these students. However by the second-year of secondary school there appears to be a growing gendered division associated with declarations of IT competency, as evidenced by the dissonance between the obvious computer literacy and competency of some of the young women (Olive College) yet their declaration of
being ‘no-good’ at computers. The purpose of computer use as a tool for communication is evident in both genders, but it is primarily the boys who use it consistently to play games.

5.3 Consideration of IT in subject or career choices in junior school Students

Student decisions about career and course choice are a product of their habitus (Hodkinson and Sparkes 1997) with the gathering and processing of information an ongoing process influenced by environment, not a discrete activity (Hossler et al. 1999). To develop an idea of where IT sits in the career-choice schema of students they were asked the question “What do you want to be when you finish school?” This question was positioned after the discussion about favourite subjects and before the question related to IT subjects and courses so as not to influence students by directing them to focus on IT in particular. There were particularly gendered responses to this question in the types of careers and future job prospects of the students.

Only three of the boys interviewed made any mention of a future career in IT. Jacky of Elm College was definite about being a computer designer or games designer, and Adam and Ryan at Olive College mentioned “something to do with computers”, although Ryan qualified his response with “I want to do something with computers but I don’t want to be stuck indoors, so probably something like Engineering”. None of the others mentioned IT in their career plans. Many mentioned stereotypical male careers like Policeman, Army, and some more ambitious or fanciful like Actor, Comedian or Professional Athlete. When prompted further with the question “Have you considered an IT course at University or a career in IT?” some of the boys said they had not discounted IT outright. Interestingly while less than a quarter of the boys were considering IT they were not convinced that the career path was sufficiently rewarding or interesting.
Yeah, maybe but not really, I’d go and do a course but I wouldn’t do it for a job. (Elm College)

Thought about it a bit but I didn’t like it, I thought lawyers would earn more money. (Elm College).

Well I have definitely considered doing computer programming but I would much rather do it for fun, like animations. (Oak College)

I sort of thought about it, but I would do digital video, you know special effects. (Oak College)

Not sure, because I am not really a person who likes being in front of a computer, I like being outside, you know, being active, so I wouldn’t really take in the job of like IT, because you’ve got to stand in front of a computer all day. (Oak College)

These qualified responses echo the factors accounted for in the literature of students considering IT as stereotypically boring and isolated. The possible money earning potential was considered by one student who considered a legal career more rewarding, but not by any of the other boys. Not one of the boys from Gum College or Oak College (the laptop school) were considering IT until prompted, while two of the boys most critical of the IT curriculum at Olive College were considering this as a career path. It is apparent from these responses that IT is considered more of a leisure tool or activity than a potential future career path by these young men.

When the girls were asked the same question there was some moderated consideration of the career path.

I have considered it, but I like it for entertainment, not for work. (Elm College)

Like using but not learning about ... (Elm College)

Obviously will use them if working with forensics. (Gum College)
Maybe for design. (Gum College),

I would have to use them if I was a magazine editor. (Olive College)

Most of us are artistic and not interested in technology. (Oak College)

In all only one in five girls interviewed had considered IT as a tool or adjunct to their career path and not one as a first choice. As a whole they were usually quite dismissive and there were many utterances of “no way” in immediate response to the question. These responses indicate that while the young women do picture themselves using IT, it is as a tool in another career (forensics, design) yet the last comment indicates that there is no link perceived between the creative use of IT as a tool in the artistic field.

Like the junior school boys, these girls were considering quite stereotypical career paths, for example wanting to be a Veterinarian for the reason of liking animals or an Architect because they enjoyed design as well as a Dancer or an Actor. There was however a wider variety of possible careers under consideration with many girls listing four or five possible career paths, and even one or two saying “I think it is too early to decide, we haven’t even done our electives yet” (Bethany, Elm College). There was a greater number mentioning a desire to work with children or in a caring career path.

A teacher, I like working with young people, I like little kids, I like helping people, we had a buddy system in Grade 6 with the preps. (Sonja, Elm College)

I always liked helping people, a problem solver, like working with kids and something like that. (Natasha, Gum College)

I want to work with kids with disabilities, problems. My brother has got problems, something to do with his brain. (Mitzi, Gum College)

This strong personal connection with career choice was much more pronounced in the interviews with the girls than with the boys and the following quote is quite indicative
of how these girls saw many options open to them and were not at a stage of narrowing career choices yet.

I want to be in musicals, in movies. I do a lot of dancing and acting. Mostly musical but I will settle for a TV series, or a news reporter on TV or the radio. Or if I can’t do that a Psychologist or a School Counsellor, helping kids and that, and if I get really good scores in VCE I want to be a lawyer. (Alice, Oak College)

The predominant difference ascertained from these interviews between the genders is that not one of the females had a desire to work in a technical career path. No-one wanted to be an engineer or an IT technician and the young women did not see IT as anything beyond a tool and not leading to a career path in its own right.

5.4 Influences on career and course choice in junior school students

A major factor evident in the career choice literature is the influence of family expectations on possible career options of students. A general question asking who or what these students thought was the major influence in their decision-making about courses and careers emphasised that at this stage of their life, many girls and boys are strongly influenced by parental expectations. About half the boys declared that they were directly influenced by their parents or another close family member when considering future career choices. One third mentioned television shows and sports idols and a few mentioned the opportunity of making money. Common responses were “Dad was in the army”, “My friend’s dad was a detective”, “A lawyer for the money” from the Elm College boys. Television influences were most prominent in the conversations with the boys from Gum College, and sporting stars or idols featured strongly with the Oak College boys. The career choices of these boys were also influenced by sporting activities or hobbies, personal activities and things they liked doing. The one student who was most keen on an IT career liked working with computers and spent four to five hours each day playing computer games.
The influence of a same-sex parent was quite obvious in the responses from the girls who also mentioned favourite school subjects or personal interest as the influence on their course and career choices. While fathers featured strongly with the boys at this stage of their life, mothers featured in more than half the responses from the girls. Interest in the curriculum area at the current stage of their schooling and ability in the area was also mentioned. Television shows like the forensic investigation programs and magazines were mentioned by some of the girls particularly at Elm College, one of whom wanted to be fashion designer. Other family members were also mentioned, but not one girl mentioned a sporting identity in particular.

5.5 Comparison of responses from junior school girls and boys

Boys and girls gave broadly similar responses to most of the questions, which is in accordance with the career choice literature for students of this age (Siann 1994). There were distinct stereotypical career path aspirations, but greater similarities than differences when focussing on IT courses and careers with very few boys considering IT classes as their favourite, and only one girl. The influence of the teacher was prominent in one third of the student responses, across both genders. The curriculum was the major influence on determining like or dislike of a subject and this was directly related to whether it involved physical activity or was engaging through creativity or interactive exercises.

The majority of these junior school boys and girls were very frequent users of IT, for both school work and leisure. The primary difference between the genders was that only one boy admitted to an aversion of computers, while many of the girls happily admitted to hating them or not being good with them. Paradoxically, these girls were often daily users of IT for internet-enabled communication as well as downloading of music. A small group of boys were considering an IT career path, yet none of the girls were considering this option. When prompted further the idea had not been totally discounted by about 1 in 3 boys, but most of the girls saw IT as complementary to other types of careers. The strength of rejection of IT as a possible career path was much greater with girls than with boys.
Typically parents were the strongest influence in course and career choices with a consistent association within the genders; boys were most strongly influenced by their fathers, uncles or brothers and girls by their mothers. Popular culture was an influence in about one third of the students in both genders, and personal interest also featured strongly. Girls at this age seem to consider a wider number of options when ruminating on future career paths, be they fanciful or realistic, while boys tend to be more focussed on one or two broad areas. These gender differences and similarities will be compared with students from higher year levels, and any school based characteristics will be discussed further in the next chapter.

5.6. Conclusion
The interview responses from junior school students presented in this chapter demonstrate that there is a minimal gendered divide in purpose of use of IT and attitude to IT competency in this age-group. The plans for future study and career paths are still quite malleable for these students, and in some cases quite fanciful, strongly influenced by their parents and close family members as well as celebrities in the sporting, music, or television arena. IT was rarely mentioned as a favourite subject by either gender, although IT use was firmly embedded in the leisure and education experiences of both boys and girls. The next chapter will present findings from interviews with middle school students to gain a greater perspective on how decision-making around IT study and careers is shaped further according to gender.
6.1 Introduction

The middle school sample was chosen in order to shed further light on factors contributing to students’ subject and career choice at a critical decision point in their secondary school experience. The average age of these middle school students was 15, the age when young people in Australia can legally start part-time work enabling them to earn their own disposable income. There are more than 34% of young Australians in part-time work (Sheahan 2005 p.34) which provides them with choices that extra income brings. It can be surmised that social choices begin to impact on educational choices of students at this age.

As with the junior school students, interviews were conducted at each school in groups of four or five students, with young women interviewed separately to young men. At each of the interviews seven open-ended questions were used to initiate discussion amongst the students as discussed in chapter 4. A total of thirty-seven students were interviewed, twenty young men and seventeen young women in nine separate group interviews. Oak College was the only school that did not have a female student cohort in Year 10. The school had only recently enrolled female students in this campus and had a junior and senior school intake but the middle school classes were still single sex.

Students in the middle school are beginning to contemplate their selection of VCE subjects, which in turn will influence future study and career paths available to them. Particular instructions were given to the interview facilitators in each of the schools that the selection process be random and that studying IT at that point in their education was not a criterion for interview. A random selection allowed a broader snapshot of student study and career choices to be canvassed. This was particularly important in the middle and senior school student selection process because IT is not a core unit in the curriculum.
This chapter will present the findings from interviews with the middle school students in the same structure as the previous chapter; however these findings necessitated increased analysis of responses related to influences on study career choice so this section has been expanded. The chapter concludes with a comparison of responses between genders, between students in government school and those in independent schools, and lastly between middle school students and junior school students.

6.2 Extent of use of IT by middle school students
As with the junior school students, asking these middle school students about favourite subjects not only gained an insight into their attitude to IT use in school and for leisure purposes but provided information about any gendered differences in educational interests. The first question was general in asking about favourite subjects, with no mention of IT by the interviewer, the second focused on IT use either at school or home.

6.2.1 Favourite Subjects – IT and other
The responses to “Tell me about your subjects and about your favourite subject” ranged widely across the schools as well as between the genders. However the noticeable commonality was the overwhelming absence of IT being either mentioned as a subject being studied or as a favourite subject by the majority of students of either gender.

The young men at Elm College focussed on five common core and four elective subjects then quickly moved on to a discussion of their teachers’ influence on whether they enjoy a subject or not, with no mention of Information Technology either as a favourite subject or an elective. At Gum College only one of the young men mentioned IT as a favourite (it was an elective subject) and said he enjoyed IT and Maths because he was “not really an articulate person, more with theory”, he repeated “I am not very articulate, IT is probably my favourite subject … I can see through the code and know exactly what each thing needs to do and what has to be done” (Chris, Gum College). He proudly stated that he was up to twenty projects in front of anyone in the IT class then stated “I love it” with a degree of passion in his voice. For several of the young men the primary factor that made a subject a favourite or not was whether they felt they had an aptitude in that area. For example one mentioned his favourite subjects as being Science
and Maths “because it is easier for me”. His family settled in Australia from Malaysia only two years ago and he did not enjoy English classes “English is not so good” (Caleb, Gum College). Having a competency in the area certainly influenced the enjoyment of subjects in several of these young men. Unlike the young men at Elm College, the Gum College students did not mention teachers influencing their enjoyment. Only one other mentioned IT, “I am good at computers I suppose, but don’t want to work in an office for IT” (Karl, Gum College). This response demonstrated a stereotypical portrayal of the career path being sedentary.

Only one of the young men at Oak College, the laptop school, considered a subject that relied heavily on IT as his favourite (Commerce). Two of five mentioned this subject in their favourites, one because of the IT component within the subject: “it’s Information Technology and Politics” (Leo, Oak College); the other because of the business aspect of the content. Most of the young men at Oak College enjoyed the practical subjects in their courses such as Woodwork. At Olive College none of the young men made any comment about IT as a favourite although one subject that used IT as a tool, Media, was mentioned as a favourite by one of the five interviewed, “media, film analysis, creativity, music videos, it is a modern subject” (Todd, Olive College). The young men at Beech College unanimously agreed that subjects that were conducted in a non-classroom setting were their favourites, like Physical Education and Sport.

Overall, Information Technology, a subject with the potential for curriculum content to be practical, up-to-date and relevant, fared very poorly in the popularity stakes with the majority of young men interviewed. Only ten percent mentioned IT as a favourite subject, in two of the five schools in the sample. The main factors these young men referred to as making a subject enjoyable were the teacher, an aptitude in the field (Maths, Science and English in some cases), or the level of activity and practical application (P.E., Woodwork or Media) in the curriculum.

Not one of the middle school young women interviewed mentioned IT as a favourite subject, and only two mentioned it in their current subjects being studied. Of the female students from Elm College, Caitlyn mentioned studying an IT elective. The word ‘love’
came into the conversation several times in relation to favourite subjects to a much
greater extent with these young women than with their male counterparts. “I love
English and both Geographies” said Caitlyn, “I love science a lot, I want to do
Biotechnology when I get out” (Farrah, Elm College). An aptitude in the area
influenced Alex, who admitted that she is good at Maths and it is her favourite subject
but with some hesitation in her voice, almost apologetic. Amanda did not mention a
favourite subject but went straight to her hated one, Physics, and added that she “hates
the Physics teacher” which led to Caitlyn expressing a hatred of Maths and laying
blame for this on a teacher she had two years prior to the interview. Aptitude in the area
as well as teachers emerged as influential factors with these young women, just as they
were with the young men.

The young women at Gum College all mentioned teachers in their responses to the same
question. Rachel was the only one who mentioned IT in her current subjects but was
dismissive about the curriculum content with the statement “I do IT, which is the
basics” (Rachel, Gum College). In the same group Zoe listed Music as her favourite
because of its use of computers in creating music, “it’s really fun” (Zoe, Gum College).
The rest of the students focussed on likes or dislikes according to the teacher.
“Commerce… was really easy, because you know, good teacher probably. Don’t like
English, teacher is sort of spaced out, she is like not really there” (Angie, Gum College).
Zoe was forthright admitting that she liked Maths and was not at all apologetic unlike
Alex in Elm College. None of the young women at Beech College mentioned IT in their
list of subjects, nor in their favourites. Simone enjoyed Art because she liked drawing.
Yukiko enjoyed an elective named Hospitality because she liked cooking. Bobby’s
favourite was a Photography elective and Shannon’s favourite was Science, she giggled
then added “I love the biology side, it is interesting, and I love history.” As in other
schools, these young women were more likely to admit a ‘love’ or ‘hate’ for their
subjects, expressing this greater strength of emotion which was rare in conversations
with the young men. They also had a discussion on love or hate of subject based on the
teacher. Simone philosophically added “I think also it is partly how the teacher interacts
with the class” in a discussion between Shannon and Bobby on why they loved or hated
History.
Not one of the five young women at Olive College mentioned IT in their favourite subjects. All these young women enjoyed humanities type subjects, no technical subjects were mentioned at all with Health being the only subject from the Sciences. Dana loved the elective Biblical Studies “although I don’t believe in God and things, but it is really interesting and the teacher is great, it is a good class”. Ruth agreed with her “Biblical definitely”. She also enjoyed a current sociology subject called “Comparative Genocide Studies” and expressed a strong appreciation of the value of such a subject. Callie agreed with Ruth that Comparative Genocide Studies was a great subject and her favourite too because “we look at the build up of a country and what goes into it”. Sarah enjoyed Health and Human Development “it is based around our age and like, everything that we’re going through, and goes on with it, interesting because it relates to us” (Sarah). “It sounds crazy but I would possibly say English… I like the literature stuff” (Deborah). Deborah also studied French and another language.

Of all the young women interviewed only two mentioned studying IT as an elective subject, and not one mentioned it as a favourite. The ability to use it as a tool in Music lessons was the closest this subject came to being liked. Most of the young women interviewed expressed stronger emotion in listing favourite or non-favourite subjects, and were more focussed on attributing their like or dislike of a subject to the teacher delivering the subject, than the young men of the same age.

None of the young women of this age group and only a very small proportion of the young men made any mention of IT as being a part of either their school curriculum or their favourite subjects. It should be remembered that these responses were given in a context where IT was not specifically mentioned at all. The goal was to determine whether, unsolicited, middle school males and females volunteered IT as part of their discussion on school subjects. The next section records responses to a direct question about the role of IT in their lives.
6.2.2 Extent of engagement with IT for leisure and school

In western society studies indicate that young men and young women are using IT in almost equal proportions for leisure activities as indicated in Chapter 3. In this investigation the gendered differentiation of use of IT became evident when students were asked to describe how they use IT. Two-thirds of the young men interviewed used the computer for game playing. A majority expressed pride in the amount of time they spent on the computer and also in their self-proclaimed technical proficiency.

At Elm College the question “How do you use computers?” was met with knowing laughter that implied a great deal of time was spent using them. Tait frequented a nearby venue weekly where people paid to play LAN (local area networked) games. Dor Sun was familiar with this venue, but said he was more likely to play with a group of friends which included Daniel. They “bring computers over and network a few and play” (Dor Sun, Elm College). Andrew said he used the computer to keep in touch with his friends and do all his homework and mentioned game playing third in his list. Dor Sun admitted that his parents monitored and controlled the hours he spent playing computer games. All these young men admitted to using internet chat to communicate with their friends, although there was a variation in the degree of use. At Gum College there was a similar response to this question. Two out of the three young men in the group focussed on the hardware and programming aspects of IT and discussed the internal workings of a game to change character graphics (Chris), and being able to get rid of viruses (Karl). Chris admitted to being very involved with his computer, both in leisure and school activities, “first thing I do when I go home is turn on my computer, I use my computer every single day for everything I can and more”. He elaborated about his pastime with computer games, which was to change the character appearances rather than play the games and also mentioned the programming language he was studying with a certain amount of pride relayed about his skills in this area. On the other hand Caleb’s use was limited to assignments and research for school work. His response had a very school based focus and gaming was mentioned only as an occasional pastime. Karl was very offhand about his IT proficiency, “use it for work and stuff, not every night. Play games. I just know how to work it whatever, know how to fix it if something goes wrong”. Both Karl and Chris expressed pride in their competence with the
technical side of IT. Chris expressed a desire to work with computers for his career, like his hacker cousin who now works for a well known software company. This story was told with a certain amount of pride and surfaced in other interviews with both male and female students enough for it to be questioned as perhaps an urban legend. Chris had networked his home computers and was the resident expert in his home. Karl was dismissive of working in IT despite his skill in the area and expressed a desire for a career outdoors: “In year 7 and 8 I always wanted to do IT. I have veered off that idea, as I got older I want to get out more, meet new people” (Karl, Gum College). The implication to be drawn from this response is that in IT careers you do not “get out” nor meet new people. This reiterates the stereotypical view of closeted IT careers. Karl was one of the first students to mention that he had grown out of an interest in computers. This theme emerged in subsequent group interviews.

Information Technology emerged as integral to all aspects of school life for the young men at Olive College, although not wholly embraced in their leisure activities. Two of the five were very reliant on IT for leisure activities and four of the five for social communication. One used the computer “everyday for a few hours ... more into tweaking and upgrading ... odd game of ‘Counterstrike’, yeah everyday for communication … reliant on the internet.” (Adam, Olive College). All of the young men accepted the use of the internet as a communication tool for e-mail and internet chat: “it is our link to the outside world” one admitted. There was resentment expressed about a growing reliance on IT in all aspects of their education by two of the young men (Guy and Nick). Nick even stated that he would much rather hand-write than type. IT was so integrated into their education and leisure that the discussion moved on to the fairness and equity of reliance on the medium for distribution of classroom worksheets. In their last class before recess on the day of the interview the teacher told them that there would be no more class handouts (paper worksheets), and in future worksheets would be e-mailed to the student’s school accounts via the school’s intranet servers using web-mail or e-mail. “I think if the internet does something wrong I have something to blame, if I do it myself I am organised, I have somewhere to keep it” (Todd). While Olive College was not a laptop school, Todd noted: “I use my computer every day, but I could very easily not use it”. The implication is that he would rather not use it but is forced to do so to communicate with his teachers, friends and complete
curricular activities. The majority of young men at Olive College were accepting of IT as part of their education, but resentful of it taking over as the main communication link with their teachers and for work submission. Olive College was the highest achieving college in the state for the percentage of students offered university places and the school had excellent IT resources. The students are drawn from a high socio-economic group and IT is integral to home and school. Nick and Guy’s resentment was not based on an economic divide or equity issues rather on the unpredictability of the technology, Guy bemoaned: “I am really bad ... had really from the past bad experiences with technology ... tapes, cords ...even e-mail ... this is the first thing that worked” and pointed to his iPod®. Nick rejoined with “I still cannot work the iPod®”.

The young men at Oak College, another school that had high expectations of their students and attracted students from a high socio-economic background, had four years of education where the computer was integral to their classroom work and were very competent users of IT for leisure and school work. They downloaded music, videos and used internet chat and e-mail often. When responding to the question “How do you use a computer” Leo answered for David “he plays games every lesson”, David responded “not every lesson, every second lesson”, with a degree of pride. Foti was a big internet user at home, researching fish mainly, his hobby. He sent the occasional e-mail and was an infrequent internet chat user. David, who had recently spent 18 months in the USA, used it to keep in touch with friends there. Terance was not convinced that personal laptops were an aid to his learning. He was preparing in advance for his examinations and admitted to practising hand-writing sometimes in class and at home, he added:

The laptop can be used as a distraction sometimes, …[this] is bad, because most of our exams are written ,and most classes use a laptop, and your writing skills are not good, when it comes to your exams you are slow. (Terance, Oak College)

In the group interviews with the young women a completely different dynamic was evident. The prompt “Tell me how you use IT” resulted in an interesting response from the young women at Olive College. Three out of the five promptly responded that they hated computers. There was almost a competition to comment on how illiterate they were with IT. Further inquiry found that all these young women use the computer daily;
two have their computer on all the time at home. The dichotomy of hating computers but their social life revolving around internet chat groups was evident in the conversation. This type of response of expressions of hatred and bragging about incompetence was not evident in any of the interviews with the young men of the same age, yet occurred among other interviews with female students from other schools and other year levels (Olive College, Elm College). Despite the apparent hatred of computers all the Olive College young women used the computer for internet chat, and two admitted to playing ‘Minesweeper’ and various other games. They commented on the social benefits of internet chat:

For me it is easier to talk to people through the computer, not see their faces, not hear their voice. (Dana, Olive College)

I don’t think I would have many friends if I didn’t use the computer. (Sarah, Olive College)

When the young women of Elm College were asked how they use computers, the responses “internet, homework and stuff”, “talking to friends” “MSN” were first to be mentioned. After a few minutes Caitlyn expanded on her response to explain that she accessed the ‘Neopets’ website, and qualified this with the statement “I am really sad” (Caitlyn, Elm College). She explained that on this site she played with imaginary pets, and repeated the “I am really sad” statement as an apology for enjoying this activity. Alex was also familiar with this website, but her pet had died for the third time in as many minutes. When retelling how much time she spent on the computer “all day on the weekend” Caitlyn repeated “I am sad”.

Unlike the young men of this age group, there were no expressions of pride in how much time was spent on computers but instead a need to apologise for both enjoyment of and extensive interaction with IT. In the same group, Farrah expressed pride that her younger sister “is on the 95th percentile of AOL users” but was not an extensive user herself. Sarah used the computer but was not on-line often, and Amanda found it boring, also adding that she had to pay for internet usage herself so did not go on-line often. Sarah, unprompted, told the group with a certain amount of pride in her voice that her boyfriend was studying an IT course at university. Elm College is a government school
but in a reasonably affluent eastern suburb, the economic cost involved in IT use and access was only mentioned by government school students in the sample.

The young women of Gum College were all proficient and frequent users of computers for both recreational and study purposes. Stephanie admitted to using them “heaps”. Prior to enrolling in Gum College she had been a student at a school where there was a requirement that all students purchase their own laptops and admitted to being a “bad speller and my hand hurts if I write too much”. She used the computer to download songs and stay constantly connected with her friendship group using internet chat, “I usually have it on in the same room as the TV” (Stephanie, Gum College). Angie used it for school work but mainly for internet chat and e-mail. After some hesitation and an embarrassed laugh, she also admitted to loving computer games “if I find a game out, I will play it constantly until I get sick of it and then I won’t use it for a while then go back to it”. When asked what type of games she laughingly said,

Well my brother got ‘Wormblast’ for his birthday, and my mum started me on Minesweeper, and I’ve got better scores than all of hers, but I have given up on that because I can’t beat them. (Angie, Gum College).

In this same group Rachel, like Stephanie was a constant user of the computer “I use it a lot, never handwrite anything, use for the internet, e-mail, searching for things for projects” (Rachel). She recently had an unpleasant bullying experience on internet chat when another student put her telephone number on a chat line and male strangers started to telephone her. Her father had since banned internet chat for safety reasons. Zoe was a constant user, a game player and an on-line counsellor on a teenage web-site. She played “RPG games” (role-play adventure games) and considered herself “practically pro at using Google, I use it all the time”. These young ladies were all confident and competent users of computers for all aspects of their school work, social interaction with their friendship group as well as for game playing.
In contrast to the frequent IT use experienced by the young women at the three other colleges, the young women at Beech College were the least interactive with computers for leisure and school work. They mostly use it for school work, “look up stuff for projects for school, anything that is interesting like” (Bobby, Beech College). Compared to other schools, the social life of these young women revolved a lot more around mobile phone technology than internet technology. Beech College is a government school in an area where there are a plethora of private schools and quite a disparity in socio-economic positions of residents. These students had less access to IT at home and at school than any of the other students in the sample.

A number of gender differences in use of Information Technology emerged from the responses of these young women and young men. In particular, a greater number of the young men were regular computer game players. While some of the young women did play games, they were of a different type than those played by the young men. Clearly the young men expressed greater pride in their computer use and some referred to their technical competency with bravado. The young women experienced some vicarious pride in both a sister’s exceptional amount of use (Farrah, Elm College) and a boyfriend’s ability to study IT at university (Sarah, Elm College). Overall the self-efficacy of the young women when applied to computer use emerged as consistently lower than the young men and it was only the young women who were self-deprecating about their use of IT as a leisure activity. Caitlyn and the computer generated ‘Neopets’ are an example of the latter. The majority of the young women used the computer for leisure, but mainly as a communication tool, and there was a degree of reluctance and a lack of forthrightness when admitting the extent of their computer use. Overall the attitudes of the young women to IT were different to those of the young men. They did not focus on their technical knowledge and were more concerned with the variety of uses, for example internet chat, e-mail, research, on-line counselling and games.
6.3 Consideration of IT in study or career choices of middle school students

As previously mentioned only three of the twenty young men in this age group mentioned IT in their list of favourite subjects, and not one of the seventeen young women. When they were asked “Have you ever considered a career in IT?” slightly more than one third of the young men and one in five of the young women responded positively, however some of these responses were qualified, as will be demonstrated below.

At Elm College, three of the four males mentioned Information Technology as a possible career option early in the interview. The opportunity to make lots of money in the future was very important to them with Tait asking rhetorically “Bill Gates, who would not want to be him?” Later in response to the more direct question “Have you ever considered a career in IT?” all four of the young men had positive responses, with the one student who had not mentioned it earlier, not discounting it as a possibility: “Probably might, will keep options open” (Dor Sun, Elm College). Another expanded that he would “probably go programmer or networker (sic), it is like a builder, always going to need it” (Tait, Elm College). This response indicates an understanding of the integration of IT into society in general.

By contrast, at Gum College only one of the young men was open to a career in IT; this was Chris who previously expressed a love of IT and total involvement with it in his leisure time. He intended to study IT at university and “anything to do with IT, electronics ... robotics”. Caleb had discounted IT as a career path “don’t understand; don’t have time to learn, hard for me”. Karl, as previously mentioned in the last section was of the belief that he had grown out of IT already. At Beech College, IT had not been considered by the young men. Marko said: “I like computers but not working with them, high tech and all that”. Cam demonstrated a pragmatic approach in his response: “Depends on what you get paid”. This was met with general agreement and nodding by the others. Igor commented: “Need to like it. I don’t know if I like it yet” and Tom reflected that he “might get to like it”. Cam derided the activities students were now undertaking in the IT class: “stuff we are doing now, I don’t like it, just typing like a
Grade 6 class, boring” (Cam, Beech College). The general discussion diverted to the stereotypes associated with IT and, once again, about someone knowing a person who was a hacker and now making a lot of money in this field working for a large software company. In general an IT career was not discounted by these young men, but neither had it been seriously considered by any of them.

The ambivalence towards an IT career path was not shared by the young men at Olive College. When asked whether they would consider a career in IT, Nick said “Um that is like the complete wrong direction”. Guy followed with the following graphic metaphor: “If I was a car I would drive away from IT”. Two others had considered a few options. For instance Daniel had contemplated “Games design, could do artwork, multimedia, but I need some grasp of Mathematics so that turned me off”. Adam on the other hand thought: “IT Business is possibly what I would do”. There was an ensuing conversation among Adam’s focus group who noted his aptitude for IT: “he has that interest to fix a computer, whereas mine is to break it” (Guy, Olive College). Adam’s reputation was solid amongst his peers and he retold the story of how in Year 5 he outsmarted a teacher and that gave him the motivation to pursue his interest in the IT field. Daniel was also very self-assured about his competence: “I have been using a computer my whole life … but it requires a lot of patience”. In the same group Nick observed: “I was like Adam when I was younger. I grew out of it. Now I can do it, to me they are just basic skills (Nick, Olive College). A dominant theme in this group was that these young men felt confident about their computer skills but did not typically envisage computers as providing them with a career. IT tended to be seen as useful tools with which these interviewees seemed very comfortable and familiar. There was also a sense that while these young men may have considered an IT career earlier in their lives, they had virtually ‘outgrown’ the idea and moved to thinking about alternative career paths.

Of the five young men at Oak College (the laptop school), Leo and Cameron were considering careers in IT. Leo was very focussed and specific in that he wanted to work on the hardware side of things. Cameron on the other hand thought maybe he would be a programmer. Terence’s dad and brother were in IT, and this was more a deterrent than an attraction. His father had actively discouraged him from following in his footsteps, influenced by the long hours and the volatility of the career path. His brother was now
studying architecture after graduating with an Information Systems degree. Cameron’s view was also influenced strongly by his parents. His mother managed a programming team and even though she tried to teach him programming, he said he “has no interest”, however he was not totally averse to studying IT as a supplementary career focus.

The responses from the young women in the middle school age group were mixed. Alex mentioned she had considered IT until her brother enrolled in a university IT course. Her observation was that; “he seems to do so much work and it seems to be too hard” (Alex, Elm College). Caitlyn aspired to being a teacher, and as such she knew she would “need to know how to use a computer”, but had no desire to be an IT teacher for example. Amanda had no interest in IT as a career and was not planning to choose any of the senior school VCE IT subjects. By contrast both Sarah and Farrah did intend to study VCE IT subjects with Farrah being the only one of these five females who had not discounted an IT career. She did, however, qualify her response with “yeah, but I don’t know much about it. There’s hardly any ads or campaigns about it” (Farrah, Elm College). The lack of knowledge about what an IT course at university or what a career in the field involved was evident in other interviews. When the young women at Gum College were asked “Have you considered an IT career?” the response was mixed but not a flat rejection. Zoe said “I don’t know, like I have thought about it, but I don’t know much about it.” Rachel also had thought about it, she mentioned her second cousin who was earning “good money” in IT, but she then stated wistfully “if only I could get interested in IT”. Rachel and Stephanie discussed the potential of making money in IT if they could get interested: “if I knew more about it, possibly, but ... I suppose basically it is what you are interested in” (Stephanie, Gum College). The overall lack of knowledge of the career path among the middle school young women interviewed at Gum College echoed the response given by Farrah at Elm College. While the girls at Gum College had considered an IT career they were not sure what an IT career involved.

There was an overall negative response from the young women at Beech College about IT careers. Shannon associated an IT career with making money but was not interested in following this career path: “My cousin did it, he made a hell of a lot of money, I thought I will do that, but I am not interested in it. My cousin repairs, sets up web-sites,
he got very rich very fast” (Shannon). Simone, on the other hand, associated an IT career with the need for patience – as did Daniel at Olive College. This seemed to be a deterrent to Simone, who commented: “I probably wouldn’t, my brother does, but I am too impatient, I could not sit there all day… you have to be patient, it really stresses me out waiting” (Simone). Bobby responded with a flat “never” and Yukiko added “when I was very young I made website, but not so much interested now”. This notion of ‘outgrowing’ the attraction to IT bears some resemblance to that expressed by the male middle schoolers at Olive College.

The young women from Olive College answered the question about a career in IT with a chorus of “no’s”. Only one interviewee said she had considered studying IT but her response was qualified as follows:

I don’t think necessarily for the career aspect, I wouldn’t be doing it for a career in IT, definitely wouldn’t be, what I know I want to be involved in some people’s life and help, not help that my computer is not working. IT does help; it is a tool, a way of the future. One day we will not be able to get by without using them.(Ruth).

While acknowledging the need for IT skill competency, it is interesting that not one of these very competent and apparently IT-savvy young women was considering an IT career. The computer is considered a hardware object and is seen as a useful tool, rather than as the basis for a career focus.

At each school in several of the interviews someone retold the story of a rich cousin, or friend who had made a lot of money in IT. This person was always male, and usually had been discovered after being a hacker, but the attraction of money was not enough to inspire young women or some of the young men to follow in their footsteps. A stereotypical view of IT careers being passive emerged, along with a perception of the need for patience in this career. The concept of outgrowing IT as a career path emerged and this theme will be discussed in the next section. Some of the young women (at Gum and Elm Colleges), admitted a lack of awareness of what a career in IT involved, yet not one of the young men expressed this concern.
6.4 Influences on study and career choice in middle school students

There is a large degree of commonality between the genders and across the schools in the sample with respect to student responses regarding who or what they considered to be the main influence on their thinking about courses and careers. The major influences on career choice among middle schoolers were family, either parents or another close family member, followed by a favourite subject or perceived aptitude in a subject area. A third influence, mentioned by a small number of students, was a personal experience such as a close interaction with doctors or lawyers. Media influences were also referred to by a few interviewees as shaping their career aspirations. Examples included television programs or popular films. Finally a few students identified the fact that they might make lots of money as an influencing factor guiding their decisions about courses and careers. Each of these factors is elaborated in turn using illustrative data.

6.4.1 Family influences

At Elm College Tait’s father used to be a policeman and this influenced his choice of future career. Andrew’s father was also a policeman but, unlike Tait he was not as sure of his future and intended to give this further consideration after his upcoming work-experience placement at a Police Station was completed. Daniel said his father, who is a physiotherapist, was a major factor in his career choice. Dor Sun was influenced by his brother: “I think I just grew up with computers, the first memory of a computer is sitting on my brother’s lap playing a game with them” (Dor Sun, Elm College). Similar responses were obtained from the young men at Olive College. The question of who or what influenced their career choices was met unanimously by comments related to parents and extended family, as illustrated below:

My parents, my Dad has always loved film, he has always been very supportive, very accepting, he has never pushed me in one direction or another, that has helped to nurture my interest in film. (Daniel).
My Dad, like even when I was young his company was involved in computers, more Graphic Design now. If I ever needed software it was always there, and getting told I was the next Bill Gates. (Adam)

Nick commented on the wide professional backgrounds of his family with one uncle a doctor, another uncle, a director of a movie company franchise, his mother a Law lecturer, his father a banker. He has had many family conversations about future careers but is not settled on one yet.

Well my dad is a Lawyer and my mum is a Psychologist… I see where they have gone wrong and I want to fix it. Something inside of me gets me interested in business studies and the whole general field. (Guy)

David (Oak College) planned to get an electrician apprenticeship because he intended to work on his Uncle’s property. He will be completing Year 12 before the apprenticeship. Terance (Oak College) was very focussed and had a career goal to be a general manager of a large franchise of hotels. His determination and focus was impressive, and when questioned further, he added that his Uncle was in this field.

The influence of family was equally strong with young women in the study, though interestingly not one of the examples given by the girls refers to an influence from family to study IT. Farrah (Elm College), a relatively recent migrant, discussed the extent of parental influence and a pressure for her to study medicine.

I have a lot of pressure on me to do something in medicine because both my parents are doctors, grand-dad is a doctor, auntie works in a lab, uncle drives the blood around. My family is really smart, I have a lot of pressure to do something really good, I have to study really hard, I don’t want to disappoint them, but its like I cannot be that smart it is not possible, it is just not possible for me.
Bobby (Beech College) was influenced by family holidays “up the country” and admitted that her mother, who had studied Horticulture, was a big influence. Her grandmother encouraged her political interest because “every Saturday night I used to watch the news with my grandmother, she explained things to me”.

As was the case with the junior school students, there appears to be a gendered pattern in parental influence among middle schoolers. An analysis of responses suggests that fathers and male relatives are more inclined to be the major influence for the young men, while mothers and female relatives tend to be identified by the young women as more significant familial influences on their career choice.

6.4.2 Educational experiences and self-efficacy

In addition to the influence of family members, some students identified favourite subjects or subjects in which they felt they had a certain level of skill as influencing their career choice. For example Commerce was influential to some of the young men at Elm College. In this subject they were each interviewed individually by the careers teacher in the school and then encouraged to use the internet for research to help decide their future career path. In other schools the students were interested in a career path because of the curriculum in a particular subject area. Tom’s ambition (Beech College) to be an architect was influenced by the subject Visual Communication: “I just like arty, graphics stuff”. Foti (Oak College) enjoyed Science and collected fish for a hobby. He had university aspirations to “Science, Zoology or something”. Stephanie (Gum College), who listed Science in her favourite subjects, wanted to follow this career path saying she wanted to study:

Something in Chemistry, Science, Pharmacist or something this field, I would not want to have to make new discoveries, like, I would not to be under the pressure to get new stuff and that, but I like doing little experiments and putting stuff together and I guess that is what Pharmacists do. (Stephanie).
Nick (Olive College) enjoyed Media and Sciences and English, but then said,

I absolutely hate Maths and this is very disappointing because I don’t know what to do when I finish if I don’t pick up Methods next year it is going to close off a lot of doors … I get frustrated by Maths quite a lot.

This expression of the consequences of liking or not liking a subject and awareness of the possibility of closing future doors was not evident in any of the other interviews. Apart from this observation, there were no gender differences between the group interviews. There was an overwhelming absence of IT being mentioned in student responses. Not one of the students of either gender specifically mentioned an IT subject as an influence in their future career choice.

6.4.3 Personal experience

For some of the young women, more-so than the young men in the interviews, personal experience was identified as an influence on their future career path. Zoe (Gum College) was not sure what university courses were available but stated “I know that I want to be a pilot”. This desire was based solely on extensive family holiday air-travel. Angie (Gum College) wanted “to be a physio I think… I have got to be really smart”. This choice was influenced by personal experience, as she had previously suffered from a knee injury and personal interaction with professionals in this field had influenced her choice. Simone (Beech College) wanted to be a Lawyer because “with my family, we have had so many court cases and they have really helped us”. Yukiko (Beech College) was hoping to use the English language skills she was acquiring when she returned to Japan in five months and wanted to work as a translator or teacher.

Callie (Olive College) while not sure about her future career path, was basing her options around personal experiences: “I enjoy speaking to people, helping people, I can read them well, I like helping people”. Another young woman from Olive College expressed a strong desire to work in the community and help people. She was aware of stereotypical expectations in her community, to be a doctor or a lawyer. “Yeah I was just going to get a basic medical, basic psychology degree, and basically just live on the
street helping the kids, I grew up in those sorts of surroundings and I was going to do that as well” (Ruth, Olive College).

### 6.4.4 Popular media

One in five middle school students interviewed mentioned popular media as the major influence on their future career choices. Marko’s ambition to study Sports Administration was based on the movie Jerry Maguire, with his second choice being a Physical Education teacher (Beech College). While Terence (Oak College) acknowledged that his Uncle, who was a manager in a major hotel chain, played a key role in his career aspiration, he also acknowledged the role of: “Hollywood movies, I think ‘The Concierge’”. Dana (Olive College) mentioned a TV program as a key influence on her career aspiration: “I want to be a Forensic Psychologist, so whenever CSI is on I am just glued. I just love it” (Dana). Shannon on the other hand aspired to be a fashion magazine editor: “I look in all the magazines, I love all the little fashion segments, love cutting it out and sticking it in a diary”. Shannon was keen to do something in the magazine industry, though prior to this she admitted: “I wanted to be a hairdresser, then a lawyer; I have scrapped that idea now, because I don’t think I can do it”.

As with the junior school students, the influence of popular media affected personal schemas of possible future career paths, but by middle school there was a degree of realism that was present. Not one of these young men or young women focussed on stardom or sporting fame. Their future career choices, while influenced by popular media, appeared to be quite attainable and realistic in most cases. Notably not one mentioned any IT related media influences.

### 6.4.5 Perceived career benefits

In addition to the role of family, favourite subjects, personal experiences and popular media a small number of students cited their perceptions of the career benefits as an influencing factor in their career choice. Specifically the earning capacity of the career path was identified by a small but notable minority of interviews. Sarah (Elm College)
was mainly influenced by money and was of the opinion that her parents would support anything she wants to do as long as she was happy. She was already earning an income working in a fast food chain and was given management training on-site. On the whole money did not fare very strongly in the responses, although the mega-millionaire, Bill Gates, was mentioned reverentially in two interviews with the young men as they wistfully considered IT careers.

The majority of middle school students were primarily influenced by parents or close family members in their career aspirations. As mentioned in one or two places already, consideration of an IT career path was not an aspiration for the majority of students of both genders, apart from the awe inspiring wealth of Microsoft chairman Bill Gates, the lack of mention of IT in favourite subjects, personal experience and popular media influences is a telling absence that will be discussed further in the final analysis.

6.5 Comparison within schools and between junior and middle school students

The middle school students interviewed were in their fourth year of secondary school, and had been in the secondary education environment long enough for the culture of the school to influence their course and career choices. Despite the apparent similarity in the school types (all the schools had been initially chosen because of a high expectation of students pursuing a university degree) several group differences emerged between and among the schools. Some of these differences were clearly gender-related. Others, which may have been influenced by school or family culture, are noted briefly here and will be explored in the final discussion chapters.

Gender differences were evident within some of the school cohorts. From these interviews it appears that there is a degree of gender differentiation in young men and women in Year 10 at Elm College, a government school in an affluent eastern suburb, in both their openness to a future IT career as well as their use of computers for leisure in particular. The young men were all active computer game players, to the extent that one is monitored by his family and they all express pride and pleasure in this activity. The same was not apparent with the young women whose IT use was more school-work and communication focussed. The one female who was a high internet user admitted no
pride in the activity (playing with virtual pets) and was almost ashamed of the time she spent on this activity, while vicarious pride was expressed by another for her sister, and another for her boyfriend’s use of IT.

Three out of the four young men interviewed at Elm College were still considering IT as a career option; the door had not been closed, while only one of the five young women had not closed the door to the possibility of a career in IT. All were aware of a need for computer skills, but none were particularly focussed in that area. The young woman who was still considering the possibility of an IT career bemoaned the fact that she really did not know what an IT career involved.

Both the young men and young women at Gum College, a government school also in a reasonably affluent eastern suburb, were influenced in their future course choice decisions to some degree by personal connection, be it a parent or a family member, perceived aptitude (Chris and IT) or personal experience when considering their future career path. Unlike the students at Elm College, there was no mention at all about the Careers teacher to help them in their choices. A difference between the career and course choices of the young men and young women at Olive College appeared to be strongly influence by both school and family. The young men interviewed generally were focussed on business and professional careers. Their favourite subjects were those that they perceived they had aptitude in, coupled with good teachers. The young women tended to have a more humanitarian outlook to their career paths and were motivated by helping others to an extent not expressed by their male counterparts. Their favourite subjects were those they had a connection to, an interest in, and were generally humanities. These very IT literate youngsters with the potential to be high achieving in VCE were not considering IT as a career path, apart from one young man who was considering it as an adjunct to a business degree.

It was evident that the young men from Olive College had families with a strong sense of community and most were from professional careers, indicative of socio-economic background of independent school students. Their attitude to IT as a career path was more negative than that at the other schools despite the fact that they appeared to be
more aware of its applications and less stereotypical in the perceptions of the career path. Four out of five of the young men at Olive College perceived IT as a tool but not a credible career path.

The influence of the educational environment of students appears to be stronger in middle school students than in junior school students. It is apparent that the curriculum is having considerable influence on student career and course choices among middle school interviewees. The gendered attitude to IT is stronger in these middle school students than in the junior school students interviewed, with the perception of stereotypical careers evident, isolated and suited to people with poor communication skills. As with the junior school students interviewed, only a very few middle school young men were considering IT as a possible career path, and none of the young women. There was evidence in several of the interviews among some of the game-playing young men that game-playing culture was something that one grew out of, and while they participated in these activities in the past, they were now broadening their interests.

It is evident from these interviews that the middle school students appear to be manifesting a growing awareness of their individual characteristics and therefore possibilities for future careers. This was not evident among the junior school interviewees. In some cases the development of possible course and career choices, while being more realistic and less fanciful, was influenced by an awareness of academic capabilities, in other cases by personal connection to a professional in that field. There was strong evidence that young women were choosing culturally acceptable career and course options, influenced by their same-sex parent. As with the junior school girls, it was more acceptable for the young women to admit to hating computers and not understanding them than to admit to being a competent daily user for leisure and school work. The acceptance that IT is something integral to their lives and their future was evident in both genders with both young men and young women aware that IT will be a tool to be used in conjunction with their main career, but not a career focus itself.
6.6 Conclusion
These interviews with the middle school students made it clear that IT is integral in school and leisure activities for the vast majority, and that there is no obvious gender difference in the amount of use, however there is a gender difference in the purpose of use. An interesting finding (and commented on by the Olive School boys) is that IT is now considered so integral in their education and social life that it may account for why it was not acknowledged as separate in the question related to favourite subjects. It should be noted that these interviews were conducted before the curriculum change in Victoria that deemed IT be integrated across the curriculum, in many cases removing IT as a separate unit in the junior school and middle school. In each of these schools in the sample IT elective subjects were offered in the middle school curriculum. The following chapter will present the findings from the senior school students and present a comparison across the three stages of data collection used for this study.
CHAPTER 7: FINDINGS – SENIOR SCHOOL STUDENTS

7.1 Introduction
Senior school students in the sample were primarily in Year 12, their senior school of the Victorian Certificate of Education, and generally contemplating their future after secondary school. These students were at schools where there was a strong expectation that the majority of students would further their education at university. Students were selected randomly, so were not necessarily studying any IT subjects in their VCE. This deliberate strategy ensured that the opinions of a broad selection of students, not just those who were already interested in IT, could be obtained.

There are several VCE IT subjects offered to senior secondary students some of which are classified as Vocational Education Training (VET) and have a practical focus. However the mainstream VCE curriculum units were Information Processing and Management (IPM) which had a business and application focus, and Information Systems (IS) which had a more technical and programming focus. The IS unit was only offered in a small number of schools in the state. In 2004, the year of data collection, only 5% of all students studying VCE completed the IS subject (VCAA 2007). Of these students 7% were young women, or 177 in total. There was a greater gender balance in the IPM unit with 32.5% female enrolments in 2004 (2350 young women in total). The IPM unit was completed by 16% of all enrolled students in the VCE, using the compulsory unit (English) enrolment as the comparative number (44,786). These statistics indicate that not only are the VCE IT subjects taken by a much larger proportion of young men than young women, but they are not particularly popular with students in general.

The majority of the interviews with the senior school students were conducted mid-year during the months of June, July and August. This timing ensured that students had settled well into their senior school of secondary school and had a solid grasp of the subjects they were studying. The timing of the interviews was also scheduled to follow
the mid-year assessment round. Most interviewees had completed mid-year assessment and had just begun second semester coursework.

### 7.2 Extent of use of IT by senior school students

Most students interviewed for this study were studying five VCE subjects, which is the norm in Victoria. Most also included the compulsory core subject of English in their five subjects. The age of senior school students is between sixteen and eighteen. The number of students in each of the interview groups ranged in size from three to six students at any one time. In total twenty-four young men participated in the interviews and nineteen young women. All were studying VCE, with the exception of two young women at Oak College who were studying the International Baccalaureate (IB), an equivalent qualification offered in a few elite secondary schools in the state. As for the middle and junior school interviews, interview groups were single gender, and interviews lasted approximately one hour.

#### 7.2.1 Favourite subjects – IT and other

For consistency, the interviews began with the same question used for the junior and middle school student interviews, “Tell me about the subjects you are studying now, and what it is you like or dislike about them?” The typical response across groups involved students listing subjects with a comment on what they liked or disliked about the curriculum. In some cases students commented on teachers, and there were also several comments that reflected their perceptions of self-efficacy in that field. This listing of subjects allowed the interviewer to gauge whether any of the VCE IT subjects were commonly studied among this group of students. Only one of the young women of the nineteen interviewed was studying an IT subject (IPM) and it was not mentioned as a favourite subject. One other young woman had completed IS the previous year. She commented that she did not really like the subject because in her opinion there was too much programming but she had developed a strategy to deal with it, as outlined in the following response:
I was the only girl who has ever done it at Olive College … I made it my subject ‘cos I like made sure that the design was good …I do like tiny bits of code… I made it pretty. (Nat, Olive College)

This comment indicates that the young woman was extremely aware of the gendered significance of studying this subject, and the strategy she employed to feminise the curriculum in a very stereotypical manner using design and colour. In contrast, over a third of the young men interviewed were studying a VCE IT subject, seven were studying IPM and two IS. One third of these young men stated that IPM was amongst their favourite subjects, two because they thought the content was easy, “IPM, did it all last year, it was easy” (Andrew, Elm College); and one because it had a “low work load” (Brad, Gum College). Neither of these comments adds to the credibility of the subject as a future career path, and it is clear from these responses provided that these IT subjects tended to have a lower status in the VCE curriculum, according to these interviews.

The majority of students interviewed, regardless of gender, had already made a decision about their future career path and university course choices. Many listed specific courses, ENTER\(^3\) scores and the level of results or marks they would need to qualify for their preferred university course as well as their second or third course preferences. However the degree of specificity with which they described their future course choices varied. For example Adrian from Elm College was specific in naming his chosen course and institution “Melbourne Commerce”. Simon from Olive College, on the other hand, was far less specific and somewhat contradictory. He described his course choice as: “away from the sciences” but later discussed his career path as “leading to medicine”. A university degree course, with the fallback of perhaps a TAFE diploma course, figured in the plans for all the boys, even if it was as vague as “a business course” (Sam, Oak College). Most of the young women were equally aware of ENTER scores needed for courses they were aspiring to. Some comments were general “something I love” from Claire at Elm College who was enthused by Biotechnology, and “I know where it is not leading me” from Taruna whose brothers were studying Engineering and she did not want to follow their footsteps. Georgina from Gum College was focussed on a Law

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\(^3\) ENTER: tertiary entrance ranking score obtained from study score results and used as selection device for university entrance. (See list of abbreviations)
degree, but an awareness of the high ENTER score needed to get into this course led her to have “Business or Psychology as a fall back” (Georgina, Gum College).

There was variety in the favourite subjects mentioned by senior school interviewees, and there were also some variations between the schools. This suggests that school based factors like subject availability and teacher personalities influenced the likes and dislikes of particular students. Gender differences emerged with respect to attitudes to and reasons for choosing subjects. The young women interviewed on the whole expressed the need to ‘like’ a subject more often than the young men. Half the young men at Oak College, the laptop school, liked the subject Visual Communication and Design or VCD as they called it because of the:

Creativity that you are able to visualise things, do art work and put it all together, we do it by hand, on the computer, everything. (Matthew, Oak College).

Similarly, the Year 12 females interviewed at Beech College had a strong affinity with the creative arts. Alex was aspiring to a Visual Communications course, Anoop to Fashion Design and Laura to a TAFE course in Visual Merchandising. One of the young men at Olive College enjoyed Accounting because the subject provided the “least work for reward. Once you know it, [it is done] – maybe just the teacher in our school” (Gareth, Olive College). Mathematics was a highly regarded subject and a de-facto core subject for the majority of students in this sample. Only one of the young men interviewed was not studying a Maths unit, however two others mentioned that they only “keep doing it for pre-requisites” (David and Jonathon, Elm College), not because they have a particular like for the subject content. Maths is a required subject for many university courses and in the VCE students have three levels of the subject to choose from each with a different level of abstraction in the curriculum. The young women of Elm College, also studying Maths admitted that it was the “hardest subject of all”, “I am taking Maths Methods because I need a 25 in Maths [to get into course of choice] but I hate it” (Tanna, Elm College). Regardless of the school, it was important for these young women to express the need to like their subjects, and this was a consistent response among the young women and not so evident among the young men interviewed. One young woman at Beech College however felt the need to apologise for
liking Maths “I sound like a geek” (Arlette). This apologetic attitude to maths was not a common theme, although there were slightly more young women not studying maths than the young men (3 out of 19). Romy at Olive College admitted “I am enjoying maths at the moment, I enjoy maths when I know what I am doing, like all the multiple choice and stuff”. There was no apologetic tone amongst the young men regarding liking Maths, and when Vedran stated that he liked maths it was with obvious pride in his voice (Beech College).

During the data collection process it became apparent that some of the secondary schools had a particular affinity with specific universities which appeared to be influenced by either the status of the university or the geographical location of the school and its proximity to a university campus. Students at Elm and Oak Colleges named the leading research university in Victoria when asked, “Where is this year leading you?”, while four out of the five students at Gum College, which is in the hinterland of a large multi-campus university, mentioned courses at that university more often than any other. Some illustrative comments are as follows:

- Probably to Uni. I think an IT degree probably programming related, I have looked through [named university] I will also go to Open Days soon. (Brad)
- Business hopefully, um I’ve looked at courses at [named two universities] hopefully I will get the right score to get in. (Daniel)
- Hopefully commercial law, it is a high one, and practically at [named university] which means even higher again, 99.4 ENTER. (Sam)
- Radiography and Medical Imagery at [named university] (Daniel L).

At Olive College, a high achieving school that consistently topped the State in the proportion of their VCE students who were offered university entrance places, every young man interviewed was aiming for prestigious, high ENTER score courses (Simon to Medicine, Josh to Commerce, Gareth and Liam to a Law/Commerce double degree and Alex to Science/Engineering). These boys discussed feeling the pressure that came from consistently high parental expectations. The young women interviewed from Olive
College were also aware of parental expectations; however three were planning to take the following year off their studies to have a ‘gap’ year experience in Europe before returning to study Behavioural Science (Vanessa), Medicine (Natalie) or Teaching (Romy). The family expectations of high achievement were mentioned by Vanessa when retelling her grandparent’s inquiry “What are you going to study dear, Medicine or Law?” that initiated a discussion on the pressures they felt due to the expectations of parents, grandparents and the school they are attending.

It is more like that this school is a pretty good school, they want us to go further and use the education. (Romy, Olive College)

In these young men and young women from Olive College it would appear that high expectations from school and family had a strong effect on course and career choices. They reported similar career aspirations and an affinity with certain universities. The main gender differentiation however is in the IT subjects studied. There were very few young women choosing IT at VCE, which is consistent with state-wide figures, and of the young men choosing to study these subjects, the attraction appears to be a confident approach to the subject bred from familiarity of use of IT as well as a pragmatic belief that course content will be less challenging than other units, rather than for future career aspirations.

7.2.2 Extent of engagement with IT for leisure and school work

There was little gender differentiation among senior school interviewees in the amount of time spent using computers, for school work and leisure. There was however a difference in the types of leisure activities involving the use of IT between the young men and young women interviewed. When students were asked to talk about their current use of IT invariably laughter followed implying that they used it to an excessive degree. “Everything, music, chat, games” (Michael, Elm College) was typical in his response. There sometimes followed judgemental statements along the lines of “lots of crap and stuff” (Vedran, Beech College), or “only in one legitimate subject” and “don’t use it for the purpose it is meant to be used” from Mathew and Sam at Oak College.
Oak College is a ‘laptop’ school; students enter into a leasing arrangement and carry a laptop to each of their classes. The educational advantage of students working directly on to their own computer in each class and its use as a communication device between staff and students is a topic that is debated in other forums. These year 12 students at Oak College commented that laptops were a burden to carry each day. George, who called his a ‘lemon’, did not carry it at all anymore. They commented that this year (2004) the school had been invited to participate in a state-wide examination trial that allowed students from ‘laptop’ schools to sit their final examinations using their computers. According to the young men interviewed only one student had agreed to participate in the trial, which implied a less than strong vote of confidence in the use of IT. The responses of Matthew and Sam illustrate this cynicism towards the use of laptops in high stakes testing situations:

Our class has been selected to do it [the trial], but no-one is using their laptops. (Matthew)

Of all the students who could pick the trial for the CAS course, only one student has chosen to do it out of the whole class. (Sam, Oak College)

The boys from Oak College reminisced about years 9 and 10 when, according to this small group of young men, the whole of the year level played laptop games through the school’s wireless network connection, in class and out. Clearly this was not a condoned use of the resource. The laptops figured highly in their leisure activities but use for school work was limited with Mathew who stated that “IPM requires the laptop for about a third of the year”. George added: “I hardly use the laptop, don’t bring it to school anymore”. Aside from compulsory laptops and their merits, all the young men relied on IT for note taking and research, although by far the majority used their computers for leisure activities, games, movies, and internet chat. Sam commented that his whole music collection was stored on his personal laptop.

The young women from Oak College did not make the same comments about their laptop computers being a burden, however Simone said she used hers “as little as
possible” and then went on to list many uses which contradicted her introductory statement. She mentioned using her computer for:

A lot of typing, word documents, as a resource for research on the internet, I prefer that instead of the library, e-mail and whatever. I used to MSN a lot, feel guilty if I do that. (Simone, Oak College).

Like the majority of the young men of her age group, Simone was aware of the time wasting capabilities of internet chat and ‘surfing’ the internet in general. Sarah (Oak College) also regarded the computer as a primary tool for research and resources and extended her list of uses to include keeping her personal accounts and internet banking. All the females interviewed used on-line chat programs as a communication tool within their friendship groups. In fact, at each of the schools it was the young women who mentioned IT as a resource for research and school work while the boys mainly focused on leisure uses. Liam at Olive College called computers “a double edged sword” for their ability to distract from work.

Derisory comments about computers came from both genders, but were more predominant with the females. Rachel (Gum College) responded to “Tell me how you use computers” with a frustrated sigh, and Nicola from Olive College responded with the comment: “I use them but don’t like them”. The young men and women interviewed generally played games to “de-stress” (Oak) “play some games – not shoot em up” (Claire, Elm), with some of them acknowledging that they had to apply self-discipline to their use in this their senior school of secondary school study. It was beyond the scope of this study to investigate the types of computer games played between the genders. Three of the girls “loved the computer”, Anoop (Beech) called herself a “junkie … always connected”, as did Natalie at Olive College, and Sue from Gum College had to curb her passion because “It was sad because it (game playing) kept me from my friends”. Interestingly not one of the young men had this same opinion that game playing was a less than desirable past-time due to its lack of social interaction.
The main difference in use of computers was that only one young man out of the twenty-four interviewed expressed a dislike or avoidance of computer use. He said: “I try and use them as little as possible, only because I am hopeless at them, I use them for e-mail, word-processing. Won’t sit there for hours and play games”. This negative response was more commonly expressed by the young women interviewed with at least one from each school, mentioning that they “use but don’t like” computers (Olive) or use them “as little as possible” (Oak).

7.3 Consideration of IT in study or career choices in senior school students

In trying to determine whether students had ever considered a career in IT or if in fact this career choice had ever entered their list of possible degree courses, the question “Have you ever considered an IT course?” was posed. This question raised some interesting comments with negative responses outnumbering positive ones among both genders and across schools. One of the strongest negative comments was from a high achieving young man who held a leadership role in his year level and was considering a career in business. His response of: “I’d rather be a garbo! [garbage collector]”, (Daniel, Gum College) equated a career in IT with a blue-collar occupation. Other comments indicated strongly developed schemas among the interviewees of both genders of IT being an isolated and boring job with little lifelong sustainability rather than a credible career path. These perceptions are illustrated below:

IT closes doors, you will be unemployed after 45. (Liam, Olive College)

No, I don’t like the lifestyle. (Sam, Oak College)

There are so many more interesting things to do. (Anoop, Beech College).

Not one of the young women admitted to having considered applying for an IT degree course or pursuing an IT career while only two out of the twenty-four young men were considering it as a career path. There was a consistently strong negative response from
the young women. When asked if they planned to apply for an IT degree program: three firm "no's" from the young women at Elm College, two firm ‘no's” from the girls at Oak College, and “I hate them” from Sarah (Oak College). Comments relating to the sedentary nature of the career path and the lack of interaction were common from the young women.

Nevertheless, about a third of the students had conditionally positive responses to the question. A selection of illustrative responses follows:

Yes, but I don’t know what it involves. (Jonathon, Elm College who hoped to study engineering)

It would be really nerdy. (Vedran, Beech College)

I will use one in my career but not as a career in itself. (Rachel, Gum College)

Could work in the business side of computers, I studied it for 2 weeks in year 12 then changed. (Sarah, Oak College)

Maybe as part of a graphics course. (Alex, Beech College)

Yes, I did consider it but was put off by the geeks. (Olive College)

As previously mentioned, two of the young men were definitely planning to pursue IT courses, Brad (Gum College) was very keen and labelled himself a ‘techo’. He was happy to be jovially called an ‘anti-social geek’ by his peers. Mathew (Oak College) was considering combining an Information Systems course with a Business degree to maximise his employment chances, as illustrated in the following comment:

Yes I have [considered an IT course] Information Systems/Business is my bottom preference. I would not have a clue where that would lead, probably an IT major in a business or something. That is just my fall back at the moment.

The lack of knowledge of what an IT career involved and the stereotyped perceptions of the IT ‘geek’ and isolation of the career were common in both genders. It was only the
most technical males who were seriously considering a career in this field, and the admission of a lack of knowledge extended across genders. None of the young women interviewed and the majority of the young men had not considered IT as a possible career or higher education course choice.

### 7.4 Influences on study and career choices in senior school students

The students were asked to comment on what they considered the most important factors influencing their future careers and university course choices, be they human or otherwise. The overriding response in both genders was the influence of parents or family members. Family was mentioned as a positive influence in the responses of half the young men and just under half the young women, be they parents, grandparents or uncles. Only one young man mentioned family in a negative way and said that he wanted the opposite career to that of his parents.

> My parents work in a business; my parents co-own a business, my mum works at [name of a large telecommunications company]. They come home with all these stories of the people who sit at their computers all day, it is just not the life I want to live hence I want to open up a coffee store. (Sam, Oak College)

Overwhelmingly, however, both young men and young women alike, were much more likely to mention the influence of family members on their career choices. On a small number of occasions a teacher was mentioned as influencing their career or course choice, but not necessarily a current teacher.

> Umm my piano teacher, old piano teacher – [from a student going into Commerce], “she was an accountant and I looked deeper into that. (Brian, Elm College)

The young women mentioned their experiences in a work placement program that had been part of their middle years of school slightly more often than the young men. In some cases this experience helped the students decide the career they did not want to
pursue, rather than encourage them to follow that path; that is, the work placements sometimes functioned as negative experiences rather than positive experiences. On the whole, however, these work experiences tended to be positive influences, as illustrated in the comment below:

Work experience, I went to PW real estate and saw how business and IT work together. (Claire, who at the time of the interview was considering Psychology)

School and social characteristics were also influential. The young men from Elm College discussed interest, passion, ability and monetary rewards more than the other students, and the young men from Olive College discussed cultural stereotypes and expectations to a greater degree than any of the other groups. It is acknowledged that these thematic emphases are to some extent the product of the open ended group interview, since the conversation thread started by one student often encourages others to follow.

7.5 Gendered Comparison of emergent themes in senior school student interviews

In almost all of the interviews, which were conducted in the middle of the final school year, these senior students had a clear sense of purpose regarding their post-secondary school plans. There was no obvious pattern of gender differences in terms of type of career path, with the majority of the young men and young women equally expecting to continue their studies in higher education. Only the young women from one particular school were considering taking a year off their studies to pursue humanitarian activities in another country, a gap year. This decision may have been influenced by several factors including advice from school teachers, career counsellors, or possibly the influence of strong affiliation between family and school on contributing to social growth and education programs in lesser developed countries.
In relation to attitude to and consideration of Information Technology as a career path, not one of the young women interviewed was considering a future career as an IT professional and neither were most of the young men. It appears that in the minds of these senior school students, apart from one exception, there was little status or credibility connected to IT courses in higher education. The acceptance of IT as a supplementary tool in their career or a part of a double degree was not an overriding aspect, only mentioned by one girl and one boy. There was a shared expectation among the interviewees of computer use in everyday life. IT was seen as essential to study, leisure and communication activities by the majority of students. These findings will be explored further in the discussion chapter.

7.6 Gender based comparison across year levels and between schools

This study explored the attitudes towards IT of school students from three year levels and across five schools. Junior, middle and senior school students were interviewed in order to determine the developmental nature of male and female students attitudes towards IT as a tool, a subject of study and a career. This section provides a review of the key themes, similarities and differences emerging from interviews with 113 students gathered from 27 separate group interviews.

Junior school students were quite stereotypical in their consideration of future career paths that appeared to be strongly influenced by gender schemas developed through their participation in a western industrialised society and also by the social connection to a fairly middle-class affluent peer group. For example, more than half the students interviewed were strongly influenced in their consideration of career and course choices by their same gender parent. The junior school girls however appeared to consider a wider range of possible future careers than junior school boys. At this age, the second year of secondary school, the findings suggest that there is already a strong gender difference emerging with respect to attitude to computers. Girls were predominately self-deprecating and happily bemoaned their lack of ability with IT. The small minority of girls who enjoyed IT reluctantly spoke of this enjoyment in the group interview situation. On the other hand, junior school boys were more comfortable speaking about
their use of IT for game playing or otherwise, and while the girls were certainly regular users of IT, they perceived computers as tools, adjunct to other professions and used for school work more than leisure. It can be surmised from these interviews that IT does not appear to be in the schema of possible future careers for most young people of this age, regardless of gender.

The middle school students, the majority of whom were in their fourth year of secondary school were also quite stereotypically gendered in their list of future career choices. For instance young men considered business or law enforcement and young women identified with business or caring professions. It is interesting to note that while business was often the preferred career choice among the middle school females, their was a lack of articulation about what it was in particular in business they wanted to pursue. The popularity of a general Business degree in 2004 appears to have replaced the position held by the amorphous Arts degrees of the 1970’s, as the career path to pursue when a particular profession is not apparent but the desire to go to university exists. In this age-group, as with the junior school students, IT as a credible career path lacked resonance with all but a minority. These students emerged as competent and capable daily users of IT and the majority of young men were still active computer game players. On one or two occasions students verbalised the attitude that boys growing into young men outgrow computer game playing and in this age-group, the emergence of the story of a ‘hacker’ male, usually a friend of a friend, who now works for a large corporation making lots of money also arose. In the cohort of young women it was still ‘cool’ to admit being ‘useless’ with computers, which belied the amount of time the middle school females admitted to spending on computers.

The results of the interviews with the senior school (Year 12) students are not promising for IT academics and professionals who may think that current media and intervention programs are working to attract students to their university IT courses and subsequently the IT profession. Students at this stage of their education have mainly discounted IT as a credible career. Their responses reflect the influence of media reports of jobs being sent off-shore and there continues to be a pervading perception among both male and female senior school students that IT is a profession for young men only, and that it is not a lifelong career. Very few, and in that case only the most technical or ‘geeky’ (a
term used by the respondents) were considering a higher education course or career in IT. There was a significant gender difference in relation to the question of ‘liking’ or ‘disliking’ computers among senior school interviewees.

### 7.7 Conclusion

The responses from secondary school student interviews indicate a sequential attrition in student consideration of IT as a future course choice or career path. The movement of IT from student consideration of possible futures is expressed through responses of ‘maybe’ from some of the junior school students to ‘possibly’ from some middle school students to ‘no-way’ from the majority of senior school students in this sample. The factors that contributed to students finally selecting IT higher education courses are pertinent and possibly more illuminating to academics and business people in the field of ICT. The next chapter will present the results of interviews with the university students.
CHAPTER 8: FINDINGS - UNIVERSITY STUDENTS AND I.T.

8.1 Introduction

This chapter will present the data collected from the interviews with students who are currently studying an Information Technology degree at each of the two universities sampled. The major conclusion drawn from the interviews with the secondary school students is that very few consider an IT degree course, so the opinions and histories of first-year university students who have chosen to study IT, particularly the young women, provide a critically important insight into the factors that influence student course choice and add to the women in IT discourse. It is fair to say that these students have chosen to study in this discipline despite the general trend (based on statistics as well as the findings of this study) of their peers to avoid IT. The interview responses are organised into categories according to the type of Information Technology degree courses the students were enrolled in.

In Chapter 1 the range of Information Technology degree courses offered in Australian universities was introduced. The types of IT courses have been grouped into three categories: the first category includes the more technical courses closely related to engineering or mathematics such as Computer Science and Software Engineering; the second category consists of Information Systems and Business IT related courses which fit under the business oriented banner; and thirdly those focused on design and creation of multi-media using IT, grouped under the Multimedia heading. In the introductory chapter the practice of combining an IT degree with a degree from another discipline was introduced as a common practice in the late twentieth century when IT enrollments were at their peak. Many of these double degree courses are still popular in universities. The responses from students enrolled in double degree programs are thus the fourth category in this chapter.

While both the research university and the technical university offered courses in all four categories, none of the students enrolled in technical or multimedia courses at the
research university volunteered for this study. In all responses the primary unit of analysis was gender so the absence of students from technical and multimedia degrees from the research university did not impact on the analysis or outcomes from this study. Table 6 summarises the categories used for analysis purposes. The Bachelor of Information Systems was the only degree offered in both locations, each of the other degrees were unique to their university.

<table>
<thead>
<tr>
<th>Degree name</th>
<th>Category</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Computer Science &amp; Software Engineering</td>
<td>Technical</td>
<td>Technical</td>
</tr>
<tr>
<td>Bachelor of Science (Computing)</td>
<td>Technical</td>
<td>Technical</td>
</tr>
<tr>
<td>Bachelor of Information Systems</td>
<td>Business</td>
<td>Technical and Research</td>
</tr>
<tr>
<td>Bachelor of Information Technology</td>
<td>Business</td>
<td>Technical</td>
</tr>
<tr>
<td>Bachelor of Multimedia (with different majors)</td>
<td>Multimedia</td>
<td>Technical</td>
</tr>
<tr>
<td>Bachelor of Information Systems / Business</td>
<td>Double</td>
<td>Technical</td>
</tr>
<tr>
<td>Bachelor of Information Systems / Commerce</td>
<td>Double</td>
<td>Research</td>
</tr>
<tr>
<td>Bachelor of Information Systems / Geomatic</td>
<td>Double</td>
<td>Research</td>
</tr>
</tbody>
</table>

Table 6 Classification of degree types

The chapter will conclude with a summary of emerging themes and a focus on the similarities or differences between and among the students in the different IT courses, the factors that affected their decision-making as well a gendered analysis of attitudes to Information Technology.

8.2 Setting the scene

The two universities sampled in this research are quite different in history and character. The reasons for sampling these universities were presented in the research design (Chapter 4). A description of the history and characteristics of each university is provided in Table 1 which highlights the twelve point average difference in the student ENTER score between the IT courses of the two universities. The difference in university ENTER score requirement reflects the high status of the older research university compared to the younger technical university and may have had an influence on the type of student choosing to attend each. This factor will be discussed if relevant to interview responses, in addition to the factors that influenced whether students chose
to study IT or not. Nevertheless it is still possible to determine key similarities and differences in career choices beyond any university characteristics and the factors that influenced the choice of an IT higher education degree in these young women and men.

### 8.2.1 The interview process revisited

In total thirty-three students were interviewed, some individually, some in pairs and some in groups of up to four. While the initial intention of the research was to conduct group interviews, this was dependent on the voluntary participation of students and individual timetables that often prevented this from occurring. Each of the interviews followed a similar format of seven open-ended questions used to guide the discussion. The questions were informed by the review of the literature and were designed to allow the students to reflect on the factors that influenced their course decisions, their schematic repertoires built up over their secondary education experiences, the social capital of their family situations or happenstance, and the particular event or experience that led to enrolment in an IT course. Data reduction using inductive coding methodology described in chapters 4 led to a final grouping of responses to the questions into four themes, informed the literature, of:

- Extent of use of IT and perceived self-efficacy related to IT for leisure and study applications
- Factors that attracted them to their chosen degree in IT
- Time: at what age or at what time in their schooling was the decision made to study IT.
- Future: the clarity of future career plans and the level of commitment to IT as a career path.

Interviewee responses will now be presented according to the type of degree course students were enrolled in and addressing these four themes.
8.3 Students enrolled in Technical degrees

Four students in the university sample were studying IT degrees at the more technical end of the spectrum. They were all students of the technical university. Three were enrolled in a Bachelor of Computer Science and Software Engineering degree (CSSE); Len, Thomas and Lynette, and one a Bachelor of Science with a Computing specialisation (BSciComp); Rod. There was only one young woman in the group, which is representative of the general enrolment trends in this area of IT as presented in Chapter 1. A brief description of the background of each student is provided in Appendix 3, using pseudonyms to respect confidentiality.

8.3.1 Extent of use and perceived self-efficacy in relation to IT of students in technical degrees

The use of computers was second nature to all these students. There was a total acceptance of the technology. IT was integral to their studies and a lot of time was spent using them to complete university work and assignments. All demonstrated strongly developed self-efficacy with the technology and used IT in most of their leisure activities. All of these students, regardless of gender, enjoyed playing electronic games. The sole female interviewed, Lynette, declared that she was not a player of computer games, but that she loved playing Nintendo, an electronic game not dissimilar to a computer game played with a console and on a television screen. The tone in which this was said implied that in her view, this activity was more socially acceptable than computer games: “I play Nintendo 64, not PC games”, with a strong derisory emphasis on the ‘not’. She also accessed her e-mail daily. The three young men in this sample, Len, Thomas and Rod were all passionate about computer games. Len admitted that his dream job would be as a games programmer, and Rod believed he developed his logic skills from playing computer games as illustrated in the following comment: “it’s not really shooting people that is the addiction, but developing tactics to counter their tactics, it is a very logical game I suppose”. Rod went on to comment that in the past he had been so involved with gaming for leisure that it affected his behaviour:
[Game name] kept me busy for about two years until I realised it started to affect my social life. I started talking similar to the game and realised we are too old to do that, and there was a tactic to duck and shoot, so ended up feeling the impulse to do it in real life (Rod, BSci(Comp)).

This surprising outcome of physically ducking when rounding building corners is an indication of how rooted the concept of the game was in this young man’s mind. The virtual world was strongly affecting his sense of reality and daily behaviour. While this is an exception and only one example, the extent of involvement with computer games was a lot stronger with the males interviewed, Len, Thomas and Rod, than with Lynette. Only Rod, who had noticed the development of extreme behaviours, mentioned outgrowing game playing, a concept that was mentioned by several of the secondary school young men and that will be revisited in the discussion chapter. Neither Len nor Thomas mentioned being obsessed with game playing nor were they concerned with outgrowing them, in fact Len aspired to a career in this area. The overall difference in use of IT among these technical degree students appears to arise from a gendered attitude to computer game-playing. The use of IT for study was an accepted fact of their everyday life; however the use of IT for communication purposes was only mentioned by Lynette.

8.3.2 Factors that attracted students in technical degree courses to IT

The results of interviews with the secondary school students revealed that there were five main factors that influenced their course and career choices. These were family influences, educational experiences and self efficacy, personal experiences, popular media and perceived career benefits. The university student interviewees mentioned similar factors that influenced their decision to study their IT course. Family rated highly, as well as familiarity with the medium and course content. Len was in the first year of his CSSE course and had chosen this particular course at the technical university because his father had graduated from it many years earlier. However, Len added that he had always planned to study IT because his ideal job was as a games programmer. Lynette, on the other had, had arrived at this course after starting two other higher education courses at two other universities. She said she was seeking “creativity and
logic” and at the time of the interview believed she had finally found it in the Computer Science and Software Engineering degree. She admitted reluctantly that her mother had recommended computer science to her when she was in the senior school of secondary school, but she rebelled against her mother’s advice, as summarised in the following comment:

My mum always said that I should do it [computing], but after she said that, I thought I’m not doing it…my mum probably thinks she did [influenced her current course choice], but I don’t want her to…I spent a lot of time just looking at the handbook.

Thomas’ mother had been a programmer, but he claimed that she was not an influence in his choice and ascribed this to his ‘mates’ and the LAN (local area networked) games he played. His father was also very much “into computers” as well, and had helped him build his own from scratch. Like Len, family influence had guided Thomas’ career choices. Rod on the other hand was attracted to this particular course because of the course content; however his passion for programming and gaming influenced him from an early age.

Interestingly, unlike the secondary school students interviewed, not one of these university students mentioned being influenced by the media, advertisements or role models in the factors that attracted them to the discipline. The strong familiarity and experience that young men gain from playing computer games is indeed a major factor attracting these students to IT as a field of study. By contrast, the attractor for the young woman was not so obvious and developed over a period of time and as a result of apparent ‘trial and error’ and trying other study options. This is the main gender difference in factors that attracted these university students to select higher degree IT courses at the technical end of the spectrum.

8.3.3 Time: when did students in technical degrees make the decision to study an IT course

There were noticeable gender differences in the age or time these students made the decision to study IT. The three young men all had their mind set on computing degree courses from an early age. The young woman on the other hand, took a more circuitous
route to enrolling in this IT course, making her decision to study IT during the first year of university when enrolled in another course (Media). All of the young men were strongly influenced by a leisure pursuit of playing computer games, and two were from homes where one or both parents were in a technical career already. Thomas said his future plans were ‘always’ in Information Technology:

> Basically I always liked computer games … since the Atari first came out, since I was about two … always first choice was Computer Science, always wanted to do something with computer games.

He selected a number of similar IT courses in all universities in each of the eight choices permitted in his university entry selection form. Rod had a clear preference for IT but did not get good enough results to enter university straight from secondary school, and completed two TAFE diplomas, both in the IT discipline to satisfy entry requirements. Typical of gendered attribution theory where males externalise failures and females internalise them (Bandura 1997), he attributed his less than ideal secondary school results to external factors of poor subject choice rather than a reflection of a lack of ability. His views are summarised in the following comment:

> I didn’t do too well in high school, I chose subjects that I would find interesting not subjects that I would be good at … straight out of high school the options open to me were TAFE courses so I went to a … general computing course [at TAFE].

Lynette had also arrived at the CSSE course via two other courses, but unlike Rod, her first choice was in a different discipline, Media. Her decision was ascribed to her own research of the course handbook as previously stated. The other two young men attributed their course choice to an aspect of the degree. In this case it was the Industry Based Learning (IBL) component that attracted them to this particular course. This is a program that places high achieving students in industry between the second and final year of their degree. These young men had decided to study IT from an early age and the IBL component attracted them to the technical university in particular.
8.3.4 Future career plans of students in technical degrees in relation to IT

When asked what their future plans were, all the interviewees studying a technical degree at the technical university had plans to pursue Information Technology careers, although some were more focussed than others. This question was used to gain a greater understanding of each student’s schematic repertoire in relation to their career choices, whether choosing this degree was tied to their future career or just one more step in the career choice journey. Len was definitely going to work in “communication IT, I will always be able to get help from dad”. This reliance on support from his father demonstrates the strong influence of his social capital, where parental standing in the community can benefit employment opportunities of their children. Rod was aiming for “programming” but expressed concern about the job market and the trend for programmers to be sited offshore. This is the first time that the media was mentioned in the interviews, in this case reports in the daily papers about the increasing trend for major corporations to site their processing and programming departments in Asia. Rod’s concern around a programming specialisation within his IT degree appeared to be influenced by these media reports. Lynette and Thomas were unsure of what specialisation they would pursue. They were both in the first year of a three year degree. Lynette said she would “wait and see what grabs me through the course” and Thomas would be no more specific than a “not sure” at this stage. These university students did not demonstrate a particular feeling of optimism about their future career option in the field of IT and none of the students discussed the breadth of opportunities available to students as espoused in many of the advertisements and promotions for IT. It would appear from these responses that a reasonable degree of doubt exists about future career choices in three out of four of students enrolled in a technical IT degree course at the technical university.

8.3.5 Gender differences between technical degree students

The underlying gender difference in the interviews with students enrolled in technical degrees is the confidence and expectation of success in the young men interviewed as opposed to the self-doubt and modesty expressed by Lynette. Lynette was well aware that she was outside the norm in her course. Valian states that it takes more than a
critical mass of 25% of females before an occupation is considered ‘human’ as opposed to ‘masculine’ (Valian 1999) and if Lynette was aware of not being in the majority gender, so too would others in the class, including the academics delivering the units. The year she started there were only two females in a class of twenty-two students. It is highly probable in this situation that the ability of these young women are judged first according to the stereotype of their gender of not being academically able in IT, before ability (Valian 1999). Lynette was modest about her achievements to date and commented that it was only dawning on her that a lot of the male bravado of her peers was not backed up by good results. This is illustrated in the following admission:

I find it a bit lonely, it is a bit intimidating when people speak in their computer language to show you what they know, but the thing I have learned is that they act like they know it but they don’t, like I’m getting better marks than half of them.

The combined effects of being in the minority gender in the course, having less technical background in IT due to a varied educational background while being in the early stages of building IT self-efficacy, and being surrounded by males who have exhibited a much greater level of comfort with the technology, contributed to Lynette’s feeling of not belonging. In contrast the three young men appeared far more comfortable and confident with their ability and alignment to the student cohort, evidence of the shared hegemonic discourse of masculine technical expectations associated with western society (Corneliussen 2004). Rod was so connected to his computer that he classed fellow on-line gamers as a substitute for his friendship group and acknowledged that he had few ‘real-time’ friends.

This past weekend I started playing a new one [on-line computer game], it is a system world on-line, it is a community of about ten thousand people online. I don’t really have that many friends.

He discussed the definitions of geeks and nerds, defining the differences between them as follows:

There is actually a difference between geek and nerd, both are highly skilled at IT things but the geeks are more socially acceptable. The geeks dress in cool clothes and comb their
hair and the nerds don’t comb their hair … I don’t fit the profile, I am above the profile.

Both Len and Thomas were comfortable in their classes also. Len was having some difficulty with the core programming subject but did not doubt his ability to master it as demonstrated by this comment: “I think once I get the hang of Java I will enjoy it more, when I become more fluent or something”. This provides further evidence of the predominant masculine expectation of success in IT previously discussed in the literature chapter (Corneliussen 2004). The expectation of success and feeling of belonging within the student cohort was only apparent in the young men interviewed, with Lynette very conscious of not being part of the norm. The less than critical mass of young women in the course, a background from the arts and fewer previous technical experiences than her male counterparts, along with a modest understanding of her abilities contributed to Lynette’s feelings of being ‘lonely’ and intimidated in the classroom.

8.4 Students enrolled in Business oriented IT courses

A greater number of students interviewed were enrolled in business oriented IT courses, the Bachelor of Information Systems (BIS) and the Bachelor of Information Technology (BIT). These courses have a core technology component and also a strong curriculum focus on how IT is used in functional areas of businesses. There were eight students interviewed enrolled in the BIS, four males and four females, all from the research university, and six enrolled in the BIT all from the technical university. The BIT course is considered an Information Systems course at the technical university, and has high selective entry requirements. Students must have a reasonably high ENTER score, usually in the 90s, as well as satisfy the requirements of an interview to gain a place, so while this course was at technical university, the level of achievement of the students in the course (ENTER) was equivalent to that of the students studying BIS at the research university. The BIT also provided compulsory industry placements and a monetary scholarship for the duration of the degree provided the students continue to pass their subjects. The scholarship part of the course allowed for a substantial stipend during their studies (AUD$9000 tax free per annum). The BIT students are considered the elite
in the IT faculty at the technical university, and the course is only offered to Australian citizens or permanent residents. The voluntary nature of the interview process for this thesis resulted in the six BIT students being female, no males responded to the advertisements. In the total cohort of students interviewed who were enrolled in business oriented IT courses, eight were from the research university and six from the technical university.

### 8.4.1 Extent of use and perceived self-efficacy in relation to IT of students in business oriented IT courses

More than two-thirds of the BIS students considered IT integral to their daily life. They used the computer daily during semester for university work, and also for “movies and music” (Harja), “games sometimes to take my mind off work” (Simon), and for email on a daily basis. Other uses included browsing, electronic shopping, and internet chat (Alison, Julianne, Ah Ren and Bia). Only two BIS students admitted to not being daily users of the computer for leisure activities and both were males from the research university. Adam stated that he spent enough time on the computer during the day and avoided it in the evenings, and Yonis said he was only an occasional user; he did not use internet chat and was “not a gamer”. These students were keen to distance themselves from the stereotype of the computer ‘geek’, despite being enrolled in an IT course.

The computer was integral to the daily life of the group of high achieving females studying the BIT at the technical university. They all used internet chat daily and espoused its advantages over the telephone as a communication tool, as illustrated by the following comment: “During the semester like every night, sharing ideas, networking, without that we would have … [struggled with the course]” (Mandy). Jenny denigrated other students in the course who go home to program each night, claiming that they “had no life”; yet she used her own computer for communication every night, which in her opinion was a more acceptable pastime to writing computer programs. This is a similar comment to that made by the secondary school girls, who decried their ability with IT yet used it for communication, music and photography. While many of
the students used technology daily, none of the young women expressed a passion to the same extent as Sally, who pragmatically stated:

Girls pretend they don’t use IT much. There is something wrong if you do an IT course and you don’t want to spend time on the computer. You have to enjoy it to be able to do well at it.

All of the students used the computer for communication, but in sharp contrast to the students in the technical degree course, only half of the young men and none of the young women used it for game playing. It was integral to their leisure activities only as a medium for planning outings and coordination. All these young women were high academic achievers and consistently had this affirmed by belonging to the ‘elite’ group in the technical university with a strong sense of community and support provided for the small cohort of students that were admitted to this course each year at the technical university.

8.4.2 Factors that attracted students to these business oriented IT degree courses

When asked what attracted them to their course, a common theme to emerge was that the BIS course at the research university was considered a compromise degree by the majority of the young men and women interviewed. The overwhelming majority of students from the research university had chosen this degree second to the Bachelor of Commerce, a degree offered in the Business discipline that had high educational and employment credentials and consequently had more competitive entry requirements than the BIS degree offered by the IT discipline. Simon, Harja and Adam all mentioned that their first choice was the Commerce degree but they did not have a high enough ENTER score to get in. Alison also stated that the BIS was her second choice, Commerce her first, and it was Yonis’s third choice, Commerce being his first and a double degree his second. Harja was in his third year of the BIS degree and admitted that he “likes Business more”. The only student to mention something other than compromise in their decision-making was Simon who had enjoyed the VCE IT subject he had studied and this had helped him decide to enrol in the BIS at the research university.
All of the young women studying the BIT at the technical university had been influenced by another person to study IT at university. A number were influenced by family members, for instance Sally and Soula had older sisters who encouraged them to consider the BIT and Mandy was encouraged by her brother. She had been contemplating a Law degree in her senior school of high school but did not enjoy the VCE subject Legal Studies. She said she was “always on the computer, making websites” and her brother “gave her a talking to … really didn’t know until that talk, had thought Law was for me”. Jenny was encouraged by her mother (a librarian). Similarly, three young women studying the BIS at the research university were influenced in their course choice decision by family; Alison had been encouraged by her father, Julianne said both her parents and her sister had influenced her and Arlena mentioned her brother as an influencing factor. Two young women mentioned significant others in their school experience as being major influences in their course choice: Rachel recalled being impressed by a visiting speaker to her school and Lin Mai talked about her high school IT teacher who had “promoted and encouraged her through the boring bits”.

Bia, an international student from China studying the BIS at the research university made her course choice “on enrolment” and reported the potential employment opportunities in China as a major factor. She was the exception among the young women by not mentioning a specific person who had influenced her. This is the only case where “happenstance” could be said to have been applied, although the career characteristic of the potential of high rewards and future employment were also factors. The influence of siblings, same-sex or otherwise, and parents was quite strong throughout this sample with eighty percent of the young women encouraged to consider an IT degree course by a sibling or parent. By contrast, the majority of the young men were in this course by default, and not one mentioned being influenced by another person. Three out of the four young men mentioned that their choices had been limited to degree courses in the research university, which implied that the status of the university was of high importance in the decision process. The fact that the curriculum of the BIS degree incorporated business curriculum with some IT was sufficient for them to consider it as a compromise degree.
**8.4.3 Time: when was the decision to study a business oriented IT course made**

There was no obvious gender differentiation in the time these students made the decision to study their current course. The majority of students in the BIS degree arrived at their decision relatively late in their school education. “Late secondary school” for Alison, “late year 12” for Julianne, “late, I was toying at becoming an interpreter” (Arlena), “on entry” said Harja, and “in senior school”, said Simon. This was a common theme across universities for students enrolled in business oriented IT courses, and differed somewhat from the gendered differences in time of decision-making for the students enrolled in the more technical IT courses. It would appear that many of these young men and young women enrolled in the BIS course at the research university were not firmly convinced about an IT degree course until their late teens. In the technical university BIT course, half of the young women had decided to study Information Technology in middle secondary school. Sally, who expressed a passion for IT, had always wanted to study it, and Rachel and Lin Mai mentioned being attracted to IT in middle school. On the other hand Soula, Mandy and Jenny, also in the BIT, did not decide until their senior school of high school with Rachel and Soula only applying after getting their senior school results which were better than they had previously anticipated, and after much encouragement by their family, applied for the scholarship BIT course. Overall the possibility of an IT degree course was not under consideration for more than two-thirds of these students enrolled in business oriented IT courses, male and female, until their senior school of secondary schooling, or even later in Soula’s case.

**8.4.4 Future career plans of students in business oriented IT courses in relation to IT**

The majority of the students in the research university were in the BIS course because they did not meet the entry criteria for their first choice of course. This compromise situation meant that students had to adopt a more divergent focus in their studies. For example while some of the students sampled had hoped to enrol in a pure business degree in the form of the Bachelor of Commerce, they instead found themselves enrolled in a degree classified as IT with some business applications. This led some students to express doubt and concern over future job prospects. Harja considered the
BIS too general and therefore felt he was not prepared for any particular career specialisation and was contemplating further study to complete a Masters of Commerce. Yonis was also considering enrolment in a specialisation Masters degree on completion of his Bachelor degree. Future plans for the other students varied. Adam and Bia wanted to work in a “firm”, and both clearly stated the non-technical side of IT as their preference, reflecting their initial commerce focus. Julianne, who had always liked playing with computers, was considering a career in multimedia or communications. Only the young men were concerned about their future employability with their current degree, none of the young women shared this concern and all were reasonably confident that they were employable. Alison said her “father would help get her employment”, while Bia was confident that she could gain a position in the non-technical side of IT in China. She cited “electronic commerce or Multimedia” as possible career paths. On the other hand An Reh was considering travel after graduation.

There was a mixed response from the young women enrolled in the BIT degree at the technical university when asked whether they would continue in IT beyond graduation. Sally and Rachel were convinced that they would continue with an IT career path and expressed an awareness that they were moving into what they perceived as a masculinised profession. Sally had a great deal of self-efficacy with IT and confidently stated: “We are coming to take over”. While she had been part of a student intake of under a critical mass of female students “eight girls and twenty-seven guys” she believed that “gender is not an issue but the boys are more annoying” (Sally). By contrast, Soula and Mandy were just as strongly convinced that they were not going to continue in an IT career. Soula, whose first love was Psychology, said she “want[ed] to be a Private Investigator” and was considering doing a training course in the evenings to achieve this end. Mandy, half way through her degree, had decided that her future was “not computing. I am going to add Marketing electives”. Interestingly while both Soula and Mandy had made the decision to study IT late in their secondary schooling mainly because of the encouragement of a sibling, neither of them appear to be “persisters” (Bandura 1997) in this field. Lin Mai and Jenny were also ambivalent about their future. “Not sure, maybe more business than IT” stated Lin Mai, while Jenny was contemplating something “not full-time in front of the computer, maybe a Business Analyst”.
8.4.5 Gender differences between students in business oriented IT courses

There was less obvious gender differentiation between the males and females in the business oriented IT courses. Some had arrived at a decision to study IT mid-secondary school, some later in senior school. More than half these students considered business or commerce as their first career interest, therefore IT as a second area of interest tended to lack the status or credibility of a career path in its own right for them. Clearly, second choice course options played a role in their views of the value of IT as a viable career.

The BIS and the BIT degree courses both had a greater proportion of female students than the CSSE course discussed in section 8.3. Nevertheless like Lynette, Mandy in the first semester of her second year, reflected that she and her friends did not fit the stereotype and expressed a feeling of not belonging in the course, as illustrated in the following comment:

I think that is how we are different … coming into the course
I looked around the room and said, who are these people? I have nothing in common with these people. These people are nerds, I am not a nerd … I think that is how we are different from a lot of people in the course, where they just go home and they want to keep programming, want to do programming for fun.

Also, like Lynette in the CSSE course, there were a number of young women in the BIT who were modest about their accomplishments. Soula, Julie and Mandy all expressed surprise when they were offered places in this highly regarded and competitive course, and like Lynette, were quite modest and unsure about their ability.

I was sort of shocked when I did get it [ENTER score over 90], like even my sister didn’t believe me and that … she’s like yeah … a couple of my friends told me what they got, and they got 87 and 89 or something and that, and they are really smart, after I heard that I nearly had a heart attack. (Soula).

There was none of this modesty expressed in any of the conversations with the young men enrolled in the BIS. The main emotion from this selection of males who found
themselves in a second preference course was some regret that they did not get into the Bachelor of Commerce, and some annoyance, implying that it was not their fault but a fault with the system. Overall in this cohort of students, three out of four students, regardless of gender, were not considering a future career in IT.

8.5 Multimedia IT students

In the university student sample there were six students enrolled in a Bachelor of Multimedia (BMM) at the technical university, two females and four males. Two of the young men, Kamphone and Kang, were undertaking a networking specialisation, Alex was undertaking a marketing specialisation. The fourth, Yun, was completing the course with no specialisation. The two young women, Jin Lei and Sui Lin, were undertaking the marketing specialisation.

8.5.1 Extent of use and perceived self-efficacy in relation to IT of students in multimedia IT courses

Like the other university students interviewed, all of the students in the BMM degree used computers daily for communication and study. Both the young women used the computer daily as a communication tool, for e-mail and chatting with friends. They did not play computer games, although Jin Lei watched movies on her lap-top because it was all she had. Three of the four young men expressed a passion for playing computer games, although Kamphone who had recently gained his driving licence said he had “moved on” and did not spend as much time playing games as he used to, implying that he now had extra social pursuits that were not reliant on IT. Alex was keen to distance himself from the stereotype of a male computer user by telling the interviewer that he was “not a typical geek”, although he had regular Monday night game playing sessions with his friends.

Every Monday night is our X Box night. All the boys get together with three TV’s and three X Boxes and play each other. Girls are not into it. They come and watch and then leave. (Alex)

IT was a significant component in the social and leisure interests of all these Multimedia students. Kang was a very competitive computer game player. He
mentioned this twice in the interview and claimed that his poor secondary school results were a result of “too much time gaming” and this is what led him to a multimedia degree course. This response will be discussed later in this section.

8.5.2 Factors that attracted students to study a multimedia IT course

Like the students in the other degree streams, the influence of parents and siblings is evident in the decision-making of at least half of these students. Sui Lin was in this course mainly as a result of the encouragement and advice of her sister to combine her design skills with technology. On the other hand Kang’s reasons for choosing this course were less ambitious and less thoughtful. He commented:

I decided to go into that course because basically I just want a piece of paper to give to my parents [so that I can say to them] Look I am not stupid this is my Bachelor degree. (Kang)

The cultural background of his parents may have influenced the high expectations they had for their son, to the extent that they financed his studies in a foreign country. Somewhat derogatorily, he went on to say that he chose this field because of his computer gaming background. His attitude to an IT-related career tended to reveal that he devalued the career and had little confidence in his own intelligence:

I tell parents [sic] I think I decide I want to do IT because I am not good at anything else, just computer games.” (Kang)

Three of the six multimedia students interviewed admitted that design was their first interest and they used IT as the tool to help them achieve the best outcomes of this area of interest. This finding was consistent across genders. Kang and Alex however had always loved IT and it was the primary reason for their decision to study an IT degree course. They were in this multimedia course because they did not have the level of academic results required to enrol in what they perceived as more prestigious technical courses, like Computer Science or Software Engineering. The Bachelor of Multimedia was the third course since secondary school for Alex. He had attempted an IT diploma
at a TAFE institution but found it too technical, then transferred to a diploma course with an IT multimedia focus, before gaining entry into this Bachelor’s degree course at the technical university. He had selected this course because it combined his love for creativity with IT and supplied “future skills”, as illustrated in the following comment:

That is another reason why I went into this field …’cos jobs that don’t exist now will in 5 years’ time… that I can’t even imagine … exist now. As long as I am in the area I can always learn what I have to learn because I have already got the background. (Alex)

Jin Lei arrived at this course via the workforce. She had been employed as an event organiser in Singapore and had the perception that moving from a generalist business diploma to a speciality course would increase her job prospects. So like Alex, the benefits of the BMM in enhancing future employability were identified as attractors.

Unlike the BIS and the CS students, the majority of the BMM students had an artistic or design focus that was the key that decided their choice of degree. It should be noted that the BMM at the technical university had a lower ENTER score than the other Bachelor degree courses, so students who may not have qualified for the BIS or CS degree could get into this one.

8.5.3 Time: when was the decision made to study a multimedia IT course

All of the multimedia students interviewed at the technical university had made their decision to enrol in this course late in their secondary education or after some time in the workforce. There was no gender differentiation in their responses to this question. Kamphone made his decision in the senior school of high school, and chose this course because of the IBL option. Alex had difficulty getting straight into university from secondary school and, in his search for courses with creativity and marketing components, had studied two TAFE diplomas to gain entry into this Bachelor of Multimedia course. Yun decided “last year” and Sui Lin only two years prior to this interview. None of the students, regardless of gender, had decided on this course specifically because of the attraction of the IT component. Even Kang, who was focused
on the end “piece of paper”, had this course listed as his last preference on his selection document, and had failed to gain a place in any of the other courses. Like many of the students enrolled in the business oriented IT degrees, this course was not their first preference. Their decision involved some degree of “happenstance” (Hodkinson and Sparkes 1997), or the opportunity to gain entry to an IT course that had a lower entry requirement than other IT courses and, at the same time, allowed them to engage their interests of media and design.

8.5.4 Future career plans of students in multimedia IT courses in relation to IT

The young women studying a multimedia degree were not as clear about their future as the young men. They hoped to have increased opportunity of employability due to the IT skills they were obtaining, but had no specific career path in mind. The young men had varied ideas of where they were heading. Yun hoped to move into computer animation or computer centred design. Kang had ideas of running a computer market and a coffee shop. By contrast Alex and Kamphone were focussed on travel and working overseas, and had no definite intentions for using their degree as the basis of future career plans. They did however agree that their IT degree would give them greater employment opportunities than a media degree with no IT component.

8.5.5 Gender differences between students in multimedia IT degrees

There was a distinct gender difference in attitudes towards IT amongst the multimedia degree students. Only the males saw IT as “for them” and the degree course an avenue to employment in the IT industry. Responses suggest that the sense of belonging to the current discourse of IT and being comfortable in the IT environment resonated with the young men in this sample to a greater degree than with the young women. For example Kamphone said he was “always connected” and sees his future in “designing content, user experience design or else digital video and audio”. Alex considered himself “self-taught” in multimedia computer packages. Kang reported that he “felt emotionally angry” when he saw that his friends appeared to be better than him at computer game-playing and that he “just decided I am going to beat these guys and one day they are
going to come back and ask me how do you do this and how do you do that sort of thing”. The females perceived the course as necessary to enhance employment opportunities, even if they perceived the potential job market for IT was not positive.

I think it will be more and more stressful because with more and more of those IT things, you will be able to be reached at any point of time, things are expected to be, work to be completed in shorter time frame, so requirements will be higher, it will be more and more stressful. (Jin Lei)

Half of these multimedia students were in the course because of a love of design and creativity. IT was perceived as the tool in their future career path, the enabler and not the primary focus. None of the young women were studying IT because it was their first choice, their first preference being design or marketing.

8.6 Double Degree IT students
Nine students interviewed were enrolled in double degree courses. There were four males in the sample; Raymond was enrolled in a Bachelor of Information Systems and Bachelor of Business (BIS/Bus) at the technical university. Bin Tan and Andrew had combined a Bachelor of Geomatic Engineering with a Bachelor of Information Systems (BIS/GE) at the research university, while Ammer, also at the research university, was enrolled in Bachelor of Information Systems, Bachelor of Science double degree (BIS/Sci). Of the five young women in the sample, three were enrolled in double degrees at the research university. Ransirini, Tian Xia and Zhen were students in a combined Bachelor of Information Systems, Bachelor of Commerce (BIS/Comm) degree course. Diane and Amy, at the technical university were studying the same degree as Raymond, the BIS/Bus course.

8.6.1 Extent of use and perceived self-efficacy in relation to IT of students in double degree IT courses
Bin Tan and Andrew had combined Geomatic Engineering (quite a technical degree) with IS. They were keen to elaborate on their use and views of computers. They both had a passion for IT and were extremely confident users and builders of hardware
components as well as networks. Andrew had been competent with the use of IT “for as long as I can remember”. He was involved in managing the network for the on-campus residential college where he lived. He claimed to “never turn off” the personal computer in his room, using it to keep in touch with a world-wide social network, to play and edit music and to create multimedia applications. Through his conversation he demonstrated a very strong sense of self-efficacy when applied to IT. Bin Tan had also built his own computer when younger and it was integral to his life while he studied in a country other than his own. He used it daily to access the internet newspapers in order to keep up to date with both the news in this country and his home country. Ammer who had combined Science with Information Systems, did not express the same degree of passion for IT as Bin Tan and Andrew. He claimed his passion for “soccer, not IT”, but as the conversation progressed he said he was “fascinated by technologies” and was a regular user of internet chat for communication. These young men saw IT as an appropriate complement to the Engineering and Science aspects of their degrees. Raymond, who had combined IS with Business at the technical university admitted to spending a lot of his leisure time playing computer games. He regarded this double degree course as a compromise to suit his parents, “they wanted Business. I wanted IT”.

Of the three females in the BIS/Comm double degree at the research university, only one admitted to a passion for IT. Tian Xia was a self-confessed “net junky” who spent five to six hours a day on internet sites, mainly playing LAN games and skipping class. She commented apologetically: “Actually I have not been attending IS lectures very much … my will power is very weak”. In contrast both Ransiririni and Zhen demonstrated low self-efficacy related to computing and little confidence in their IT ability. For example Zhen had completed all the Commerce components of her course before her IS subjects. She recounted that she had failed IS in her first year, and consequently postponed as many of the subjects in this area as she could. She contemplated graduating with a single degree, but did not want to waste her parent’s money. “Now since went so far no point wasting my parents money, so I am going ahead, see how it go [sic]”. Diane and Amy, the two young women in the BIS/Bus degree at the technical university were not daily users of the internet or IT in general. Neither had internet connections at home and both said that they used IT mainly for study purposes. Diane expressed surprise that she was doing well in some of her IT
units. This response (below) is similar to that of the only girl interviewed who was studying a technical degree.

It surprised me [that I was doing well]. Database 1 maybe. I grasp the theory ... feel like a babe in the woods doing Web Development, I got so excited when a program worked. [however] there have been concepts in class I haven’t been able to grasp. (Diane)

Diane did not express confidence in her ability and was hesitant to predict success because there had been “no test for Web Development, only exam”. This response was in contrast to Len, from the technical degree, who confidently predicted success and enjoyment once he grasped the difficult concepts in Java programming (section 8.3.5).

Amy admitted to liking computer games when she had a chance to play them, which was only occasionally, and this was not a regular leisure activity. Her responses suggested that she had developed a greater confidence with computers than Diane and had “found computers interesting” in secondary school. She elaborated: “mostly the basics, Excel, Access database, just the basics, but I really enjoyed it”. It was not her main career focus, which had been a degree in Aviation until her senior school ENTER results indicated that this would not be possible. This IT course had been chosen because of the double degree with business.

It was quite clear that only the young men interviewed demonstrated strong IT self-efficacy and were comfortable with both the hardware aspects of IT as well as the software aspects. The young women were not so confident. In fact Ransiri and Zhen exhibited particularly low self-efficacy. This may be somewhat attributed to cultural influences since both students were of south-east Asian heritage, yet this factor is not sufficient as an explanatory variable, for Tian Xia, another young woman of south-east Asian heritage was very involved with computer game playing and was confident about her IT skills. Diana and Amy admitted that IT was a tool to complement their business degree, and while Amy expressed an enjoyment of software applications in secondary school, she was reluctant to admit ability in this field, she commented hesitantly: “I
think Database is my favourite, but it also has the most workload. Database has lots of assignments.”

8.6.2 Factors that attracted students to study a double degree IT course

In common with the students interviewed from the other degree streams, family rated highly as an influential factor in the decision to study a double degree. Family and familiarity with the medium were cited as major factors that attracted interviewees to technical degrees. Family rated second to compromise in the reasons interviewees cited for selecting business oriented courses, and family, including siblings, were accredited with influencing the course choice decisions of students enrolled in the multimedia courses. The status and credibility of an Engineering degree and strong parental influence were the reasons why Bin Tan had combined Engineering with IS. He enrolled: “to satisfy my parents… The engineering part was because all of my uncles were engineers”. His parents had been concerned that the IT market was saturated and had encouraged him to combine his love of IT with another discipline. Bin Tan had “loved” IT since he was about 12 years old and admitted to being “more interested in the hardware than the software”. His first choice had been a double degree with the Bachelor of Commerce, but “my result wasn’t really that good, so I couldn’t get into Commerce”. His parents had also insisted that he attend the research university rather than try for a Bachelor of Commerce degree at another institution. The strong familial ties and the investment of family honour and money strongly influenced his course choice, factors evident in several of the interviews with international students. Raymond, studying the double degree at the technical university, also mentioned his parents as the main reason for his course choice, followed by his “love” of multimedia. Later he added that his results also influenced his choice and that his mathematics background had been considered insufficient for admission to the course he had first applied for at the research university.

Andrew, like Bin Tan, was influenced by the status of the university. He had completed extensive research into possible courses while at senior high school, but admitted that only courses at the research university were considered. He was a local student but his
uncle had held a senior position in one of the residential colleges at the research university, where Andrew now boarded. The extent of Andrew’s research prior to selecting his current degree course was into the various degree combinations he could study at the research university, not about any other university courses. Ammer, the young man who was least passionate about IT in this group, had enrolled in the double degree (BSci/BIS) after he had completed extensive research into available courses in Year 12 and because he thought “engineering was too difficult”. Ammer was a first generation migrant to Australia and indicated that his cultural background influenced his course choice by saying: “because I came from a different country, when I came here and saw all the new technologies and that attracted me, I was 12”. He went on to add that he chose this degree because he did not want to be a “straight programmer” and the double degree allowed him flexibility in career choice, by saying: “If you are not satisfied with one degree you can move to the other” (Ammer).

None of the young women interviewed were attracted to their courses because of the Information Technology component. In fact, Ransiri had enrolled in the double degree because she “was really bad with IT and wanted to improve”, not because of any love of the discipline. She accredited a forum presentation at her school given by successful young accountants as being the main driver in her course decision, but she did not get offered her first choice, the Bachelor of Commerce. She chose the double degree because she considered IS as the “least technical IT course to do”. Zhen had been influenced by her father and a mentor who had recommended that she study Computer Science, however she thought this would be “too difficult”. Her first course choice, like Ransiri, had been the single degree Bachelor of Commerce, and to her surprise she was offered a place in the BIS/Comm instead, so accepted it.

Neither Diane nor Amy who were enrolled in the double degree BIS/Bus had a passion for IT, and considered the combination of IT and business as an “insurance” to increase their future employability. Diane expressed a pragmatic attitude, much like Ammer and commented that if she didn’t like the IT aspect of her course she could focus on the business content. Amy had been influenced by a school speaker, a stockbroker, as explained in the following:
All of the young women in the BIS/Comm double degree at the research university mentioned that Commerce had been their first choice and main interest. Ransiri had combined it with the IS degree because this was the “least technical IT course”, and Tian Xia, the young woman with a passion for computer games, had considered a Commerce/Arts combination but decided BIS/Comm was more marketable. It would appear that the status of the research university influenced the course choice of some of these young women much as it did with the young men interviewed from the research university. They had accepted their second course choice at this university rather than courses that matched their first choice, for example a Bachelor of Commerce, at another Melbourne university. It was also noted that the international students were strongly affected by parental expectations, a factor not mentioned by the Australian students. The decision to combine a business degree with IT was in most cases influenced by family or in one case an invited speaker to a school’s career day. However, while three of the four young men interviewed had a passion for IT and stated this as a factor that influenced their course choice, not one of the young women did. The IT component of their degree for the majority of these young women appeared to have been selected to add to their future employability rather than because of a particular interest or attraction to the course content. This was the main gender difference in the double degree students.

8.6.3 Time: when was the decision made to study an double degree IT course

The majority of double degree students of both genders had made their course decision late in secondary school or even after obtaining final results. Diane was the exception among the female students; she had arrived at her course after fifteen years working in industry. During this time, in an Accounting office, she had developed competence in a software package to the extent that she became the resident expert. The company moved interstate which prompted her to apply for the BIS/Bus course.
8.6.4 Future career plans of students in double degree IT courses

Only one of these double degree students was focusing on an IT career as their first choice. Bin Tan, the one student who had “always loved IT” was “aiming for something in management” in a computing company. Engineering was the career path choice of Andrew. He wanted to work out of doors and while he loved IT he did not see it as providing him with the options he wanted. The double degree allowed him to “keep his finger in the pie” of IT particularly for his leisure activities. Ammer was undecided. He was in the first year of a five year course so he was in no rush to make a decision. He did know at this early stage that he had “no desire to be a strait programmer” and believed his double degree would lead to greater employment options. The majority of the young women were considering a business career where IT would simply be a tool rather than a focus of activity. Accounting or Finance was mentioned by two of the six women. One aspired to be a consultant, another planned to enter the general business field and felt that IT would give her an edge. Only Amy contemplated something in database administration at the time of the interviews.

8.6.5 Gender differences between students in double degree IT courses

The overlying theme emerging from the double degree student data is that the IT half of their dual degree is primarily an insurance ticket to enable them to be more competitive in the marketplace. Not one of these students, male or female, saw the IT component as their primary focus. The five female students were leaning towards a business career path, and hoping the IS degree would increase their employability. Only one young woman, Amy, was considering a career in IT and one young man had not made any decision as yet. In all cases the currency of the engineering, business or commerce degree part of the double degree had more status and was more important in the minds of the students. The IT component was regarded as enhancing skills, not a credible career in its own right.
8.7 Overview of key findings in relation to female university students across IT courses

There was an apparent lack of confidence in female interviewees regarding IT ability. They were generally modest when talking about their achievements in relation to computers. Information Technology was often not the first choice of degree for the majority of young women interviewed, even those in the high status scholarship course, the BIT. Some had made their decision late in the selection process, even after the first round of university course choices had closed, some after attempting other degree courses or being in the workforce. There were examples of this process among both females in the technical degree and in the creative IT degree, as illustrated in the following comments from Lynette and Jin Lei:

Well I was doing media, but I didn’t like how ... um it was just all English based and there was no logic, like I always liked maths and everything at school. So I wanted to do something creative but also had logic in it, and so I um ... I started computer science (at another university) and then um ... I'm doing this one, just, I don't know, I didn't see much difference between computer science software engineering and computer science. (Lynette, CSSE)

Actually, ah, I was ... I work as an event organiser for three years [in Asia] before I enroll in this course, so partially it was the job that I work on that affect my decision because after for so many projects, I want to learn more skills, yeah, so will it change after I graduate? Yeah, I am not too sure, Yeah. (Jin Lei, MM)

The apparent currency of an IT qualification in the career market was evident in the decision-making processes of some of the young women. One student arrived at her degree course after over ten years in the workforce, and showed a level of maturity in the investigation of the course that had not been employed by those who had entered straight from secondary school.
I looked through the course, and I thought IS, this sounds interesting. I hoped, it could give me another way to go. I like the computer side of things. I am not technical, in terms of the hardware side. … No this was interesting. (Diane, BIS/Bus)

Another female interviewed chose IT over her main love (psychology) because of her impression that there were minimal employment opportunities for psychology graduates.

You know IT is just one of those courses where, everyone does when there is nothing else to sort of do. Yeah, I think it is the whole job thing, there is a lot of jobs in it. (Soula, BIT)

The influence of family, parents and siblings, and teachers appear to have been an important influence in over half of the young women, but in one case a disincentive. When asked if any particular person influenced their course choice the following comment was made, reflecting the potentially significant role of teachers in shaping young people’s career aspirations:

In our (secondary school) IS class for instance, there was like eight, nine people in there [the IT class] and two of them were girls, the rest were guys. And it was pretty sexist as well, because our teacher was really you know, oh, “the guys will of course do better than the girls. (Lin Mai, BIT)

In this case Lin Mai decided that she was not going to be beaten by the boys in her class and she chose IT despite the apparently negative attitude of her teacher regarding girls’ IT abilities. The young women interviewed came to their chosen IT course from varied backgrounds. Less than a third had considered this career path in middle secondary school or earlier. The majority came to the decision to study IT as a result of perceived employment prospects or because they believed their chosen IT course would allow them to express their creativity. Almost all saw themselves as non-typical of their gender. They did not readily align themself with the stereotype of the IT “geek” and emphasised that their own uses of IT systems were predominately for connectivity and communication, not isolated game activities.
8.8 Overview of key findings in relation to male university students across IT courses

Compared to the female student interviewees, more young men enrolled in the more technical degree courses of computer science and software engineering. The latter were attracted to IT for the future job prospects and almost all had future ambitions to pursue careers in this field. The male students in the less technical degrees were interested in IT as an enabler to increase their employability but not as their main career. Approximately two-thirds of the young men interviewed were familiar and comfortable with IT because of wide experience playing computer games. Some were enrolled in their current course because of family influences. The young men reported using their leisure time to play IT games with more frequency than the young women interviewed. A couple mentioned that they used to play IT games all the time but now spend that time on their car, or have had to stop this activity due to study pressures.

A small number of the young men had arrived at their degree via other pathways, but in this case it was due to a lack of meeting initial entry requirements to the IT course they wanted rather than any doubt about what they wanted to do. The progression from game playing to computing courses in higher education continues throughout the education of some students. However, some of these male students were keen to distance themselves from the ‘geek’ stereotype. For instance one commented:

I don’t fit it [the stereotype], one of the main reasons I got my last job was that I wasn’t a typical computer geek, if you can put it. That wasn’t my life. (Alex, BMM)

Another male student emphasised the fact that he was physically active, despite a lot of leisure time spend playing computer games.

I have a friend that is very similar to me, we both like football, cricket, soccer and video games. He used to live across the road from me. Every weeknight he would come over and we would play computer games, have a hit of the cricket ball and a kick of the footy. Every night, all year. (Len, CSSE)
However, as was the case with the young women interviewed, many of these young men enrolled in the double degree selected the IT component of the degree as an insurance policy to increase job prospects.

8.9 Conclusion, Commonalities and Limitations

Having interviewed school students and university students a number of similarities were evident in the factors influencing these students’ choice of course and career path. The main influences for all students were: family, media, educational experience and self-efficacy and perceived career benefits. However the media and family aspects were less prominent among the university students. The majority of the young men studying university IT courses remembered being attracted to IT from an early age. Very few of the young women were attracted to IT in their early teens. The majority of male students expressed a “passion” for and real enjoyment of IT while only two young women did so. Information Technology courses did not rate highly in status among the university students interviewed. For instance Information Systems was a compromise course at the research university and was chosen when students failed to gain entry into the apparently high status business course (Bachelor of Commerce). In general the decision to study IT at university tended to be made in their late teens among females interviewed, or after attempting another degree course or some employment experience. This was a much more common pathway for young women than young men, who were typically attracted to the discipline via an interest in and aptitude for computer game playing, and a sense of comfort with the technology. However, even when IT was a primary leisure interest amongst the young men, in more than half of those interviewed it was not regarded as a career path.

It is apparent in this study that as the content of the degree course became less technical, gender differences between the young men and young women interviewed appeared to be less pronounced. However, very few young women exhibited the strength of commitment or passion for IT that stems from childhood and that was more evident among males. This is the “magnetic attraction” that is referred to by Margolis and Fisher (2002). Not one of the male students mentioned the influence of teachers in the
decision process, yet they were mentioned as integral by three of the females interviewed.

An IT degree was seen as a useful tool for gaining employment across genders, but the vast majority of interviewees, male and female, agreed that it was simply a tool, rather than a career path in its own right, as a supplement to their primary career interest. These interviews confirm that there are a multiplicity of factors that influence student choice when it comes to education and careers. Interestingly, the stereotypical representation of an IT “geek”, while referred to often, appears not to be adopted by many of the current students. This has implications for how the IT discipline positions itself in marketing to students. Many of the females interviewed did not consider IT in their initial career plans, or only chose to study it as insurance for job prospects to supplement their main area of interest (commerce), or supplant it (psychology).

There are several limitations to this study, as is the case in any qualitative study in which interviewees self-select to attend interviews. The cohort of students across age groups was small and students volunteered to attend interviews. There was no attempt to delve into students’ background experiences and minimal demographic information was gathered. These data are therefore not generalisable nor are they necessarily representative of the age groups and contexts of the interviewees. Nevertheless, valuable data have emerged from these interviews which have significant implications for the field of IT and for developing strategies to increase the proportion of women in IT fields. This is the subject of the next two chapters.
CHAPTER 9: SYNTHESIS OF FINDINGS AND DISCUSSION ACROSS YEAR LEVELS

9.1 Introduction
This chapter presents a synthesis and discussion of the themes that have emerged from the complex landscape of factors that contributed to decisions about course and career choice made by the young people in the sample. The lens of gender was used in analysis of the student interviews at the various stages of their education to compare the influence of factors that shaped their decision-making related to Information Technology study and career choices.

The primary question that contextualised the argument of this thesis was: “How do adolescents form attitudes to IT that may influence their study and career choices?” After a close study of the literature strands presented in Chapters 2 and 3, five research questions were formulated to guide the investigation. The research questions provide a framework for this synthesis and discussion. Each question will be addressed separately, as will the factors of influence apparent for secondary school students and university students. Age and gender differences will be highlighted where appropriate.

9.2 Factors that influence students’ IT study and course decision-making.
A leading question was posed towards the end of each of the small group interviews to determine who or what had influenced student study and course decision-making (Chapter 4). This self-reporting by students led to conversations around IT use within each group and informed the findings related to research question one:

What factors influence secondary school students in Year 8, Year 10 and Year 12, and university students when considering IT courses and careers?
Chapter 9: Synthesis and discussion

The predominant influence of same sex parent was apparent across the year levels. The influence of mothers on daughters and fathers on sons appear to strongly imprint students to consider course and career options that are culturally appropriate to their gender. The influence of popular media and sports personalities appeared to decrease with age. By contrast, the importance of personal ability, self-efficacy and connectivity with a career appeared to gain in importance as influencing factors in future study and course decision-making as students progressed through their secondary education. These findings are generally in harmony with current career choice and education literature (Durndell et al. 1995; Bandura 1997; Durndell and Thomson 1997; Hodkinson and Sparkes 1997) and are now discussed in more detail.

9.2.1 Secondary school students

In the interviews with secondary school students at each of the year levels the influence of parents was the most predominant factor in student responses to the question, however parental influence was cited most by junior school students than any other age group interviewed. Approximately half the junior school boys were considering careers that were similar to those of a male parent or uncle and more than half the junior school girls reported that they were strongly influenced by their mothers. The girls were more likely to mention interest in future possible careers aroused by the curriculum content of their school subjects. The open-ended nature of questioning in the current study, combined with the fact that interviewees may not have been currently studying an IT unit or course, may account for the slight difference in findings from those reported by Adya and Kaiser (2005) who found that fathers were the more dominant influence on whether student’s study IT. Some junior school girls mentioned popular media (film and TV personalities) however this was not as prominent as the idolatry of sportsmen by the boys of this age group. In total the effect of the popular media, television and sporting personalities had an influence on approximately one-third of the junior school students. As indicated in the introduction to this thesis there is some evidence that the media is considered to be an influence on course and career choice, see for example: (Ware and Stuck 1985; Van Oost 2000; Margolis and Fisher 2002; Lang and Hede 2004); but research in this area is relatively limited. The findings from this study confirm that at the earlier stages of education when students are beginning to consider possible future careers popular media is an influential factor, but not as influential as parents.
Chapter 9: Synthesis and discussion

The wide range of stereotypical careers reported by junior school students of each gender resonated with the career choice literature which reports that as students move through their education, their zone of acceptable careers is narrowed through circumspection and compromise (Anderson 1998). The junior school students interviewed were at the beginning of their secondary education journey therefore they had not narrowed their future career choices to any great degree. It is notable that in the general discussion at junior school level not one boy or girl mentioned any consideration of a career in IT. When prompted, one in five of the junior school girls said IT was a necessary addition to their future skill set, however it was not seen as a future course or career choice in its own right. This finding is in harmony with UK research which indicated that girls develop a pragmatic attitude to IT use, but rarely see it as a career option (Durndell et al. 1995). It has been labelled the “I can but I don’t want to” position by these authors. It would appear from these interviews that this position is held by both genders, not just girls.

The influence of same sex parent was evident in middle school students, the majority of whom were influenced by their parents or other family members when considering possible career paths. Fathers and male relatives were mentioned as the major influence by the young men while mothers and female relatives were mentioned by the young women. However more students at this stage of their education made greater mention of aptitude in a subject as an influencing factor than the junior school students. This finding is in harmony with the work of Bandura (1997) who argued that as children mature and become more aware of their educational strengths they also “become more realistic because they understand the complexities of their environment better” (Bandura 1997 p.19). It also supports the findings of Hackett (1995) and Schneewind (1995) who emphasised the need for personal connectivity as well as aptitude before careers were considered to be acceptable. Often the middle school young women reported that personal interaction with a professional or personal experience, such as extensive travel or regular physiotherapy sessions, influenced their future career and course plans. Notably, the personal connection aspect is a factor of influence for future career paths that is not reported specifically in the “Women in IT” literature. However it is implied in the work of Siann and Callaghan (2001) and Cohoon and Aspray (2006) who emphasised need for role modelling and mentoring. Moreover, Beekhuyzen, Nielsen
and Von Hellens share this view when they defined the duality of experience of women in the IT workforce through the application of Giddens’ structuration theory (2003). The implication of this finding is that with fewer women in IT, the opportunities for young women to build a personal connection to someone of their gender already in the field becomes even more unlikely. These factors contribute to a downward spiral of opportunity to learn about this career path, similar to that reported by Lang (1999) and derived from Beall and Sternberg’s downward spiral of opportunities to promote self-confidence and self-esteem in the non-technical female (Beall and Sternberg as cited in Lang 1999 p.24).

Popular media in the form of television or feature films were mentioned as influencing factors to a lesser extent by middle school students, indicating the narrowing of their “zone of acceptable alternatives” (Anderson 1998 p.148) in their future career option. The ambition of making plenty of money was mentioned as an influence by few students of both genders. It could be assumed that students were arriving at a more realistic set of options for their future careers beyond the sports star or television personality that were considered by junior school students.

By senior school the zone of acceptable careers had narrowed considerably for the students interviewed. At this age the influence of school culture factors and parents in general appeared to have had a strong impact on the course and career choices. At one of the independent secondary schools with a strong community affiliation (Olive College) the young men expressed an obligation to excel as lawyers or doctors, while the young women at the same school reported that they were being encouraged to pursue a year of travel and voluntary community service prior to starting their university courses. This gendered influence was not evident in the government schools, where the combined influences of family expectations and prior work-experience were the more prominent factors affecting student choice. The importance of experience of the work environment, or close connection with someone already in a career strongly resonated with the findings of Hodkinson and Sparkes (1997). These UK researchers found that career decisions were primarily “rational and based on personal experiences (work experience)” as well as closely connected to “family background, culture and life histories” (Hodkinson and Sparkes 1997 p.33).
Across the three age groups the major influences that shaped study and career decisions in the students interviewed were overwhelmingly parents and family, followed by cultural and educational influences. The impact of perceived educational ability was most evident in the students who were in their senior school of secondary school. They had a strong awareness of the scores they needed for entry into their selected university courses and also had considered other less ideal courses if they did not achieve the ENTER score they were hoping for, echoing a pragmatic attitude also reported in UK studies (Hodkinson and Sparkes 1997). Their course choices were influenced to some degree by the location and status of university; this was more evident in students from the independent schools, one of which had strong cultural influences to encourage students to pursue careers in professional disciplines of medicine and law.

The lack of connection between IT educational experiences or IT leisure use to a future IT career in the vast majority of students interviewed is telling, as is the absence of any mention of media advertisement or portrayals of IT personalities beyond the founder of Microsoft, revered by a few younger students. Throughout secondary school, parents appear to be the primary influential factor in shaping student decision-making related to study and career choice, embedded in which is the overriding influence of culture and social capital. A pattern emerged in the degree of influence of these factors changing as students matured through their education. In the junior years there was a strong tendency to follow a career path that was approved of by the same sex parent, or to a lesser extent, influenced by popular media stereotypes. There was an apparent gender divide in middle school students with IT study and courses only being considered by a few of the more technical male students. However the interview responses from the middle school students indicated that an accumulation of cultural factors with a greater emphasis on educational factors than the junior school students combined to build a selection of possible career futures for these young people. Overwhelmingly the majority of senior school students were not considering IT degree courses. In some instances there was a perceived lack of status with the career, and in a few other instances a lack of knowledge about the career path was expressed.

While positive experiences with school subjects appeared to influence course career choice to some degree as students moved through their secondary education, in the three
cases where IT was mentioned as a favourite subject by senior school young men, they were not considering this as a career option. Generally the reason for liking the subject was related to the course content, which they reported as being ‘easy’. None of the young women interviewed were considering an IT career and one in four made strong derisory comments when IT was mentioned, despite the majority of them being competent users. This absence of connection has implications for the discipline that will be discussed in the final chapter. A discussion of the themes that emerged from the interviews with university students sheds further light on these findings.

9.2.2 University students

All the university students interviewed were studying an IT course, either as a single degree or as part of a double degree and not surprisingly were daily users of IT. However, in the process of analysing the interviews several recurring themes emerged that were similar to the patterns evident in the secondary school interviews. These themes were firstly a gendered identification of IT confidence and use that resided in particular with some of the males interviewed and the modesty in achievement that resided primarily with the female students interviewed; and secondly the commonly cited reason for choosing a course, compromise. It is acknowledged that the themes are intertwined with the developmental stage of the individual as noted by Pascarella and Terenzini (1991) and by the cultural environment in which they have grown up (Trauth, Neilsen and von Hellens 2002). The following discussion focuses on gender differences in factors that influenced course choice and whether an IT degree entered the choice schemata when these university students were in secondary school.

It would appear that as the university students progressed through their secondary education a confidence associated with IT use developed in the young men to a much greater degree than in the young women. This is consistent with studies in Europe (Corneliussen 2004) and the USA (Margolis and Fisher 2002). It is also reflected in the majority gender of IT graduates in western countries: males, are at best twice that of women, at worst more than six times that of women (Charles and Bradley 2006). There was an opposite trend evident in relation to modesty; this appeared to be a gendered characteristic that resided more often with females, and is supported to some degree by
self-efficacy research related to success attribution (Zimmerman 1995). In general the female students interviewed exhibited modesty and even surprise about their accomplishments, a characteristic that was not present in the young men interviewed. The self-efficacy literature discusses the gendered internalising (male) or externalising (female) of success, and the reverse trend related to failure, where males will ascribe blame elsewhere when they do not succeed and females will internalise failure by blaming themselves (Zimmerman 1995; Bandura 1997). This earlier research was related to girls and mathematics, the implication from the similarities in this current study is that the gendered attribution of success and failure is proven to be evident in these interviewees and associated with IT education.

Many of the students referred to the decision to study their current IT course as being a compromise because they were not accepted into their first choice course. The IT course was obviously within their “zone of acceptable alternatives” (Anderson 1998) but in one case it was the student’s last choice out of a possible eight, an indication of its lower status. There was also the belief that an IT degree provided an extra insurance for employment by adding to the skill set of students, particularly in the double degree students of both genders. The exception to this was one cohort of young men studying Information Systems at the Research university who regarded their degree, which was typically not their first choice, as being too “general” in content and not specialised enough for future employment in an IT career. They discussed the need to complete a Masters level qualification to improve their employability. There appeared to be a degree of compromise and “happenstance” (Hodkinson and Sparkes 1997) in their decision-making about their current degree course, a decision tied to opportunity to study in the perceived high status institution (Research University). In another example the influence of happenstance contributed to the decision to study a Multimedia degree with a lower entry point (male Multimedia students at the Technical University) despite having no intrinsic interest in Multimedia but a desire to study an IT degree of any description.

The vast majority of the male university students had strong self-efficacy in relation to IT hardware and software as well as an expectation of success in IT classes that was not prevalent in females and is consistent with attitudes reported by such researchers as
Margolis and Fisher (2002) and Corneliussen (2004). As in the case of the younger women in this sample, many of the university women studying IT expressed a value judgement on acceptable computer use. The negative connotation around being an identified high-end computer user ("geek") was clearly evident. These young women were adamant that spending hours on a computer on activities that were related to communication, music or video appeared was acceptable and did not mean they were “geeks”. This indicates a reflection of common media portrayals and is also consistent with other researcher’s findings that the stereotype of IT users as socially challenged and masculine is a contributory factor that deters young women from entering the discipline (Stewart Millar 1998; Wajcman 2000; Margolis and Fisher 2002). It is apparent that the media is a subtle background factor that influenced the schematic repertoire of possible future careers for these students.

In conclusion, apart from the students in this sample who were studying the most technical degrees, the university students interviewed cited factors not specifically related to the IT degree as their main reasons for selecting their courses (happenstance, compromise, status of university), and the majority did not identify with the IT student stereotype, in fact they actively separated themselves from it. This has implications for the discipline that will be discussed in the next chapter.

9.3 The role of age and gender in IT course and career decision-making

The implications of the findings from the second and third research questions will be examined together because in many cases these influences on IT study and course decision-making were intertwined.

To what extent do these factors differ according to age between Year 8, Year 10, Year 12 and university level students?

Do these factors differ according to gender?

The factors of influence that emerged from the data and that were discussed in the previous section were parents, educational experiences, personal experiences and to a lesser extent stereotypical perceptions associated with the discipline. These factors are
strongly influenced by cultural and social capital (Hossler et al. 1999), and in the case of the university students, happenstance (Hodkinson and Sparkes 1997). The difference in use of IT between the young men and young women interviewed is relevant to the consideration of IT as a future study or course choice. The reported use for school work or leisure provided insight into the extent factors differed according to age and gender. Some of these factors appeared to change in level of influence according to both age and gender of students and are consistent with reported differences in use in the literature (Clegg, Trayhurn and Johnson 2000; MORI 2001; Siann and Callaghan 2001; Margolis and Fisher 2002) as will be discussed in the following section.

9.3.1 Secondary school students

One gender variation among junior school students related to the number of future career options being considered. While these were located within traditionally gender stereotyped careers such as nursing or teaching for girls and business or policeman for boys, notably across the age levels the girls interviewed expressed a greater range of possible future careers than the boys. An IT career was absent from this list for the vast majority of students. Research conducted in Canada reported that boys showed a sense of conformity with the male gender stereotype but that girls resisted stereotyping to a greater degree than boys (Bouchard and St-Amant 2000). The responses of the junior school girls interviewed in this study did not indicate that they were more resistant to stereotypes, the majority were considering a wider range of career options that were stereotypical for their gender (refer Chapter 5).

To gain insight into the age and gender differences in purpose of IT use the junior school students were asked to reflect on the difference between IT education in primary and secondary school. They reported using computers as an adjunct to the curriculum in their primary schools, integrated into the classroom environment and sometimes used creatively for learning through games, or as a reward or a treat. Both genders expressed a sense of regret that IT was not used in this way in secondary school, implying a preference that learning be enriched through the computer game environment, which appears to be in harmony with earlier findings (Durndell et al. 1995). A large proportion of the literature tends to focus on gender differences in purpose of IT use, rather than
similarities (Blum and Frieze 2003; Barker and Aspray 2006), however the nostalgic reflections by these students imply a need for further research in this area, especially given that some researchers ascribe the gender differences in IT enrolment to the advantage males get through many years of computer game playing that is not usually a part of leisure activities of girls (Durndell et al. 1995; Stewart Millar 1998; Clements 2002).

The middle school students were of particular interest because they are usually contemplating their senior school (VCE) subject choices. Their choice of subjects can affect their individual schematic repertoire of possible careers and be influenced by their habitus (Hodkinson and Sparkes 1997; Hossler et al. 1999); the culture of the school (Bandura 1997), family expectations (Siann 1994) and factors such as gender and self-efficacy (Zimmerman 1995). Only one or two young men expressed a passion for IT that may grow into a career interest. The young women tended to link favourite subject with teacher personalities (no IT teachers however) to a greater degree than males, confirming the preference for personal connection in females more than males (Gilligan 1982). It would appear that these middle school students were beginning to be influenced by their own experiences in education and were gaining an understanding of their interests and ability through a personal lens. It appeared that the IT discipline did not hold any credibility beyond the hardware object and was not seen as an enabling pedagogy for an exciting future career by any of the students. There was hesitancy among the middle school young women to admit the amount of time spent using computers for leisure. It would appear that the stereotype of IT users being social misfits or ‘geeks’ (Stewart Millar 1998; Margolis and Fisher 2002; Ho 2005) was quite strong among young women of this age. There was a reluctance by the few young women who equalled the young men in their leisure time use of IT to admit this activity. It could be surmised that they did not want to appear lacking in social attributes in front of their peers. While this is a small non-generalisable study this finding is supported by both career choice literature (Lightbody and Durndell 1998) and research completed in Victoria (MMV 2001) that found societal perceptions of IT careers are lagging behind reality. It also reflects the shared hegemonic position that young men and young women experience in relation to IT use, where women are not expected to be competent and enjoy their use of IT to the same extent as men (Corneliussen 2004).
By senior school the young women interviewed were more likely to express a disdain for computers, at least one in four using them as little as possible, affirming that by the end of secondary school Information Technology was firmly situated in the male domain (Wajcman 2000). The constant daily use and interaction with IT did not translate to desire for a career or higher education course in IT for the majority of the students. The majority of the young men strongly expressed an opinion that IT lacked the status needed for them to consider it as a serious career path. The most striking response “I’d rather be a garbo” came from the School Captain at Gum College, an indication of the low status of the career in the eyes of this young man. This finding is similar to that found in a UK study where IT was rated as the least ‘sexy’ of all careers. (MORI 2001). At the school where IT was integral in all aspects of the curriculum through an individual laptop requirement, the young men regarded this as a burden and “basically a waste of money” (Oak College). The stereotypical image of IT careers being sedentary and isolated was strong in both genders; however a small proportion of the young men did consider IT as a back-up course for university if they did not get their first choice. While the young men considered it a low status career, several of the young women expressed a lack of knowledge of the variety of IT courses available, indicating that there was some substance to the “Deficit” theory (see Chapter 3, section 3.2.1) which attributed a deficit of knowledge to explain the under-representation of women in the industry (Craig et al. 1998; Spencer 2003).

Students at senior school level also mentioned university status as an influencing factor in future course decision-making. The names of two major research universities of the state were given as the most desired destination for the majority of the students interviewed. It appeared that habitus (Hodkinson and Sparkes 1997; Hossler et al. 1999) influenced by social status and parental expectations were the primary factors that had grown in importance and influence on course and career decision-making through secondary education. The influence of happenstance was absent from these interviews, and perhaps could be expected because the timing of the interviews, mid-year, was six months before any university offers were made. The gendered expression of disliking computers was dramatic in this age-group, only one of the 24 young men expressed a dislike of computers, while one in four young women said they “hated” them. This gendered pattern of like and dislike is indicative of feminist theory that IT is becoming
increasingly masculinised in western society (Wajcman 2000). It would appear from these interviews that IT rarely entered the zone of acceptable career paths in the decision-making process and was often a compromise degree course; a fact that is reflected by the current decline in student numbers in IT courses at senior school as well as university throughout Australia (see Figures 1 and 2, Chapter 1).

An interesting story that perhaps contributed to the cultural stereotype of IT being an isolated and masculine career path was repeated several times in different group interviews, at different schools. It could not be determined if the story was folklore or grounded in fact because it was invariably one step removed from the person telling it. In this story a “cousin”, “uncle”, or “friend of a friend” was a competent computer hacker in their youth and now making an exorbitant income working for a multinational IT company. This echoes findings reported by Margolis and Fisher (2002) that males have a strong attraction to IT that is not prevalent in females and perhaps contributes to the assumption that an emotional connection to IT is needed before a career in this discipline be considered (Margolis and Fisher 2002).

A somewhat unexpected finding was the sense of pride expressed by a small cohort of males when the subject of IT use was raised. This was apparent in interviews with school students across all age groups. There was a distinct variation in the placement of this pride, some of the young men were proud to talk about their technical expertise as well as their expertise in computer game playing. In contrast not one of the young women expressed pride in their IT ability. In the young men the sense of pride was strongly grounded in a degree of boasting about the amount of time they spent using computers and playing computer games. The exception to this pattern was that two of the young women interviewed exhibited vicarious pride related to IT use by others; one when she spoke about her sister, the other about her boyfriend’s IT use. This gendered attribution of pride was evident in senior school student interviews, even when the vast majority of both genders were daily users of IT. By senior school some of the young men were extremely confident about their IT ability, although derisive of it as a career path, a finding that will be discussed later. The young women often expressed a dislike of computers, despite their obvious competency, which supports earlier findings (Durndell et al. 1995; Siann and Callaghan 2001; Corneliusse 2004). Bandura (1997)
argued that self-efficacy was developed when a task or application had value in the eyes of a student. It became apparent in these interviews that the majority of female students had neither strong IT self-efficacy, nor placed much value on attaining this. This is consistent with Cornelliusen’s (2004) findings related to gender differences in the acceptance of the hegemonic discourse around computing, with males expecting to ‘belong’ in the discourse and females positioning themselves elsewhere. On exploration of this pattern it became obvious that the girls in this sample consistently underrated their IT skills. This is a similar finding to the reported IT use patterns in the UK (MORI 2001) where girls and boys were proficient users of IT, but that this did not translate in the same proportion to consideration of IT in their future career (MORI 2001). The interviewees at all ages were generally proficient IT users for their school work and some leisure activities, however many of the young women interviewed did not place value on this proficiency.

Overall, in the interviews with the young women in secondary school there was a stronger expression of emotional connection to favourite subjects. This included a polarity of love and hate, although love was mentioned to a greater degree, but none mentioned IT. Only a few of the young men who were high-end computer users expressed a passion for IT, but more as a leisure pursuit than a career.

**9.3.2 University students**

A surprising outcome of this research is that the majority of the university students interviewed regarded their current IT degree course as a “second choice” course, taken because they did not meet the entry requirements for their first choice when they applied for university. It was clear that an IT course was perceived as lower status than a course in Business or Commerce. For example a young man at the research university reflected how he needed to explain to his father’s friends (whose opinion he obviously respected) that his current Information Systems course was more a Business course than an IT course to improve his credibility in their eyes. This was apparent in all interviews apart from those with students in the most technical courses, where by and large the males had “always” wanted to study IT. There was also a marked difference between the young men and the young women in the level of confidence expressed in their IT ability. Even though all the young women interviewed were currently enrolled
in an IT degree course, they were considerably less confident than the young men interviewed and had lower self-efficacy related to their IT ability. This had not prevented them from studying an IT course, but the decision had been made only after encouragement from family or close friends.

These findings have wider implications. The lack of identification of IT as a career path in its own right is reflected in the declining enrolment statistics across Australia presented in Chapter 1. However, the perception of the young women that their IT degree will provide them with greater employment opportunities was an interesting finding and varied somewhat from theories that women are less affected by financial rewards in their careers than men (Gilligan 1982; Belenky et al. 1986; Lightbody and Durndell 1998; Margolis and Fisher 2002). This is discussed in more detail in section 9.4.

There appeared to be a connection with computer use and maturity that was a relatively new finding not reflected in the literature that informed the current research. It was first mentioned by middle school boys and then by senior school and university young men. It was stated by several interviewees that game playing on computers was an activity that they outgrew as they aged, but not in all cases because there were still university level males who had weekly sessions with their friends playing computer games. In one case the student mentioned he no longer played games because he had his driving license and was now going out more; in another the student stated that he wanted to get out and meet different people. None of the young women mentioned growing out of computers, although a couple in the senior school mentioned having to curb their chat and internet use due to study pressures. The identification of computer games with a childhood leisure activity has implications on students’ consideration of IT as a future career. It could be posited that the early connection of computer game playing as a leisure activity, which seems to generate a confidence and self-efficacy in computer use, does not always translate to a consideration of IT as a career option except in a very few cases, along the lines of fishing being a leisure activity that rarely leads to a career in marine biology for example. In fact “growing out of” IT game playing could be a factor that affects the image of the discipline that is magnified by the pervasive gendered computer games market (Stewart Millar 1998; Margolis and Fisher 2002), and appears
to be having a negative effect on attracting both young men and young women to university level study of the discipline.

This study has found that there was only a slight gender difference in both when and how students made their future course decisions. Only the more most technically focused young men reported being “always” interested in studying IT at university. The less technical males and the majority of the females rarely considered an IT degree throughout their secondary education. According to research, choosing a university course which leads to a career choice is often not a well researched or logically informed decision, and is a decision that students usually only participate in once (Pascarella and Terenzini 1991; Anderson 1998; Hossler et al. 1999; James, Baldwin and McInnis 1999). The final decision of what course to study was often made late in their secondary schooling and was often not the product of a logical data gathering process. However the zone of alternative careers being considered had already been narrowed by prior experiences in education and gendered social acceptance of desirable career paths (Hodkinson and Sparkes 1997; Anderson 1998). A considerable majority of women interviewed at university had made the decision to study an IT course late in their education. IT was often not the course they had focussed on through senior secondary school and in many cases they were only alerted to it as a possible option through intervention and suggestion by another person, emphasising the importance of happenstance or turning points in this decision-making process (Hodkinson and Sparkes 1997). This was also the case in three out of four of the men with the exception of those in the more technical courses who had ‘always’ focused on a career in IT.

The overriding influence of culture and family expectations was the base from which both genders developed their situated cognition of possible selves and therefore possible future careers (Trauth et al. 2002). Many of the young women at university had not considered an IT degree at all during senior secondary school and did not include it in their initial application for university places. The interviews show that the current Information Technology course was often only considered after the publication of final results or in second round and often because of encouragement by a parent, family member or friend. This finding varies from those of James et al. (1999) who found that field of study was the most dominant factor in selecting course or career choice.
Reflecting on the responses of students at the different stages in their education, many of the senior school students interviewed appeared to be considering general fields such as Law, Business, or Health related fields of study, validating the findings of James et al. as well as validating the pattern of IT not being a course under consideration. Future course choices were even more vague for the middle school and junior school students, the majority of whom were not decided on any particular career but were influenced by the current curriculum areas that they had a particular aptitude in or liked, as well as who impressed them, be that someone from their family, the media, or the sporting arena.

The influence of age and gender contribute to the multiple factors that shape student decisions about study and careers in IT. These have affected course choice by the time university students start higher education. The young men were confident and had an expectation of success in their course; the young women were not so assured. This gendered difference in a “shared hegemonic discourse that creates different expectations in … relation to computers” (Corneliussen 2004 p 173) is indicative of the cultural expectation that the connection between masculinity and IT would ensure a mastery in this field for young men, contributing to a sense of not-belonging in any young women who chose to enter this discipline or career. The expectation of success reinforced feelings of self-efficacy in young men interviewed; the lack of expectation of success and resultant lack of confidence in the young women contributed to lowered self-efficacy in this field. This attitude in the current cohort of undergraduate females was also evident in the younger students at all levels interviewed. The junior secondary school girls expressed pride and a bonding conversation in admitting how “bad” they were with computers (see Chapter 5). Similarly the young women in middle school were hesitant and apologetic when they admitted the extent of their computer use (see Chapter 6). The senior school young women placed a value judgement on acceptable IT uses for young women and expressed cynicism and derision for non-acceptable uses such as programming (see Chapter 7).

The dichotomy created in the minds of the university level young women in relation to acceptable use of IT appeared to erode feelings of self-efficacy and confidence in ability
in IT courses. Once more, this mirrors findings from other studies that found that young women felt a sense of not belonging in traditionally masculine careers (Leslie, McClure and Oaxaca 1998). An implication of this gendered pattern in use and attitude to IT is that weak efficacy beliefs around IT (Hackett 1995) may cause students to prematurely exclude themselves from higher earning IT career opportunities later in life.

It is apparent that course decision-making was a process that evolved from cumulative factors of cultural background and family expectations (Hossler et al. 1999) as well as education experiences (Bandura 1997; Todd and Work 1998). The individual had built a concept of ‘possible selves’ and their situated cognition of future career options appeared to be developed by the end of secondary school (Knox, Funk, Elliott and Greene Bush 2000). Academic scores (ENTER) being lower or higher than expected contributed to the influence of “happenstance” (Hodkinson and Sparkes 1997) becoming evident in the final course decision-making in the young women in this sample, to a greater degree than the young men.

9.4 Discipline specific factors that attract students or act as detractors

The fourth research question investigated student responses to determine if there were factors that were particularly unique to the IT discipline that may attract students of different ages and genders to the study of IT or, on the other hand, have a negative impact on student decision-making related to IT study or careers. It is worth reflecting once more on the IT discipline and its unique characteristics that may have contributed to it being a discipline and career path that holds up to five times more appeal to males than females (DEST 2006). Over thirty-five years ago it was believed that once women learnt about IT they would flock to the career path because it suited them so well (Seligsohn 1967). The idea that this is a most desirable discipline is still strongly embedded in the minds of many already in the discipline, mainly men, who have no issue with the discipline being particularly masculine (Philipson 2003), or believe that males hold a greater innate ability in this field like the (male) president of Harvard University (Bombardieri 2003).
These interviews with students of several ages show that there are a few factors that attract both genders to the discipline, but these are countered by almost twice as many factors that appear to have a negative impact on students’ perceptions about IT courses and careers. These will now be discussed in more detail.

9.4.1 Factors that attract students to IT
One outcome of the analysis of findings from these interviews is that the young women currently enrolled in IT university courses had a stronger sense than many of their male peers of their future employability being enhanced because of their IT degrees. This stronger sense of employability is enabled because these young women reported that they knew they were entering a male dominated work environment in a culture where business and industry are required to follow equal employment and opportunity guidelines. This meant that a young woman with IT qualifications was a marketable commodity.

Another positive finding for the discipline from this snapshot is that there is minimal difference in the amount of use of IT between genders. From these interviews at each of the stages in their education, both young men and women use IT as a daily component of their life. Using a computer for school work and also for communication, or research is no longer a masculine activity; males may still dominate spaces in institutions where computers are located, that was not a component of investigation in this study, but in general, the amount of time spent using IT varied little between students of each gender. Despite this the confidence and acceptance of any technical ability still generally resides in males more than females.

9.4.2 Factors that act as detractors
The discipline specific factors that appear to influence whether young people consider IT as a future study or career option that have emerged from this research are;

- the perception of the discipline as a masculine space (senior school females);
- the apparent value-laden uses of IT in leisure and study (middle, senior school, university females);
• the progression of time that places some uses in childhood (middle, senior school and university males) and;
• the overwhelming lack of status of the career path (senior school males).

While both genders use IT in significantly similar amounts of time, there is a strong gendered differentiation in acceptable use of IT before one is deemed “sad” or a “geek”. It was clear that both genders at senior school or university can label themselves as “an internet junkie” without loss of social standing, but it was not acceptable for a young woman to love programming, and only the most technical oriented young men admitted to this activity. This value judgement made about acceptable use resided strongly among the young women. The view was also expressed in some of the interviews with the senior school and university young men, particularly those in the less technical degrees.

There was evidence of a passion for IT that resided more commonly with a few of the young men, but any expression of emotional connection with their computer was not present in the interviews with the young women. In the university student interviews progression to an IT course arose from computer game playing experiences in one in four young men. Only the young men mentioned being self-taught in IT skills, clearly associating themselves with the hardware, however some of the more technical males distanced themselves from “geek” stereotype by stressing their involvement in other social activities.

The concept of status of IT in the development of possible future careers is evident through the interviews, particularly with the senior school young men. Students in junior school had considered a wide variety of career options and appeared that the status of IT careers was not a factor to be considered. However neither was the knowledge of an IT career beyond the most stereotypical of a games programmer or a network technician. By middle school it was evident that IT was already situated in the male career domain due to a gendered identification with its use for game playing and pride associated with technical expertise by the young men, and the strong de-identification of any IT competence by the young women. In both genders the lack of
knowledge about an IT career was widespread, but not particularly a top priority for future investigation either. It would appear from this research that as students progressed through secondary school cultural and social stereotypes around IT became embedded in both genders. By senior school IT was considered a low status career by several of the young men and discounted as a future career path by most (Chapter 7).

This image of the discipline as being masculine appears to be deeply embedded in the domain of IT and exacerbated by the male bonding that occurs over computer game playing, either by going to venues and playing networked games or by having friendship group parties where the players bring their hardware to one location. This is supported by research conducted in the UK and USA (Stewart Millar 1998; Huff 2002; Margolis and Fisher 2002; e-Skills 2006). Computer game-playing is a particularly male activity that young women rarely get involved in as a social experience. This finding certainly supports the hypothesis that males accept a hegemonic discourse of IT (Corneliussen 2004), but the same does not necessarily apply to females in western societies. From the conversations in the group interviews at all ages of secondary education and the young women at university, it is clear that young women use IT more often for school work. When they do use it in their own home it is a tool used for communication. The university women discussed how useful the internet chat tool was for them when doing homework as illustrated in the following quote:

I am on MSN every night during semester, sharing ideas, without that we would have .... (Mandy) ... so much more is done at home. (Jenny, Technical University)

The discipline has a clearly embedded masculine identity, however this research found a lack of knowledge about IT careers beyond the most stereotypical that extends across both genders and throughout the year levels of students. Gender specific findings such as modesty about accomplishments being a female trait is widely referred to in gender and education literature (Bandura 1997). The finding that the status of a university was more important than course curriculum was clearly evident for males but not so evident in females studying IT. The status of the research university greatly outweighed the discipline specific course choice and influenced the decisions of many of the young men and a number of the young women in this investigation.
9.5 Conclusion

This chapter has presented a synthesised discussion of the interview responses across age and gender. It is apparent that some of the findings from this small and non-generalisable study mirror those from studies conducted in similar western countries. However some of the findings have not previously been reported in the ‘Women and IT’ body of literature and have implications for the future of the discipline. The final research question “What are the implications of these findings for schools, universities and the IT industry in terms of increasing female participation in IT study and careers?” is the topic of the final chapter of this thesis.
CHAPTER 10: CONCLUSION AND IMPLICATIONS FOR THE FUTURE OF IT

10.1 Introduction

The predominant findings from this qualitative study are not generalisable but nevertheless have implications that are of value in terms of informing further research into improving proportional female participation in IT study and careers. The finding that parents were the main factor influencing students in their future study and career options, while not surprising, was interesting because of the strong alignment between daughters and mothers and sons and fathers. The findings also confirm to some extent the relationship between consideration of future careers and popular media, particularly with the younger students. Senior school students placed stronger emphasis on ability and self-efficacy in a discipline as an influencing factor when they considered future course and career options. The finding related to pride in IT proficiency which resided strongly in the males, and was noticeably absent in the females interviewed complicated the finding that girls rely on a degree of personal connection when considering possible future careers. This is discussed in more detail in the next section.

This study found that many of the university students already enrolled in an IT discipline made their decision to study IT in their final year of school, or even after the publication of university entrance scores. The university interviewees of both genders were generally more similar than different in their attitude to IT. The overwhelming response from these students, apart from those in the most technical degrees, was that their IT degree was not their first choice and not necessarily leading to the career path that they aspired to. Their IT degree was often seen as a lower status degree to a Business or Commerce degree. A majority of the young women studying IT degrees were influenced by personal connection and encouragement by a parent, teacher or other family member. There was also little difference between the genders in their attitude to IT, a finding informed by the comment by several young men that they had ‘outgrown’ their IT passion, has implications for the image of IT.
Chapter 10: Conclusion and implications

These findings imply that the IT discipline has image and relevance issues. It would appear that the discipline needs to develop greater connections between computer use and a career path. Parents are an important cog in the distribution of IT study and career information and the discipline also needs to build a stronger link between leisure and communication use of IT with the career options available. It is suggested that multi-layered interventions targeting parents, teachers and curricula would provide a greater opportunity to change perceptions related to IT courses and careers to attract a more diverse range of students to IT.

10.2 Implications for IT in the future

This research verifies earlier studies that indicate a progressive socialising of young women to follow acceptable career paths that are gender appropriate in their culture (Siann and Callaghan 2001; Trauth 2002). It indicates that IT rarely figures in this zone of acceptable career outcomes for students of both genders, indicating a society wide discipline based problem rather than a gender issue. The lack of diversity in IT does not solely reside in one gender in the twenty-first century, but extends to both male and female students. It is more readily identified as a gender issue only because women are more visible and labelled as being absent.

Surprisingly when asked where their degree was taking them, the majority of young women interviewed who were already studying a university IT course were not intending to continue with a career in IT. This is a worrying sign for the profession. In general these young women had not considered an IT course during secondary school and were steered in this direction by their parents or other family members. However many of them regarded their IT degree as a stepping stone to another profession, not a career destination in itself (see Chapter 8). The young women interviewed at senior secondary school were generally not considering IT at all. When questioned further they stated stereotypical reasons for not considering IT in their future study and career options such as the sedentary and isolated nature of the career (see Chapter 7). Of all the senior secondary school young men interviewed only two were considering IT, and one of these regarded it as a “fallback” course in case he did not do well enough in his
ENTER score to get into his first seven choices. From these interviews it appeared that only the most technical young men who were high-end IT users were considering IT as a possible future course or career.

The responses to the direct question of whether students had considered IT were not quite so negative in the interviews with the middle school young women. One in five young women had neither considered nor discounted this career path yet. Like the senior school students, when prompted, they expressed a lack of knowledge about what a career in IT actually involved. Many referred to IT as a necessary skill, an adjunct to another career, but not a career destination in itself. Similarly about one third of the young men, when prompted, had not totally dismissed IT either mentioning the possibility of making money or keeping their options open. This discussion was qualified by the perception that the career was less social than other career paths and the belief that you needed some sort of innate talent or emotional connection to IT to follow this pathway. Some of the young men acknowledged the volatility of the career path and made reference to the fluctuating nature of the IT job market as reported in the media. Some mentioned the perception that it was a career for young men only, not a career for life, which also appeared to be influenced by media reporting. The majority of the middle school and senior school young women wanted to actively distance themselves from IT. In these groups it was the norm to hate computers despite extensive use. With this attitude it is no surprise that the career path is not considered as a future option. At junior school level many girls also had not considered IT as a career. In many cases they had neither made a conscious decision to accept or reject IT. The girls had a wide range of other career possibilities that did not include IT. The majority held stereotypical perceptions of the career path, much like their middle school counterparts and were quite dismissive of IT as a future career, more so than the young men.

The lack of status of the career path in the eyes of the senior students is a worrying aspect. IT was rarely considered as a career in its own right by these students. The discipline often lacked individual identity and was associated with a view that a career in IT is most suited to an isolated, socially challenged young male who loves programming, a view held by both male and female students which is supported by earlier studies (MMV 2001). The media appears to contribute to the perception held by
these students of what constitutes an IT career. Its influence is greater now than it has ever been because of the ubiquitous nature of the media in all aspects of society through a variety of mediums such as radio, internet, television and video (Stewart Millar 1998).

The noteworthy finding which holds considerable importance to future research is the overwhelming importance of parents as a factor that shaped student course and career choices. While parental influence is reported in the career choice literature (Rayman and Brett 1995; Leslie et al. 1998; Hossler et al. 1999; Pajares 2002), the degree of influence as indicated by responses from more than half the students in the sample at each year level, was surprising. The implications drawn from these findings are that the IT discipline and profession will need to work consistently and at many levels to overcome its historical stereotype of a career most suited to technical focused, socially challenged male programmers, the perception that appears to be dominant in the minds of most of these students.

10.3 Revisiting the research question

In response to the main research questions “How do adolescents form attitude to IT that may influence their study and career choices?” an exploration of the findings from this research uncovered that IT rarely enters the course or career decision-making process of any secondary school students. The interviews with the university students found that a degree of gender differentiation existed related to the timing of when these students made their decision to enrol in an IT course as well as different pathways being used by each gender to their current IT degree destination.

The perception that a career in IT was not as secure as other professional careers was presented in the first chapter. This perception appeared to be influenced by media reporting of stock market fluctuations and IT jobs relocation to countries where employment costs were lower. It was thought that the volatility of the profession would contribute to the gender imbalance, because females were considered more risk averse than males (Eckel and Grossman 2002). The finding from these interviews was that the insecurity of the profession appeared to contribute to its lack of status, but particularly in the minds of senior school boys rather than the senior school girls. In the first chapter
it was also stated that the belief that there was a need for an emotional connection to computers to follow this career path resided more with young women than young men. This research verifies this belief to some extent. For example, in this sample many of the young women did not consider IT as more than a tool, and very few considered the career path. “I don’t normally like computers, I tend to use them” (Dione, Olive College) was a typical response from the young women. The few young men at secondary school who were considering further IT study and courses were very attached to their computers “I love IT” (Caleb, Elm College). This is in harmony with findings from Carnegie Mellon University research reported in chapter three (Margolis and Fisher 2002).

The application of theories of self-efficacy, attribution theory, occupational stereotypes and the effect of gender on current career decision-making theories, provided a framework for the investigation into the gendered nature of IT course and career choice. Salient points from the current women in IT literature, particularly the stance that there appear to be no barriers preventing women from entering IT but instead that they are executing freedom of choice, is substantiated by this research. The perception in wider society that the IT career path has a binary nature which is primarily “technical and solitary” and not “creative or social” continues to contribute to the gendered decision-making patterns of young people. The emergent theories of individual differences, structuration and expectancy beliefs were examined in the context of the interview findings. It is concluded that the IT discipline is strongly embedded within the masculine sphere of acceptable careers, an impression that influences possible career schematics in young women.

Of the four main themes that emerged from the body of career choice literature as influential factors in future course and career choices, culture was the overriding influence on student course and career choice and underpinned all parts of decision-making. Habitus, the more localised influence, was strongly affected by the social capital of parents and their expectations for their children (Hodkinson and Sparkes 1997; Hossler et al. 1999). Educational experiences (Gilligan 1982; Bandura 1997; Todd and Work 1998) and peer pressure (Margolis and Fisher 2002) each had a degree of influence on student career choices. Gilligan termed the picture an individual
envisages for their future as “possible selves”. The findings from this study indicate that this picture often did not differ greatly from cultural expectations of acceptable gender roles (Keeves 1988; Corneliussen 2004; Charles and Bradley 2006). The fourth theme that emerged from the body of literature was that of ‘happenstance’ or sheer opportunistic chance that created turning points in decision-making (Hodkinson and Sparkes 1997). This influence was present and verified in the interviews with the university students in this sample.

This research reported that the male university students interviewed generally saw themselves as naturally progressing to computing from game playing, while this was not the case in any of the women interviewed. The women used IT to a considerable degree, relying heavily on the internet for communication and research, yet the transference of this use to the possibility of a career in IT was no more evident than that of extensive use of a telephone leading to a career in telecommunications. Consequently the impact of the computer games market on the gendered nature of the discipline was supported by this study. To some of the men, writing game programs was their ideal career, particularly some of those in the more technical courses, and it appears that experiences with computer games built a strong association of “belonging” to computing. Not one of the women had the same expectation of proceeding to an IT degree course after playing computing games. Some were in an IT course after enrolling in and partially completing other courses, some after a period of being in the workplace, and others because of recognition that IT could enhance their employment opportunities despite their interest being elsewhere, rather than because they felt they belonged in IT or had a particular passion for the discipline.

The women interviewed were overwhelmingly steered to their current IT university course by another person, be that father, brother, mother, sister or teacher. Less than half the students in this sample had completed an IT subject in secondary school and only one in four had completed a VCE IT subject. The exceptions to this pattern were one young man who enjoyed his VCE course “loved IPM”, and one young woman who mentioned that she had “enjoyed a programming elective” in middle school and that had led her to consider enrolling in a Business/IT double degree.
The confidence of the men in this sample has been commented upon earlier. It is worth noting that only the young men claimed they had taught themselves all they needed to know about computers. None of the young women offered this information that they were self-taught in their IT skills. This re-enforces the technical component of the IT discourse and male bravado in iterating their pathway to self-skilling.

This research has uncovered the concept of outgrowing computers, evident in the middle and senior secondary school boys as well as some of the university men, and could certainly be a factor contributing to declining enrolments in IT by both genders in the twenty-first century. Faculties are increasingly worried about declining enrolments in all areas of IT, not just the most technical, and the marginalisation of the discipline to become a service discipline in universities appears to be an outcome of this decline in enrolment numbers. The situation where the computer game market has created a particularly strong identification with young males and enables boys and young men to gain a comfortable knowledge of hardware and software in a leisure activity appears to have had a negative outcome not only for young women but also for some of these young men, in that as they have matured they have discounted IT as a childish pastime.

In the course of this investigation it was concluded that much of the existing “Women in IT” research centred on what had been labelled the “deficit model”. The assumption that there is a deficit in the knowledge of young women and that they are not choosing IT because they are unaware of it. In the process of this research further concerns were voiced that the discipline is not only not attracting young women, but also not perceived as attractive to many young men; the “Y” generation. In fact it appears that it is only attracting the most technical high-end IT users, and that since there are fewer females that fit this profile, there are fewer females in the pool of students interested in IT. It is in fact leading to a downward spiral of opportunity for increased diversity and creativity. Lack of knowledge about the career path was a factor in all but the smallest minority of students of both genders in secondary school and is confirmed in the interviews with many of the current IT students at university, a significant majority of whom had tried other courses, careers and even paid employment before selecting their current course. There was a lack of gender differences in responses from girls and a
substantial proportion of boys; they are uniformly not attracted to IT courses and unaware of what an IT career involves.

The general trend was identified of young people forming negative impressions about the discipline as early as junior secondary school. It would appear that computing and IT has already been “gendered” as a male discipline before students enter secondary school. Surprisingly this male, technical stereotype is also a negative factor for many of the young men interviewed, with the “geek” being the only one who persists. These findings are in congruence with the body of self-efficacy literature (Bandura 1997) in that many of these young women held no value on gaining IT self-efficacy and their interactions with IT were as a tool. The university student interviews and their lack of ambition to follow an IT career also support Hackett’s findings than “Women's occupational self-efficacy is significantly lower than men's for traditionally male-dominated occupations” (Hackett 1995 p.235). The stereotypical career ambitions of the younger students clearly follow the career choice literature predictions of Adya and Kaiser (2005) who emphasised the imprinting of gendered social expectations for young women. It would appear that girls are not being prevented from selecting IT courses and careers but that they are choosing not to follow the career path due to a perhaps stereotypical perception of what an IT career involves. This is in line with Siann and Callaghan’s findings (2001) but does not necessarily support the model of a progression of cyclical decisions to a zone of acceptable careers and compromises (Anderson 1998). There is a strong indication that family influence through cultural and social capital and in many cases an event or “happenstance” are primary influences in course choices, made late in the senior school of school (Hodkinson and Sparkes 1997).

This research concluded that there is a gender divide in relation to choice of IT career and course options, but more importantly, IT does not enter the concept of possible selves for the large majority of students of both genders. Only the most technical of the young men consider IT in their future career options, and none of the young women.
10.4 Future research and concluding remarks

Further investigation into student expectations and experiences of IT in higher education as well as the secondary school curricula would be useful. IT has existed as a separate faculty in modern universities in Australia for less than twenty years and over that time gender has become an issue as these IT faculties and departments have become more and more masculine. Without such an investigation, it is not unfeasible to predict that Information Technology may lose relevance as a separate discipline in higher education in the future. At secondary school level in Victoria, where this study is located, IT is now integrated into the curriculum at junior and middle school level and does not exist as a separate discipline area. The junior school interviewees reported a preference for IT curriculum that takes advantage of computer games methodologies in an integrated classroom environment like in their primary school experiences. An investigation into the effectiveness of this curriculum integration and whether it has a positive or negative impact on senior school IT enrolments with students of both genders would be worthwhile.

The concluding quote in the first chapter of this thesis was from a government sponsored study that called for more research into “the reasons why girls participate less in those curriculum areas most associated with information technologies and what curriculum changes may best facilitate girls’ greater participation and success” (Collins et al. 2000 p.15). This thesis sheds greater light on these reasons and suggests that girls are not participating as much as boys in these curriculum areas because they find them uninteresting and unattractive. Future research using a larger and more diverse sample (country and city) could investigate student attitude to core IT curricula at various year levels as well as gather their opinion on how students would prefer to interact with IT at secondary school.

It was thought that subtle exclusions pertinent to this discipline may be at play, discouraging girls from pursuing this career path, and indeed a seminal work in the women in computing literature identified the reducing number of women pursuing IT
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career paths as “The incredible shrinking pipeline” (Camp 1997). The IT discipline in Australia appears to be affected by a perception of lack of relevance of IT as an independent career that begins early in secondary school, and extends to both genders. Young women and many young men are not considering IT as a valid and independent discipline and the consequence of this is that they are being excluded from employment opportunities in this area. It was thought that poor choices resulted in a gender division in information literacy and girls becoming members of information poor. This research has shown that this is not so and that young women and young men are almost equally literate in IT, using it for communications, research and internet surfing. They are just not choosing to formally study this discipline at university level. Research into how to attract these disaffected students to IT is needed, in particular building perceptions of connectivity and relevance of the discipline as an independent career as well as an adjunct to other career paths.

The implications from this research indicate that the IT discipline has serious issues to contend with related to its image, relevance and environment. It is apparent that students cannot readily define what an IT career involves. Within the discipline it would appear that the broad spectrum of courses and different bodies of knowledge that compete with each other for funding, students and status under the IT badge contribute to this confusion. It is not an easily defined career, such as medicine, law or even business. The core perception of IT is of being a computer programmer just as the core perception of medicine is being a general practitioner and the core perception of law is being a trial lawyer. The discipline is hampered by the lack of status and positive image in society ascribed to programmers, and this all contributes to the confusion and lack of willingness of students to participate in this field. The image problem of the IT discipline extends to the terminology which appears to promote (motor) skills and jobs, rather than focus on higher status career options. A discipline-wide evaluation would be useful to develop a more accessible image of an IT career that extends beyond the stereotype of male, anti-social and hardware focused.

This thesis concludes that IT is a ubiquitous and varied discipline that is unique in its many applications across other disciplines. At university the course content of the discipline can be strongly technical focussed, a business enabler, foster creativity and be
strongly embedded in communication. However its image in wider society is mainly connected with the hardware and associated objects rather than as a creative or enabling pedagogy. The lack of women in IT is not necessarily a gender issue, but a core discipline image issue. Girls are not making decisions to follow future careers or courses in IT because it is not entering the body of career and course choices they build throughout their education; it is instead a tool embedded in their every day life.
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References and Appendices


APPENDIX 1: SCHOOL PROFILES

Below is a profile of schools in sample taken from each of their web pages (in italics). The names have been edited as well as street locations. The purpose of this appendix is to indicate the common features of the government and independent schools sampled while maintaining their anonymity. The description are provided to give the reader further information regarding school culture. The researcher’s comments on each school are included.

**Elm**

Established in 1974, Elm Secondary College is located approximately 20kms east of Melbourne. The college offers a broad general education from Years 7 to 12 and has a strong multicultural background, with over 40 nationalities represented.

The college has a tradition of excellence and achieves impressive Victorian Certificate of Education (VCE) results, with a high percentage of our students continuing to tertiary studies. The community views the college as a well respected Government school with students coming predominantly from surrounding suburbs. The college also welcomes students from overseas communities. Slightly more than 1200 students enrolled with a strong expectation of more than two-thirds of students furthering their education at university.

Edited from school web-site*, 24 Aug. 2007

At Elm College, a non-selective outer Eastern suburban government school, one Middle School (Year 10) IT elective is offered. According to the IT co-coordinator, Mrs K., there are about 200 students in this year level, and the ratio of female to male taking this elective is about 40/60. She added that there is a ‘good mix’ of male and female IT teachers and the Principal requires that all staff include an ICT component in every field of study. This integration of IT in the curriculum is achieved through a number of resources. There are five full IT labs (classrooms of networked computers used for IT classes where it can be expected that each student has individual computer access to complete their set work) and three ‘half rooms’ within the school. There are pods of computers (small groupings of five or six computers) in the Social Sciences area. The
Library has a pod and a classroom, the Visual Graphics classroom has a pod and Music also have a pod of Apple computers, not PC’s.

**Gum**

Situated approximately 25 km east of the Melbourne CBD, Gum Secondary College is a co-educational and multicultural school of approximately 1200 students from Year 7 to Year 12. The College is a safe and secure learning environment that values and respects students' individual achievements. It is part of an education precinct and adjoining the College is a Primary School.

The college is committed to the delivery of a challenging, high quality, inclusive curriculum. Students are encouraged to strive for excellence. The College offers over 32 VCE subjects and access to a selection of VET courses. The College maintains a well disciplined environment supported by a sub-school structure and a highly experienced student well-being team. The College has a proud tradition of academic excellence, complemented by outstanding sporting achievements and a history of musical and dramatic performances.

Edited from school web-site*, 24 Aug. 2007

Gum College, like Elm College is a non-selective government school in the eastern suburbs of Melbourne. The school is well resourced with computers, and according to the Principal, Ms F., is considering installing a wireless network that will allow students to bring their own laptops and access the school intranet from anywhere within the grounds. Unfortunately the timing of the interviews did not take in to account that many middle school (Year 10) students were on a work experience placement. There were only two Year 10 males who were not on work experience and who volunteered to be interviewed, Caleb and Chris, and they were joined by Karl who was in Year 9. The young women interviewed were primarily in Year 9 (Rachel, Stephanie and Angie) with only one, Zoe, in Year 10. The Year 9 students are slightly more distanced from considering VCE subjects and careers, but their responses to the questions inform the research and are included to add to the insight on current uses of computers and factors that influence career choice and attitudes to IT as a future career.
Oak

Oak Grammar School is a multi-campus Anglican school situated in the northern suburbs of Melbourne. The School has built its reputation on catering for individual needs and sees diversity, both in terms of educational opportunities and student population, as a real strength.

Reflecting its Anglican foundation, Oak Grammar School is based on Christian principles whilst acknowledging the cultural and religious diversity of contemporary Australian society. Students are encouraged to understand the religious views of others, especially those of students in the School who belong to other faiths. The Secondary School at Oak campus offers students a wide range of options, both academic and co-curricular. In 2003 a pathway for girls was commenced at Years 7 and 11, (VCE) that in subsequent years will move through all levels 7 to 12. In addition, girls have been admitted to the International Baccalaureate course (Years 11 and 12) since 1999.

Edited from school web-site*, 24 Aug. 2007

Oak College was the second independent religious school in the sample. It had the history of being a male single-sex school from 1915 to the 1990’s. In 1992 it established a second campus and in the later half of that decade started admitting young women in Years 11 and 12. It went fully co-educational in 2003, admitting females in Years 7 and 8. Oak College is also the only school in the sample that is a ‘laptop school’, which means it is school policy that all students provide their own laptop computer. The focus is for the computer to be integral in all subject areas. The use (or misuse) of their laptops was a topic of conversation in a number of the student interviews.

Olive

Olive is a coeducational day school situated in the inner-east of Melbourne. It was established in 1942, now has nearly 1050 students from years 3-12 and offers a broad based and comprehensive educational program and a wide range of co-curricular activities including camps, seminars, sporting & cultural activities. Olive College focuses on the worth and contribution of each individual child including those who are highly able or gifted, those who possess moderate to severe learning difficulties, and those who possess moderate to severe mental and/or physical disabilities. The college possesses a strong sense of community and family and is a leading edge school with outstanding results in each of its
VCE years. In recent years 100% of VCE candidates received tertiary place offers.

Olive Community assists a significant number of its families with fee assistance ranging from 10-100% and embraces this as a community obligation – this is separate from our scholarship program. It encourages and fosters the full involvement of its students in Australian life as proud, responsible and committed citizens. The College constantly strives to create an environment of mutual respect and support among staff, parents and students and maintains the flexibility and open-mindedness required to deal with a constantly changing world. It has an energetic development policy with world class facilities

Edited from school web-site*, 24 Aug. 2007

Olive College, an independent school, prides itself on the academic achievement of its students. The Deputy Principal Mr. C., informed that it is the top school for VCE results each year, however in his opinion more students go on to do Commerce and IT than Medicine and Law. The IT classes in the senior school are very small despite excellent IT facilities. The school has digital audio and video studio facilities and incorporate digital music and video in some elective classes. The senior IT teacher is a woman, although the gender mix of other IT staff was not forthcoming.

**Beech**

Beech College is a medium sized, non-selective secondary college in the inner suburban area of Melbourne. Its community is culturally diverse and prides itself on the harmony and tolerance nurtured by the college. The College offers an extensive range of programs supported by talented and caring staff. Students are encouraged to participate in a variety of activities in order to develop their academic, physical, social and cultural skills. Curriculum planning ensures that students can build success and plan for the development of specialized skills in later years of their education.

There is a strong emphasis on students accepting responsibility for their own learning at Beech College. Students are supported in their studies by a framework of administrative and welfare staff who take an active interest in the progress of each individual. Year Level Coordinators, Student Welfare Counselors and other services such as Careers advice are available to assist students maintain their focus on achievement and excellence. Personal values, with an emphasis on accepting others and their differences, are enhanced through students taking positions of responsibility and through participation in a range of extra-curricular
activities such as sports, cultural activities, conventions, camps and excursions.

Edited from school web-site*, 24 Aug. 2007

Beech College was the third non-selective entry government school in the sample. While it fit the criteria for selection in the year that the school was approached, the percentage of students gaining entry to university courses in the following two years would have excluded this school from being part of the original sample. Beech College was located in an Eastern bay-side suburb of Melbourne. It has a strong connection to a Visual Arts College located in the same suburb. In this leafy suburb many students travel to nearby prestigious independent schools.

*URL references available on application to supervisors.
APPENDIX 2: LETTERS OF INTRODUCTION AND CONSENT FORMS

Project: "How girls make decisions about education and careers in information technology"

Introduction
We would like to invite you to participate in our research project. The aim of the study is to investigate what factors affect student career choices at key points in career decision making, as well as on what basis information technology courses and careers are considered or rejected. The research sample will be taken from first-year IT undergraduates at the University of Melbourne and Swinburne University Of Technology as well as a selection of students in Years 8, 10 and 12 at several secondary schools in Melbourne. The Human Research Ethics Committee has approved this project (HREC04000).

What will I be asked to do?
Should you agree to participate, you would be asked to participate in a small group interview with three or four other students from your year level at a time convenient to you. The interviews will be gender separated, that is, only boys or only girls will participate at each time. The interview will be of about 1 hour duration, so that we can get a detailed picture of what factors influence your subject, course or career choices. With your permission, the interview would be tape-recorded so that we can ensure that we make an accurate record of what you say.

How will my confidentiality be protected?
We intend to protect your anonymity and the confidentiality of your responses to the fullest possible extent, within the limits of the law. Your name and contact details will not be kept. In the final report, you will be referred to by a pseudonym. We will remove any references to personal information that might allow someone to guess your identity. The data will be kept securely in the Centre for the Study of Higher Education for five years from the date of publication, before being destroyed.

P.T.O.
How will I receive feedback?

Once the thesis arising from this research has been completed, a brief report will be sent to each university for placement in their library. A copy will also be available to you on application at the Centre for the Study of Higher Education. It is also possible that the results will be presented at academic conferences. An electronic version will be available on my personal website at: http://www.it.swin.edu.au/staff/ciang

Will participation prejudice me in any way?

Please be advised that your participation in this study is completely voluntary. Should you wish to withdraw at any stage, or to withdraw any unprocessed data you have supplied, you are free to do so without prejudice. The researchers are not involved in the ethics application process. Your decision to participate or not, or to withdraw, will be completely independent of your dealings with the ethics committee, and we would like to assure you that it will have no effect on any applications for approval that you may submit.

Where can I get further information?

Should you require any further information, or have any concerns, please do not hesitate to contact either of the researchers on the numbers given above. Should you have any concerns about the conduct of the project, you are welcome to contact the Executive Officer, Human Research Ethics, The University of Melbourne, on ph: 8344 7507, or fax: 9347 6739.

How do I agree to participate?

If you would like to participate, please indicate that you have read and understood this information by signing the accompanying consent form and returning it in the envelope provided. The researchers will then contact you to inform of a mutually convenient time for the group interview.
Consent form for persons participating in research projects

PROJECT TITLE: “How girls make decisions about education and careers in Information Technology”

Name of participant:

Name of investigator(s): Ms Catherine Lang & Professor Craig McInnis

1. I consent to participate in the project named above, the particulars of which consists of a group interview that will be tape-recorded, have been explained to me. A written copy of the information has been given to me to keep.

2. I acknowledge that:
   a. I have been informed that I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data previously supplied;
   b. The project is for the purpose of PhD research.
   c. I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements.

3. I consent to interviews being audio-taped, understand that participants will be referred to by pseudonym if required in any publications arising from the research.

Signature __________________________ Date __________
(Participant)

Signature of Parent (if participant is under 18 years of age.)

Signature __________________________ Date __________
(Parent)
APPENDIX 3: UNIVERSITY STUDENTS INTERVIEWED, COURSES ENROLLED IN, AND SHORT PROFILE.

The tables below provide a short profile of each of the university students interviewed. All names are pseudonyms. The first column indicates how the degree program was grouped according to the classification provided Chapter 8: Technical (T); Business (B), Multimedia (MM); Double (DD). The second column provides the full name of the degree program, the third column the pseudonym of the student, and the fourth column the short family and study profile.

### Technical University - Males

<table>
<thead>
<tr>
<th>DD</th>
<th>Bachelor of Information Systems/ Bachelor of Business (Double Degree)</th>
<th>Raymond</th>
<th>Indonesian. Completed secondary education in Singapore. Rejected from two larger research universities before being accepted to this one. Plans to return to Indonesia and manage father’s business.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM</td>
<td>Bachelor of Multimedia (Networking major)</td>
<td>Kamphone</td>
<td>Laotian background with family now in USA, Canada and France. Has Australian permanent residency. Selected this course straight from secondary school.</td>
</tr>
<tr>
<td>MM</td>
<td>Bachelor of Multimedia (Marketing major)</td>
<td>Alex</td>
<td>First generation Australian from Greek heritage. Selected this course after completing two TAFE diplomas, both IT related.</td>
</tr>
<tr>
<td>MM</td>
<td>Bachelor of Multimedia (Networking major)</td>
<td>Kang</td>
<td>Indonesian with family in Indonesia. Has Australian permanent residency. Selected this course to ‘show parents he is good at something’. Brother studying in USA.</td>
</tr>
<tr>
<td>T</td>
<td>Bachelor of Science (Computing)</td>
<td>Rod</td>
<td>Australian. Selected this course after completing TAFE Diploma. Passionate computer-game player.</td>
</tr>
<tr>
<td>MM</td>
<td>Bachelor of Multimedia</td>
<td>Yun</td>
<td>Indonesian Chinese. Completed some secondary schooling in Malaysia and has a sister studying in New Zealand. Selected this course based on exemptions offered for prior study in home country.</td>
</tr>
<tr>
<td>T</td>
<td>Bachelor of Science (Computer Science and Software Engineering)</td>
<td>Len</td>
<td>Australian. Selected this course straight from secondary school, an independent single-sex school. Father works as computer programmer.</td>
</tr>
<tr>
<td>T</td>
<td>Bachelor of Science (Computer Science and Software Engineering)</td>
<td>Thomas</td>
<td>Australian. Selected this course straight from secondary school, a government co-educational school. Mother works as computer programmer.</td>
</tr>
</tbody>
</table>
### Technical University – Females

<table>
<thead>
<tr>
<th>T</th>
<th>Bachelor of Science (Computer Science and Software Engineering)</th>
<th>Lynnette</th>
<th>Australian. This course is the third university course she has started. Was seeking ‘creativity and logic’.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM</td>
<td>Bachelor of Multimedia (Marketing major)</td>
<td>Jin Lei</td>
<td>Singaporean. Selected this course after three years in the workforce an event organiser in Singapore. Complete TAFE level diploma qualifications in Singapore.</td>
</tr>
<tr>
<td>DD</td>
<td>Bachelor of Information Systems/ Bachelor of Business</td>
<td>Diane</td>
<td>Australian. Selected this course after 15 years working in accountant’s office. Confidence built through office applications.</td>
</tr>
<tr>
<td>MM</td>
<td>Bachelor of Multimedia (Marketing major)</td>
<td>Sui Lin</td>
<td>Indonesian Chinese. Selected this course after completing TAFE level qualifications in Indonesia.</td>
</tr>
<tr>
<td>DD</td>
<td>Bachelor of Information Systems/ Bachelor of Business</td>
<td>Amy</td>
<td>Kenyan. Selected this course straight from secondary school. Attended Australian single-sex independent school for last two years.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Technology (scholarship course)</td>
<td>Sally</td>
<td>Australian. Started in Computer Science in another university, and then transferred to this course. Confident IT user.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Technology (scholarship course)</td>
<td>Rachel</td>
<td>First generation Australian from Asian heritage. Selected this course straight from secondary school, an independent single-sex school.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Technology (scholarship course)</td>
<td>Soula</td>
<td>First generation Australian from Greek heritage. Selected this course straight from secondary school, independent single-sex school.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Technology (scholarship course)</td>
<td>Lin Mai</td>
<td>First generation Australian from Asian heritage. Selected this course straight from secondary school, co-educational government school.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Technology (scholarship course)</td>
<td>Mandy</td>
<td>Australian. Selected this course straight from secondary school, co-educational government school.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Technology (scholarship course)</td>
<td>Jenny</td>
<td>Australian. Selected this course straight from secondary school, single-sex independent school.</td>
</tr>
</tbody>
</table>
**Research University – Males**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Program</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD</td>
<td>Bachelor of Geomatic Engineering/Bachelor of Information Systems</td>
<td>Bin Tan</td>
<td>Malaysian Chinese. Selected this course after completing secondary school in Singapore. This course was second to Engineering/Commerce.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Harja</td>
<td>Indonesian Chinese with Australian permanent residency. Selected this course after unsuccessful application for Bachelor of Commerce.</td>
</tr>
<tr>
<td>DD</td>
<td>Bachelor of Geomatic Engineering/Bachelor of Information Systems</td>
<td>Andrew</td>
<td>Australian. Selected this course straight from secondary school, a single-sex independent school. University reputation paramount in choice of course.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Adam</td>
<td>Australian. Selected this course straight from secondary school, a single-sex independent school. Selected this course after unsuccessful application for Bachelor of Commerce.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Simon</td>
<td>Australian. Selected this course straight from secondary school, a single-sex independent school. Selected this course after unsuccessful application for Bachelor of Commerce.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Yonis</td>
<td>First generation Australian of Greek heritage. Selected this course straight from secondary school, a single-sex independent school. Selected this course after unsuccessful application for Bachelor of Commerce.</td>
</tr>
<tr>
<td>DD</td>
<td>Bachelor of Science/Bachelor of Information Systems</td>
<td>Ammer</td>
<td>First generation Australian of Turkish heritage. Selected this course straight from secondary school, a government co-education school.</td>
</tr>
</tbody>
</table>
## Research University – Females

<table>
<thead>
<tr>
<th>Degree</th>
<th>Course Details</th>
<th>Name</th>
<th>Background/Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD</td>
<td>Bachelor of Commerce/ Bachelor of Information Systems</td>
<td>Ransirini</td>
<td>Malaysian. Selected this course straight from secondary school in Malaysia.</td>
</tr>
<tr>
<td>DD</td>
<td>Bachelor of Commerce/ Bachelor of Information Systems</td>
<td>Tian Xia</td>
<td>First generation Australian from Asian heritage. Selected this course straight from secondary school, a government co-educational school. Avid computer game player.</td>
</tr>
<tr>
<td>DD</td>
<td>Bachelor of Commerce/ Bachelor of Information Systems</td>
<td>Zhen</td>
<td>Chinese. In final year course. Commerce was the first choice. Had failed IS in first year and was now completing the IS part of the double degree.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Alison</td>
<td>First generation Australian from Greek heritage. Selected this course straight from secondary school. Father works in IT and strongly influenced her decision to study this course.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Bin Bia</td>
<td>Chinese. Selected this course straight from secondary school in China. Growth in e-Commerce in China was motivation for this course.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Julianne</td>
<td>Singaporean. Selected this course after unsatisfactory experience studying computer science in USA.</td>
</tr>
<tr>
<td>B</td>
<td>Bachelor of Information Systems</td>
<td>Arlena</td>
<td>Indonesian with Australian permanent residency. Selected this course straight from secondary school.</td>
</tr>
</tbody>
</table>
Author/s:
Lang, Catherine

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