EXPERIENTIAL FACTORS WHICH INFLUENCE HOW FEMALE STUDENTS PERCEIVE COMPUTING AND COMPUTING CAREERS AT DIFFERENT STAGES IN THEIR EDUCATION

By

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A thesis submitted for the degree of Doctor of Philosophy

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December, 2009

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ABSTRACT

FACULTY OF ENGINEERING, SCIENCE AND MATHEMATICS

SCHOOL OF ELECTRONICS AND COMPUTER SCIENCE

Doctor of Philosophy

EXPERIENTIAL FACTORS WHICH INFLUENCE HOW FEMALE STUDENTS PERCIEVE COMPUTING AND COMPUTING CAREERS AT DIFFERENT STAGES IN THEIR EDUCATION

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The declining numbers of women in computing is a cause for concern for those in education and the IT industry alike. The need for a diverse workforce is necessary in order to have a creative balance in the IT Industry. The reasons for this decline are varied and can be attributed to factors such as the media, schooling or parental influences. This thesis specifically investigates how young people experience computers both in school and out of school, and how this influences the way in which they perceive the IT industry as well as its impact on career decisions.

Questionnaires were used to provide statistical outcomes, and interviews were conducted to probe deeper into the thoughts and feelings of GCSE level, A-level and degree-level male and female participants.

It was clear from the results of the study that both male and female students have very different experiences of computing, which inform their perceptions of the IT industry, whilst role models, such as parents, influence career decisions. It was clear that where female students had a positive and exploratory experience of computers and positive role models, they were more likely to consider computing as a career. It was also significant that out of school experiences, which differed between the genders, proved to be the most influential.

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Acknowledgements

I would really like to thank Wendy Hall and Su White for their supervision. This included answering of my many emails, listening to me rant and inspiring me. It took a lot of guidance, patience and support to get me to actually focus and write up this thesis. I would also like to thank Alison Fuller, my advisor, who pointed me to various articles and gave me the opportunity to work on the Computer Clubs for Girls Evaluation project. It was fabulous.

I would like to thank Mark Weal, Brenda Johnston and EA Draffan for reading early drafts of my work and for their ongoing support throughout this process.

I am lucky enough to have had the support of the most fabulous people who have kept me sane (not sure if they did this task very well), made me cups of tea, listened to me and told me to shut up and get on with my thesis: my best mate Melissa Stepney, Clare Owens, Annette Marie Collins, Woody, the mighty Sue Black, the fabulous Dr Onjira, Melike Sah, Noura Abbas, Sally, Joyce Lewis (thank you for introducing me to the Christian Bale anger management programme ☺), James Llewellyn, Rikki Prince, Sophie White, Beth Ricketts, Eric Cooke, Lauren Dampier and Jane Morgan.

I am very grateful to Hugh Davis and the Learning Societies Lab who have supported me, allowed me to send them spam to publicise various Women in Computing events and did not complain too much when my desk was messy. My thanks also go to BCSWomen, ECSWomen and the LSL Breakfast group. These networks were not only amazing as displacement activities but also for support. In particular I would like to thank Karen Petrie, Hannah Dee, Margaret Ross, Kate McArthur and Mair.

This thesis would not have been completed without the teachers, pupils, lecturers and university students who participated in the questionnaires and interviews. They have given me a real insight into their lives. I sincerely hope I have done their stories justice.

Definitions and Abbreviations Used

BCS	British Computer Society
CC4G	Computer Clubs for Girls
DES	Department for Education and Science
DTI	Department of Trade and Industry
IT	Information Technology
JQC	Joint Qualifications Council
NCC	National Centre of Computing
QAA	Quality Assurance Agency
QCA	Qualifications and Curriculum Authority
SET	Science Engineering and Technology
SSDA	Sector Skills Development Agency
STEM	Science, Technology, Engineering and Maths
UCAS	University and College Admissions Service

Chapter 1 Introduction

'Computing is too important to be left to men.'

Karen Spärck Jones (2007)

1.1 Introduction

Chapter 1 gives the background and motivation to this thesis. This chapter begins by presenting three scenarios that introduce the different ways in which female students can be influenced to be persuaded or dissuaded at different stages of their IT and computing education: GCSE level, A-level and degree level. The IT industry, computing, and Information Technology at higher education will next be defined to give context to this thesis and the chapter concludes with the research questions, research contributions and the structure of this thesis.

1.2 Scenarios

The scenarios provide an indication of the experiences and perceptions of the participants within this study. Emily, Tianna and Sophie are three female students at GCSE level, A-level and degree level respectively. They have all experienced using computers at school and at home. They have different perceptions of the IT industry based on their prior experiences of computers and may or may not aspire to work in the IT industry. When considering the scenarios, the following questions need to be considered.

How does the magnitude of their experience influence the way in which they think about technology as a career option? How would this influence their views? How will their

experience in a school environment and a non-school environment influence decision-making? How much will experiences of computers influence their perceptions of the IT industry? How much will these perceptions drive them to make decisions about how they could potentially contribute to the IT industry? Does computing not appeal to them because they are female or because they do not like computing? Or will it appeal to them?

Scenario 1: Emily Smith, 16 year old female student, studying GCSE ICT.

Emily Smith is currently studying for her ICT GCSE at a modern comprehensive. GCSE ICT is compulsory for all students at Emily's school. She feels that the course is useful but is unsure whether she would like to study A-level IT or computing as she does not think the course would be helpful for her career. She also feels that the course would be difficult to get a good grade in as she does not understand what the different modules are about. In addition, Emily does not feel that the course will 'suit' her personality as she prefers working with people. She does not find GCSE ICT too difficult, but feels the lessons are repetitive and can get a little tedious. Emily does not see herself working in a technical computing job because she feels that it would be lonely and boring. At home Emily enjoys using the computer to stay in contact with her peers via e-mail, MSN and MySpace. Emily likes to make sure that her MySpace page is kept up-to-date with her photos and that the MySpace page matches her personality. She does this using online tools which allow her to customise her page. She often discusses tips on how to do this with her peers. She prefers to use the computer on her own in her bedroom as it is more private. Emily's parents encourage her to pursue a career which will exploit the creative side of her personality and have indicated that an office job where she has to 'sit in front of the computer' may not be suitable for her. Emily is still unsure of her A/S level options but does not think IT or computing are strong contenders.

Scenario 2: Tianna Ramsey, 18 year old female student, studying computing A-level.

Tianna Ramsey is currently studying computing A-level at sixth form. The course is manageable but she is finding her programming coursework really difficult. She decided to study computing at A-level because she enjoyed her GCSE ICT course and wanted to learn more. Her teacher encouraged her to study computing as she received a high mark in her GCSE ICT course. She decided not to drop computing at A/S level because she got a B grade her exam. Despite this, she feels that computing is not something she would like to do in the future because her programming coursework is complicated. Tianna does not feel supported on her course and is intimidated by the others in her class. Since she began the second year of the course, the other female students in her class have dropped the course, leaving only two other females. Tianna enjoys using the computer at home to communicate with her friends via e-mail, MSN and Facebook. She prefers to use the computer alone in her room for privacy. Her parents are supportive of her but have indicated that they feel that the computing A-level maybe too stressful for her. Tianna does want to go to university but is unsure of what course to take. She feels that computing will be too difficult for her at degree level and believes that she would not be able to cope if she was to have a job in the IT industry.

Scenario 3: Sophie Cowell, 20 year old female student, studying computer science.

Sophie Cowell is in her second year of studying computer science at university. Sophie found her course challenging during her first year because she was introduced to concepts which were new to her. She found programming difficult but she persevered and started to enjoy this aspect of computing. She soon realised that there was more to computing than just programming. Sophie decided to take computing at degree level because she was advised to by her teacher and her family. She had not taken computing at A-level and did not know much about the subject. Before she considered computing as a degree course, she felt that it would not suit her as she did not like the idea of sitting in a dark room programming. Sophie's father works at the local science park and understood her love for problem solving as she was thriving at A-level maths. He was worried about her career prospects if she took maths at university. He advised Sophie to think about computing and they went to different open days to get more information about the course. Sophie felt it was the right option because it had a combination of problem solving and logic. She felt that it would be difficult because she didn't have a programming background but felt supported to take the course. Sophie prefers to use the computer at home but also in the computer lab, where she feels she can get help with her coursework and be with her friends. She is not obsessed with the computer and is not bothered about how fast it is but is concerned about how she can make things work in the most effective way for the brief she has been given. She is aware that there is a gender imbalance on her course but she has got used to this and feels that it is not a problem most of the time. Sophie would like a job in the IT industry but is unsure of what she would like to do.

The scenarios posed above provide a snapshot of how female students at different stages of their education feel about their IT and computing experiences and how they perceive their future in the IT industry. Sadly, in a society that is driven by technology, Emily (GCSE) and Tianna (A-level) in the scenarios above do not perceive the IT industry to be a positive place.

Understanding how female students of different ages view the IT industry, how they experience computers at different ages, and what influences them to consider IT or Computing as an option for higher education is important if we want a balanced workforce in the IT sector. As it stands, the numbers of women in the IT industry are declining. The percentage of women in the IT industry has fallen by 4% since 2004 which means that only

21% of the IT workforce is female (BCS, e-skills and Intellect 2009). This thesis aims to explore how women experience computers at different ages and how this influences attitudes to taking IT at university and as a career.

1.3 Setting the scene

The shortage of women in the IT industry has been a cause for concern for those in education and industry alike. Those in the IT industry are developing life changing tools, applications for health, education and other areas. The concern is that women are not able to contribute and influence the way in which these tools are created (Greenfield, 2002).

The shortage of women in computing has been especially noticeable in the last five years where there has been a significant decline of women in technological roles (Faulkner and Lie, 2007). This has contributed to a skills shortage in the information technology sector (RAENG, 2003; TUC, 2008), which is prominent both in the UK and globally (NCC 2008).

The consequence of the recession has meant that many people working within sectors such as finance and those in the public sector are at risk of losing their jobs. However, jobs within computing and IT are described to be safer than others during the recession (NCC 2009). More specifically, the types of IT jobs which are least likely to be affected are those in software testing, IT security, web designing, project management and business analysis (Walters 2009). Although IT jobs are described to be 'safer' there are still shortages within the IT industry. In a recent report conducted by the national survey of IT salaries and employment trends, it was found that shortages in the UK IT industry have jumped from 4.2% to 6.8% in 2009 (NCC, 2009). The UK IT industry is predicted to need between 156,000-179,000 people for new and replacement jobs in the next ten years (Frazer 2007). However, in 2005 the total number of IT related graduates (those studying computing or information technology) was 15,930 and only 30% (4,779 graduates) of these decided to go into the IT industry.

Despite this, another 'symptom' of the recession is that women's jobs, on the whole, are more likely to be affected than in previous recessions. This is evidenced by the higher female redundancy rate since the beginning of 2008: an increase of 2.3%, which is almost double that of redundancy rates for males (TUC, 2009). The figures so far have shown that the numbers of women in the IT industry and the need for women in the IT industry is evident.

Higher education is also experiencing a decline in the numbers of female students opting to study computing. The University Central Admissions Service (UCAS) figures state that the numbers of female students choosing to study computing at higher education is at 7% (UCAS 2008). Nevertheless, enrolments on maths degrees are up by 8% and engineering subjects are up by 6.4% (HEFCE, 2008).

The issue has been a prominent one for the last two decades. Over twenty years ago, Lovegrove and Hall documented this in the paper '*Where have all the girls gone*' (Lovegrove and Hall 1987). Their findings showed the numbers of women were high but, after a significant decrease of numbers and despite initiatives, there was still no significant increase in the number of women choosing to study computing at undergraduate level. Chapter 2 focuses further on this.

The issue is also one which exists globally. The number of women choosing to study computing at university is low in the UK in comparison with universities around the world (Galpin 2002). Factors such as education policy, attitudes to science, and facilities available may contribute to the low figures. Table 1-1 compares the UK with other countries. The information is extracted and adapted from a recent study compiled by the Anita Borg Institute in the United States (Simard 2006).

Country	**Percentage of women in higher education studying computing**
United Kingdom (2006)	**7%**
America (2007)	28%
Australia (2006)	25%
India (Bombay ITT)	8%
Canada (2005)	19.9%
Pakistan (2002)	18.2%
Turkey (2002)	20.2%
Africa (2000-2005)	8%

Table 1-1 Percentage of women globally studying computing at higher education (Simard 2006)

There are various reasons for the low number of women choosing to study IT at higher education, such as negative perceptions of working in the IT industry (Hellens, Pringle, Nielsen and Greenhill 2000; Nielsen, Hellens and Wong 2001), the idea that working in the IT industry involves solely programming (Grant, Knight and Steinbach 2007), or simply that IT is just for men (Christie, 2005). There are also educational factors. According to research

by the Sector Skills Development Agency, girls lose interest in IT lessons between the ages of 10-14 based on their perceptions of careers in computing (Helmsley-Brown and Fosket 2001; SSDA 2004). At the age of 14, pupils would not have experienced computing concepts at school (such as programming) or experienced the IT industry (unless they had some kind of work experience). This means that they have had to rely on the images of computing which have been conveyed to them. It is also at this age that pupils have to make educational choices as to whether to continue with IT or computing at school. This thesis will focus on the female students' educational experiences at school and outside of school, in order to understand how they influence perceptions and future career plans in the IT industry. The next sections go on to provide the research questions for this thesis.

1.4 Research Questions

The main research question in this thesis is:

'*How does experience impact the way in which female students at different educational stages perceive their futures in the IT industry?*'

In order to help answer this, four sub-questions were identified, which are under the headings 'perceptions' and 'experiences'.

Experiences

I. How does the IT experience in formal education shape the way female students at different educational stages view the IT industry?
II. How does the IT experience *out of a formal education setting* shape the way in which female students at different educational stages view the IT industry?

Perceptions

III. How do female students at different educational stages perceive the IT industry?
IV. How do female students at different educational stages perceive themselves in the IT industry?

Through understanding the ways in which young people experience computers at school and at home, this thesis has identified how women perceive their futures in the IT industry. The wider implications of this thesis aim to provide a basis for recommendations to schools in order to help recruit and retain women in computing by broadening their computing and IT experience.

1.4.1 Scope of thesis

This research is based on the UK education system and the results are specific to that. There are trends that may mirror and reinforce those in other education systems around the world but the contributions found in this thesis are specific to courses that took place in the UK during 2007-2008. Therefore, this thesis provides status on student experiences and highlights factors that could dissuade or encourage female students from further study or careers in the IT industry.

1.5 Contribution

The research in this thesis illustrates the way in which young people experience computers and how this influences the way they perceive the IT industry. In essence, this research provides insights into what factors influence females to study computing and carry on to studying computing or IT at university. The researcher believes her key contributions are as follows.

I. The type of course in IT or computing previously experienced had an impact on whether female participants decided to continue with further IT and computing courses.

The results of this thesis have shown that the courses taken by participants either at GCSE or at A-level had a direct impact on whether female students decided to continue studying IT or computing at A-level or degree respectively. GCSE level participants generally found their course boring and found it difficult to understand what they would learn from further courses in IT. Those female participants who took A-level *IT* were far more likely to continue on to study it at degree level because they enjoyed the course and were able to understand how it related to the IT industry. However, female participants who took A-level *computing* were far less likely to continue to a computing degree because they found the programming module difficult and did not understand how the concepts of the course related to the real world.

II. Female participants were more likely to study maths than computing at A-level and parents influenced them to study computing at university.

Female participants studying computing at degree level did not rely on their previous experiences of computing when they were deciding whether to take computing at university. The majority of female participants did not study A-level computing but entered their degrees with A-level maths, and it was their parents who persuaded them to study computing at university.

III. Classroom atmosphere has an influence on female participant's opinions on the IT industry as well as their confidence levels.

The atmosphere of the classroom or learning environment has an influence on the opinions of female students on the IT industry, as well as confidence levels. In particular, this related to females on A-level computing, who found the lessons difficult. They felt intimidated by the number of male students in the class and felt they did not receive the right type of support. Participants taking the A/S level course indicated that they would not continue to the A-level course as they felt neglected and isolated.

IV. Parents/guardians heavily influenced the views of female participants to continue to study computing or IT at degree level.

The influence of parents/guardians was high, persuading or dissuading female participants to continue or begin to study computing or IT at university. This was done in two ways: first, by introducing their daughter to computers, getting them to help with setting it up and generally encouraging an interest in computing, secondly, through helping their daughters to research computing and IT degrees at university. All female participants studying computing degrees said that they would not do this course if their parents had not supported them. A recent study conducted by the British Computer Society (BCS) found that girls were interested in computers but they would not like to pursue it as a career path (Georgiou 2005). This research extends those findings by demonstrating that if females have support and guidance then they are more likely to follow this through.

V. **There is a distinct difference between the way in which male and female participants used the computer at home and this influenced attitudes on IT careers and courses.**

Positive experiences involved varied prior experiences of computers; these included game playing, social networking and using the computer with friends. The majority of girls questioned, who did not perceive themselves in the IT industry, said that they only used the computer for homework and social networking. Those that did perceive themselves in the IT industry were exposed to other things such as game playing and information about IT careers. These were the types of experience which were active learning ones and involved the process of reflection, understanding of how what they were doing could apply to the wider world, and the complexity of what they were doing.

VI. **Views and perceptions of the IT industry and courses changed as female participants became older because they became more realistic and more positive than younger participants.**

Views and perceptions of the IT industry changed and developed as female participants became older, and they became more realistic. The older participants had a broader experience of computers at school, whereas younger participants had to rely on skills-based experience from school. As participants became older, they were more likely to want to work in the IT industry.

The next section describes how the IT industry and Computing at higher education will be defined in this thesis.

1.5.1 Defining the IT industry and Computing in higher education

Defining the IT industry

Defining the IT industry is problematic because it is ever changing. It has a number of meanings depending on the person or context. The levels of experience and knowledge often define what the IT industry means to individuals. The IT industry for this thesis is defined according to the Skills Framework for the Information Age (SFIA) framework. The SFIA framework provides a reference model in order to identify skills to develop and work in the

IT industry[1]: '*strategy and planning, development, business challenge, procurement and management support and ancillary skills'.* The SFIA framework is regularly updated. The framework is publicly available, described in depth in chapter 3, and is presented in figure 3-7.

Defining Computing and IT at higher education

Computing and Information Technology at higher education are defined (for the purpose of this thesis) according to the Qualifications Assurance Agency (QAA) (see Table 1.2). The QAA calls Information Technology courses 'Information Systems' and it is under the Computing category. For this thesis, we will be using the term Information Technology (IT). The terms 'computing' and 'computer science' will be used interchangeably in this thesis.

Computing and Computer Science	*Degree programmes in computing include study of the nature of computation, with effective ways to exploit computation, and with the practical limitations of computation in application terms. The concept of computational thinking captures these concerns. Computational thinking is a basic analytical ability that has relevance (which every computing graduate should recognise) in many aspects of everyday life. (QCA 2007)*
Information Technology	*Theoretical underpinnings. Data, information and knowledge management. Information in organisational decision making. Integration of information systems with organisational strategy and development. Information systems design. Systems approaches. Compression technologies. Development, implementation and maintenance of information systems. Information and communications technologies (ICT). Decision support. Management of information systems and services. Content management systems. Organisational and social effects of ICT-based information systems. Economic benefits of ICT-based information systems. Personal information systems. Digital libraries. (QCA 2007)*

Table 1-2 Definitions of Computing, Computer Science and Information Technology

1.6 Thesis structure

This section presents an outline of the chapters in this thesis.

[1] SFIA provides a framework of reference of IT careers http://www.sfia.org.uk/.

Chapter 2: Women in computing: Literature review: This chapter explores why there is a lack of women in the IT industry and the longstanding nature of the issue.

Chapter 3: Perceptions of the IT industry: Literature Review: This discusses the way in which the IT industry is perceived by young people, and how these perceptions differ to the way in which the IT industry is defined by professional bodies. Chapter 3 provides a background to the research questions focusing upon perceptions.

Chapter 4: Experiences of computers: Literature Review: This explores the way in which young people use computers in both school and outside of school. Chapter 4 provides a background to the research questions focusing upon experiences.

Chapter 5: Research design: This chapter explores the key research questions and describes the methods used to investigate them. The design of the study takes a mixed method approach (questionnaires and interviews). This discussion is followed by an account of how the study was conducted.

Chapter 6: GCSE level results: The results from the GCSE level participants are presented in the form of four themes: experiences of computers at school, experiences of computers out of school, future career plans and perceptions of the IT industry.

Chapter 7: **A-level results:** This presents the results for the A/S level, A-level computing and IT participants. As with chapter 6, the results are presented in the following themes: experience at school, experience out of school, future career plans and perceptions of the IT industry.

Chapter 8: Degree level results: This chapter provides questionnaire and interview responses from degree level participants studying IT and computing at the University of Southampton, at South Bank University and at Solent University. The results are presented in the following themes: experiences at university, experiences out of school, perceptions of the IT industry and future plans.

Chapter 9: Discussion and Conclusion: This discusses the results and their importance to the current work in this field. This chapter presents recommendations and future work.

1.7 Declaration

This thesis describes the research undertaken by the author while working within a collaborative research environment. This report documents the original work of the author except where stated.

1.8 Conclusion

Chapter 1 has given a background and motivation to this thesis. It has presented three scenarios of female students studying GCSE ICT, A-level computing, and degree level computing. The scenarios gave an insight into how female students at three different stages of their education experience and perceived their future in the IT industry. The scenarios emphasised how there are various factors that could dissuade or encourage female students to think about careers in the IT industry.

The chapter emphasised the significant shortage of women in the IT industry. This is a longstanding issue and, despite initiatives, there has been no significant increase in numbers of women joining the IT industry for the past two decades. It provided a definition of the IT industry (SFIA framework) and IT and computing using the QAA definition.

The chapter provided the research questions, which aim to investigate how experiences out of school and within school influence female students to perceive themselves in the IT industry. The chapter gave an outline of the contributions within this thesis and provided the thesis structure.

Chapter 2 presents a literature review highlighting the reasons why there is a lack of women in computing.

Chapter 2 Women in Computing: Literature Review

'If it ain't broke, take it apart and fix it'

Thinkgeek.com (2009)

Chapter 2 presents a literature review that explores why there is a lack of women in the IT industry and the longstanding nature of the issue. The chapter begins by demonstrating the social and economic need for more women to enter the IT industry. It then explores the way in which computers were introduced into schools and how this has contributed to the declining numbers of women entering the IT industry. The various causes are then discussed for women being dissuaded from pursuing a career in the IT industry, which include: the influence of parents, the influence of the media, the perceived geek culture, personal interest in computers, personal confidence, ability with computer games and the influence of teachers. The Sex Discrimination Act is investigated as well as its role in this issue. The chapter concludes with an outline of current initiatives to help recruit and retain women in computing.

2.1 The need for more women in computing

The under representation of women in computing has been cause for concern in western countries for social and economic reasons. A recent report published jointly by Intellect and the BCS states that in 2001 in the UK, the number of women in the IT industry had fallen by 4% since 2004,which means that only 21% of the IT workforce is female (BCS, e-skills and Intellect 2009). The decline in numbers women entering the IT workforce is detrimental to

the UK since the country is reliant upon a sufficient supply of scientists and technology specialists to boost its economy (Harding 2009). The low numbers of women choosing to enter the IT workforce has contributed to a skill shortage within the IT industry in particular and it is therefore essential that numbers of women in the IT industry are increased (Bacon, MacKinnon, Hollis and Cadby 2008).

There are various reasons for the lack of women in the IT industry. Often cited is the perception that jobs in the IT industry are geeky or just for men (Trauth 2002). The lack of interest in IT careers or courses is said to begin from an early age. Girls typically lose interest between the ages of 10-14 (SSDA 2004)[2]. Although some girls are not interested in ICT, a high number of girls are choosing to take the GCSE ICT short course, which is a half GCSE and only requires the commitment of one lesson a week.

Despite this high number of girls taking ICT at high school, the numbers decrease at college and then at university level. Camp (1997) describes the problem as the 'Shrinking Pipeline' where the numbers of females decrease at each stage in the educational process. Camp's study was conducted in the USA, but the situation is mirrored in the UK. Figure 2-1 shows that in the UK the drop in girls in particular is stark between GCSE level and A-level.

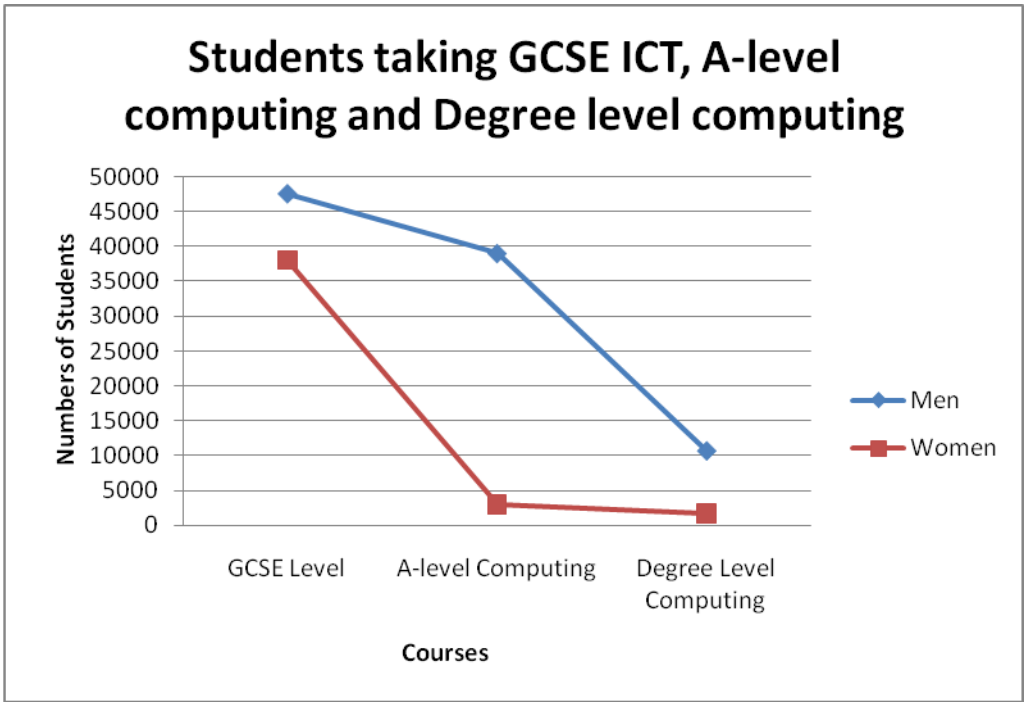


Figure 2-1 Men and women taking GCSE ICT, A-level computing and degree (JCQ 2008; JCQ 2008; UCAS 2008)

[2] Sector Skills Development Agency

However, not everyone sees it this way. Some argue against the need to increase the numbers of women in computing, and barriers are put in place to prevent such an increase. For example, men often do not understand why there is a need to increase the numbers of women in computing or do not understand why there is a need for initiatives. Thus, there exists male disapproval of 'helping' to increase the numbers of women in computing. This is less obvious in academic peer-reviewed articles, but more in blogs, wikis and as 'comments' on online news articles[3].

Socially and economically, it would benefit the UK to increase the numbers of women entering the IT industry. The Greenfield report drew attention to the reasons that the numbers of women in science, engineering and technology need to be increased. These are (Greenfield 2002):

1. Competitiveness: moving the economy forward.
2. Return on investment: cost of training is significantly high and it is vital that good use is made of this investment by retraining women returners.
3. Benefit to science: Exploiting diversity enhances the quality of science, engineering and technology. Through highlighting different aspects of science and by bringing a more varied perspective, a more varied perspective of the outcomes results.
4. Mixed markets and skills: Organisations are missing markets and maybe missing benefits of different aspects of research and its application. In other words, women are not represented in design and development.

This is reinforced by the more recent report 'Women in IT Scorecard', which highlights the fact that the decline of females in computing will have an impact on the IT industry in the next decade, and that the UK needs to increase the number of women in order to drive the IT industry forward (BCS, e-skills and Intellect 2009).

2.2 Long term issues

The UK has long been concerned about the under representation of women in computing. This has not always been the case as women played a significant role in the origins of computing as a field. Initially, the term 'computer' was applied to the woman who performed mathematical calculations by hand for male scientists and for the military during

[3] http://terriko.dreamwidth.org/28709.html

the Second World War (Rossiter 1982). Two examples of notable women are Ada Lovelace who is known as the first programmer as she 'programmed' Charles Babbage's 'analytical engine' (Swade 2000), and the women of Bletchley Park, who during the Second World War made up the majority of staff at Bletchley and were vital to the code-breaking operations which greatly contributed to victory (Hinsley and Strip 2001).

Computing as an academic discipline emerged in the 1960s (Estrin 1996). The paper *Where have all the girls gone?*, written over a decade ago, showed that the numbers of women in computing were a lot higher in the 1970s and early 1980s but took a fall in the mid eighties (Lovegrove and Hall 1987). Figure 2-2 is a taken from the paper and demonstrates the decrease in numbers of women entering computer science courses during that period.

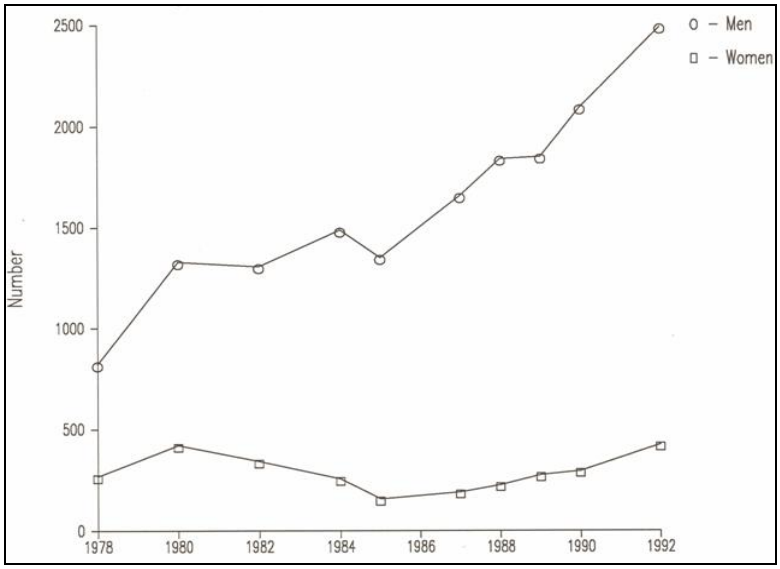


Figure 2-2 Entry into Computer Science courses at UK universities (Lovegrove and Hall 1987)

The numbers of women enrolling for computer science degrees fell dramatically in 1984 and has not yet sufficiently recovered compared to the number of men entering the subject. Unlike traditional academic subjects, computing was made known by entering UK households through electronic gaming consoles and the early PCs. As most computing and gaming activities were created by men, and catered mostly for men, who mostly used game playing as their most prominent application, these did not appeal to women (Rossiter 1995).

2.3 Introduction of computers into schools

Within secondary schools, the gender gap in computing began before computers were introduced into schools. Before the Sex Discrimination Act of 1975, it was common for boys and girls to study separate subjects at school, e.g. cooking for girls and woodwork for boys. After the Sex Discrimination Act was introduced, there was a move in the UK to comprehensive schools, where all pupils, regardless of gender, race, ability and social class, had access to the same educational opportunities (Deem 1981). Girls were also generally underachieving during this period (Byrne 1978). During this period, the majority of girls did not have the opportunity to study 'physical sciences' whilst at secondary school. Girls who had a choice often chose to study biology or opt out of science altogether (Whyte 1986). This is demonstrated in a survey conducted in 1973 by the Department of Education and Science (DES), which found that only 17% of girls were offered the chance to take physics in years 10 and 11 compared with 90% of boys. Of the girls who were offered the chance to take physics, only 17% took this compared with 52% of the boys (Sciences 1975).

It was clear that even with a choice of subjects, there was a distinction between the types of courses boys and girls preferred to take. Ormerod conducted a study into course preferences and choices and found that maths, physics, chemistry and geography were seen as male subjects, whilst biology, languages and art were seen as female subjects (Ormerod 1975). Whyte suggests that this distinction in subject choice was due to the way in which physical sciences were taught in mixed-sex schools (Whyte 1986). It was found by Pratt, Seale and Bloomfield that those in single-sex schools were less influenced by the image of the various subjects (Pratt, Seale and Bloomfield 1984).

In the 1980s, information technology in schools was taught as part of 'craft' subjects and it was not until 1990 that IT became a compulsory subject. Within crafts, there was the option of learning various skills, such as technical drawing and cooking. The introduction of the Sex Discrimination Act in 1975 meant that all craft subjects had to be available to both sexes. To implement the changes, schools had to offer a rotating crafts timetable, i.e. a few weeks for each type of craft. Although this seemed a move forward, the split between boys' and girls' subjects was still evident (Whyte 1986; Forrest 1992). The way in which computers were introduced had detrimental effects on influencing women to take computing, and the way young people enjoyed the subject. The next section focuses on how ICT was introduced into schools.

2.4 The introduction of the national curriculum

During the 1970s and 1980s, there was an increase in funding to get more computers into schools (Fothergill 1981). Maths teachers and computer enthusiasts organised the use of computers in schools and experimented with either the Apricot or the Commodore. However, at the time these computers were not for mainstream use by pupils as they did not have graphics or sound cards and were only suitable for word processing and spreadsheets (Forester 1985). Teachers often selected a few students to be part of computer clubs and to learn more about the computer. These students were most often boys, who were enthused by the computer (Carter and Jenkins 2001).

Computers were introduced into schools for mainstream use in 1984 by the Department of Trade and Industry (DTI) who founded a programme to put a computer into every secondary school. At this stage, local authorities had the choice between the Acorn BBC model B, RM computers and the Sinclair Spectrum. These particular models were chosen because they were British-made and also had good graphics and sound (Boyd-Barrett 1990). By 1986, most local authorities had decided to move to the RM Nimbus, which was based on the Intel 80186 processor. This machine was equipped with a mouse and a windows environment. This was followed by the Acorn Archimedes in 1987, which had 256 colours, graphics, windows icons and a mouse. The variety of machines available proved to be confusing for schools (Bosley-Barrat 1991). However, there were also issues about the use of computers in the classroom as teachers and schools were not trained in their use. This therefore resulted in teachers not feeling confident enough to use the computer in front of pupils (Baker 1983). The DTI provided additional funding to train teachers in computer use. By sending teachers on this training scheme, schools were able to buy computer equipment at half-price. To help train teachers further, local authorities set up information technology centres supported through the Microelectronic Education Programme with advisors (trained teachers) to provide guidance for schools. This programme cost £23 million and trained 100,000 teachers. In 1986, a Microelectronics Support Unit was formed, in order to provide more support and training for teachers. The teachers who were trained initially were the maths teachers who trained the teachers later on. The courses were run after school or during the weekend and lasted two to three hours (Pickford and Hassell 1999).

In 1988, the Unit was merged with the Council of Educational Technology. This helped provide a central focus for promoting the application and development of technology across the entire school system. However, a survey conducted by the DES found that only half of all

teachers had taken the initial computer training and only a quarter had taken some sort of computer qualification. Due to the lack of training in computers, schools may not have been fully prepared for the Education Reform Act in 1988 when computers became an integral part of the school curriculum (Kirkman 1993). Technology improved to the point where PCs came with graphics and sound capabilities as standard. Secondly, Microsoft released a version of Windows that was suitable for use in schools.

Information Technology was a new subject in schools, which was originally placed in the Design and Technology subject area. In fact, the rapid and perceived importance of computers prompted its quick introduction into the UK schools' national curriculum with the idea that it could revolutionise teaching and learning.

To make sure that teaching was adequate, more money was pumped into teacher training. At this stage, the aim was to make sure that pupils were digitally literate. From 1988 to 1992, the DES announced its IT in schools initiatives, which meant that £22 million was made available through local education training grants to support the professional development of teachers. A further £37 million was made available through Educational Support Grants to train advisory teachers who would co-ordinate IT applied to their own subject area. Each education authority had a responsibility to provide for its own professional development. These grants and initiatives were preparation for IT to be launched as a subject in its own right (Pickford and Hassell 1999; Selwood and Pilkington 2005).

In 1990, IT was seen as important enough to be made a 'core' national curriculum subject, which meant that it was examined along with English, Maths and Science. IT was also applied in other subjects to demonstrate its practical application. As computers became easier to use, there was less need to understand how they worked. This gives the impression that the computer was 'just' a tool to perform certain tasks (Opie and Katsu 2000).

Today in the national curriculum, all pupils (regardless of gender) are taught ICT to the same specification (BECTA 2004). During key stage 3 and GCSE level, Microsoft Office is often used in order to help demonstrate the skills being examined. Pupils at this stage in their education are taught to be competent users of a computer, rather than learning about computing itself (BECTA 2004).

Twenty years ago, it was common for boys to be given priority on the computer (Lovegrove and Segal 1991). Today, trainee teachers are made aware of the enthusiasm of boys on the computer and are advised to give an equal chance to both boys and girls in the classroom (Sampson 1999). However, there are still many instances where boys are more

dominant on the computer and the teacher reinforces this behaviour by not encouraging girls to push forward (Fossum, Voyles and Haller 2007).

2.5 Factors influencing educational IT career choices for women

2.5.1 Social influences

Parents

Parents are able to influence the way in which young people feel about certain careers (Ozdemir and Hacifazlioglu, 2008; Thomas and Webber, 2009). In a study by the Institute of Employment Studies on the influencing factors of Science Engineering and Technology (SET) career choices, it was found that children from a young age (eight) pick up ideas about careers and occupations from their parents. This is to the extent of being able to hold stereotypical views about certain careers at this stage; the younger the child, the greater the parental influence (Skelton and Hall, 2001). Boys are far more likely to be aware of occupational stereotypes than girls are, especially regarding jobs which are stereotypically for girls and jobs which are stereotypically for boys (Pollard, Jagger, Perryman, Gent and Mann, 2003). The occupations of fathers are seen to be important for women, since those who decide to choose to go into non-traditional careers are heavily influenced by their fathers (Blattel-Mink, 2002). The strong support of mothers was also seen as important for females wanting to pursue a career in science and technology (Breakwell, 2001). Although the views and opinions of parents were influencing factors in decision-making, parents themselves do not feel they are well informed about careers in SET and did not feel that this was a viable long-term career for their children (ETB, 2005).

Media

According to studies conducted by Gatewood, Gowan and Lautenschlager (1993), the media portrays negative images of the IT industry. The findings emphasise that the more exposure someone has to real information, the more accurate is their image of that particular career (Gatewood, Gowan and Lautenschlager 1993).

Computing on television does not portray the dynamic pace that the IT workplace boasts (Lister 2005). Instead, it focuses on making fun of the IT geek image. An example of this is a television series called the ‘IT Crowd’, which is a programme about a technical

support team set in a basement. This denotes a darkened room and the unglamorous side of the IT industry, as described by Margolis and Fisher (2003).

Margolis and Fisher also found that in the USA, those who understood the positive aspects of computing were able to look past the stereotypes. The study asked females (studying computing) if they were a 'geek' and found that females denied it stating that they enjoyed computing but they did not let it take over their lives like 'they' [geeks] did. Females who were informed and understood the virtues of computing paid less attention to its image (Margolis and Fisher, 2003).

Perceived Geek Culture of ICT

There is a perception that there is a prominent male geek culture present in the IT industry (Clayton, Hellens and Nielson, 2009) and this could be a factor in dissuading girls to opt out of computing careers and courses (Myers and Beise, 2001). Women scientists are viewed in a negative way by both men and women. It was found that the perception of a female chemistry student was negative, with men saying that they would not like to go out with her and female participants indicating that she would not have a fulfilling career (Brownlow, Smith and Ellis 2002).

2.5.2 Experience and attitudes

Interest and Enthusiasm

It is apparent from a number of studies that boys have far more interest and enthusiasm for computers and ICT lessons than girls (Rommes, Overbeek, Scholte, Engels and Kemp 2007). There is a strong correlation between those who are enthusiastic about computers and those who are also interested in computers (Comber, Colley, Hargreaves and Dorn 1997; Colley and Comber 2003). There have also been studies, which have unfortunately found that computer enjoyment and interest decreases as age increases for boys and girls, but this is more extreme for girls (Camp 1997; Schumacher and Morahan-Martin 2001).

Confidence, Anxiety and Self Efficacy

Confidence is said to be a factor in dissuading girls from enjoying the computer (Brosnan 1998; Levine and Donitsa-Schmidt 1998; Margolis and Fisher 2002; Cooper 2006). However, confidence increases as experience and knowledge increases (Margolis and Fisher 2002). According to Cooper and Weaver, girls prefer not to use the computer in front of

others as they are anxious about making mistakes (Cooper and Weaver 2003). Girls had lower confidence levels, even when they got high grades in their classes (Beyer, Rynes, Perrault, Hay and Haller 2003). As a consequence, girls experience a crisis of confidence which means they are more likely to drop out of their computer courses (Kekelis, Ancheta and Heber 2005). Boys are twice as likely as girls to rate their computer skills as above average (Sax 2000). This study found that girls suffered more from computer anxiety than boys, especially at university, where male students showed a lessening of computer anxiety throughout the years, whereas females became more anxious (Todman, 2000). This shows to some extent that prior experience does not influence computer anxiety for females, but demonstrated a key difference in computer-related behaviour (Whitley 1996). However, girls do perform better in the presence of another female (Corston and Colman 1996).

Self-efficacy can be broken down into perceived competence, skill and aptitude. Like confidence and anxiety, girls tend to under-estimate their skills in ICT lessons and on the computer (Hasan 2003).

Games

Typically, computer games are aimed at boys as they involve competition, violent graphics and male characters (Klawe 2002). Boys begin to play computer games at a young age, sit in front of the computer for a long time and carry on this pattern as they get older; however, girls do not follow this pattern (Cassell and Jenkins 1998). It has been suggested that the early exposure that boys have to the computer is a reason for their higher confidence and for not feeling as anxious as girls (Hartman and Klimmt 2006; Brenick, Henning, Killen, O'Connor and Collins 2007).

Teachers and Career Advisors

Teachers are able to influence and reinforce gender stereotypes and perceptions of careers through their own attitudes. Teachers do this through their gender stereotyping of roles and choices through their interaction with students. According to a study by Sanders and Stone (1996), it was found that teachers often give students the impression that males are better at working with computers than females (Galpin, Sanders and Chen 2007). It was found that teachers in primary schools often thought males were more interested in computers and therefore males enjoyed teaching them a lot more (Culley 1988).

Careers advisors are a source of information for young people. However, it has been documented that career advisors can be biased (Bimrose 2001). In other words, the advice

given is often dependent upon what gender the advisor is or what they perceive the pupil is capable of doing (Engineering and Technology-Board 2005).

2.5.3 Using the computer out of school

Using the computer out of school does not follow a curriculum of any kind nor is it subject to testing for qualifications. It is self-directed and understanding is gained through communication online, face-to-face or learning by doing a task. Technological experience out of school allows pupils to explore technology for enjoyment rather than for educational merit. It gives pupils the freedom to do what they want to do. This can be in the form of games, social networking and other IT-related activities that take place outside school hours. The way that girls and boys use technology out of school is different and highlights personal preferences rather than being restricted to curriculum-based learning materials. Singh found that women were more likely than men to use the computer for social networking and for a specific purpose rather than just for fun (Singh 2001). Comber and Colley found that with more experience, confidence grows, as does a positive attitude towards computers. However, girls use computers less, like them less and underestimate their ability compared with boys. Computer games and music technology are dominated by boys (Colley, A and Comber, C 2003). It is important that young people have a positive interactive experience with the computer. Where this occurs, the young person is more likely to continue taking courses or enjoying IT career options (McCormick and McCormick 1991; Camp 1997)

2.6 Initiatives

There are (and have been) a huge number of initiatives to try to increase the number of women in IT. Through surveying the different initiatives available, it was clear that there are two types of initiative: recruitment of women into computing and retention of women in computing, as well as those which aim to do both. Each type of initiative cannot exist in isolation. Initiatives that specialise in the recruitment to computing, such as women returners' schemes, rely on initiatives such as BCSWomen to retain women in computing in order to help support the women who have decided to go into the IT industry.

The initiatives are often dependent upon external funding bodies or a person who is willing to take the time to manage these networks. There are a number of UK based

initiatives listed in Table 2-1. This list provides an example of the initiatives available and by no means aims to list every initiative.

Name of Initiative	Description
E-Learning Computer Clubs	Computer clubs for girls (CC4G) is an initiative aimed at 10-14 year old girls to get them enthused about ICT, to encourage them to stay interested in ICT. It is funded by the Department for Children, Schools and Families and created by e-skills. CC4G is free to schools that would like it and is currently in use in 3,100 schools. CC4G is a volunteer run club within schools, which takes place outside school hours. Pupils log on to an e-learning site that allows them to apply and expand their knowledge of ICT through various challenges aimed at young girls. These challenges include projects on the environment, music, fashion and celebrities. CC4G also has links with industry, which donates software and knowledge to the initiative. As CC4G is a voluntary organisation, it often depends on the staff and parents of the respective schools to run it in a way that is best for the pupils involved. This scheme is dependent on staff and volunteers[4]. Since June 2009, the scheme has become a mixed club, rather than one just for girls.
UK Science and Engineering Week	National Science and Engineering week is usually held in March and its aim is to encourage and increase knowledge about science and engineering[5]. The week is full of different hands-on activities that bring science and engineering alive to the public. The activities are held at universities as well as at other organisations. Most importantly, the main event activities are held locally in order to bring science closer to the public. IBM is an organisation that has been taking part for the last five years with an activity called 'Blue Fusion'. The objective is to promote technology to young people. They focus on GCSE students who compete in activities as well as use new technologies. The event is run onsite for four days[6].
Encouraging young scientists	It is important to encourage gifted young pupils by honouring their achievements in science and engineering. By doing this, it helps them realise the importance of what they can contribute to the future. An example of this is the British Association of the Advancement of Science Young Scientists and Engineers Fair. This is an award ceremony for students showing excellence in science and engineering. Pupils attend the fair and present projects that they have conducted to a panel of judges.
Women Returner Schemes	Women in the IT industry who go on maternity leave find it difficult to go back into it due to the rapid change of technology and emergence of new challenges. There are two

[4] www.cc4g.net

[5] http://www.cardiff.ac.uk/nsew/index.html

[6] http://www-05.ibm.com/employment/uk/hursleycommunity/bluefusion/blue_fusion.html

Name of Initiative	Description
	ways that organisations can help women return to work after maternity leave: either through maternity leave initiatives or through encouraging women that have been out of work for a long time (either through maternity leave or other reasons) to retrain to go back into technology roles. An example of this is the University of Sheffield academic women returners programme. Women researchers in STEM can apply for up to £15,000 to help them maintain research activities whilst away. This has so far helped support 33 female academics returning from maternity leave[7].
Support groups	BCSWomen is a specialist group that helps to provide networking opportunities for BCSWomen members. It does this through an online group, where women can exchange ideas and advice by email and through a supportive forum. The group are starting to hold regular regional networking events. The group has over 900 members[8]. Womenintechnology.co.uk is a jobs board and networking group for women in the IT profession. The jobs board is directed at major firms so that they can raise their profile to women. The network also holds events and training courses directed at women[9].
Women in computing groups within organisations	Within organisations, women who work in computing help provide women with a network of supportive friends and colleagues, in case they feel isolated in their workplace. These are prominent at universities. Women@CL is an example of a group which provides mentoring, networking sessions and an opportunity to hear talks by other women in their field[10].

Table 2-1 List of UK based initiatives

In addition to the large number of initiatives available, there are also laws and guidelines in place to make sure that women are taken seriously in the workplace. The next section outlines these.

[7] http://www.opportunitynow.org.uk/best_practice/exemplar_employers/women_returners/case_studies/uni_of_sheffield.html

[8] www.bcs.org/bcswomen

[9] www.womenintechnology.co.uk

[10] http://www.cl.cam.ac.uk/women/intro/

2.7 Gender, the workplace and the law: the current situation in the UK

2.7.1 Sex Discrimination Act 1975

The Sex Discrimination Act stipulates that it is unlawful to discriminate based on a person's gender or marital status. The Equal Opportunities Commission has published a code of practice to assist employers which states that every individual should be assessed on their merit, that it should not be assumed that certain jobs are for certain genders, and that qualifications or requirements for a job should not be something which stops a specific gender from obtaining these unless they can be justified (Hobsons 2006).

2.7.2 Equal Pay gap and Equality Bill

Women are being paid less than men in the workplace. Research conducted by Hobsons careers found that female graduates are earning 17% less a year than male graduates. The gap gets wider as they get older, even in the case where men and women have studied the same subject, achieved the same degree classification and do the same job. According to findings by the survey specialists Celere, women in specialist roles earn £32,614, which is £13,655 less than a man would earn in that same role (£46,269). The largest pay gap between men and women is in the IT industry (Hobsons 2006).

2.8 Conclusion

Chapter 2 emphasises that the reasons why women are not entering the IT industry are complex and based on many factors. In particular, this chapter has highlighted the impact of the national curriculum and how it has influenced the way in which female students feel about the IT industry and studying IT as a subject. The chapter discussed the ways in which young people are exposed to technology at home in the form of games and social networks. Computer games, in particular, have been more geared towards boys. We discussed the way in which perceptions of the IT industry which are given out are factors in dissuading young people, especially female students, from continuing further in the IT industry.

Chapter 3 discusses the way in which the IT industry is perceived by young people, and how these differ from reality.

Chapter 3 Perceptions of the IT industry: Literature Review

'Elle's Father: Oh sweetheart, you don't need law school.
Law school is for people who are boring and ugly and serious.
And you, button, are none of those things.'

Legally Blonde (2001)

This chapter discusses the way in which the IT industry is perceived by young people, and how these perceptions differ to the way in which the IT industry is defined by professional bodies such as the British Computer Society (BCS). The chapter begins with a description of how perceptions are formed and how these perceptions contribute to the stereotypes of the IT industry. Various images of the IT industry that are given out are described, which can be put into three categories: the image of the IT industry as a whole, the image of the type of person who works in the IT industry and the image of careers in the IT industry. The chapter then describes the reality of the IT industry as defined by the Skills Framework for the Information Age (SFIA). SFIA provides a framework of careers in the IT industry. The chapter demonstrates there is a clear gap between how the IT industry is perceived and how it is in reality.

3.1 Perceptions of the IT industry

From the survey of the literature reviewed it is apparent that the portrayal and perceptions of the IT industry is a significant factor in dissuading young people, especially

females, from IT careers (Clarke and Teague 1996; Margolis, Jane and Fisher, Allan 2003; Mercier, Barron and O'Conner 2006)**.** The perceptions of IT careers are inaccurate and often do not match the IT industry at all (Gupta and Houtz 2000; Klawe 2002).

3.2 How is the IT industry portrayed?

Young people rely on images and experiences of the IT industry they receive from various sources around them to help form impressions. It is through these experiences and images that representations are formed (Hayes 1993). The term 'social representations' was introduced by Moscovici, which is a system of understanding that is required for concepts which may be outside an area of expertise for a particular group (Moscovici 1981). To apply this, representations of the IT industry mean different things to different people depending on their prior exposure and expertise. This is highlighted by Hodges, who states that first impressions have an impact on how individuals see the world (Hodges 1974). Hodges found that first impressions are very strong, especially if they are negative. This is because they came from socially undesirable characteristics, which stick in people's minds as being unattractive to them as individuals (Hodges 1974). IT careers have certain stereotypes, which are portrayed by the media and often used as examples by others to describe those working in the IT industry. The use of stereotypes is described in the next section.

3.2.1 Stereotyping

Stereotyping involves classifying people against predetermined criteria on the basis of a common characteristic such as gender (Hayes 1993). To put this into context of those that work in the IT industry, it ignores personal attributes such as the personality, e.g. '*they are nice*,' in favour of seeing collectively, e.g. '*those that work in the IT industry are geeks*.' This impression is not helped by the stance taken by the media as well as others who help inform career decisions, as explained in the next sections.

From conducting a literature review, it is apparent that three types of image of the IT industry are:

1. Perceptions of the IT industry as a whole.
2. Perception of careers in the IT industry.
3. The type of person that works in the IT industry.

In a study by the Engineering and Technology Board, in which parents' perceptions of SET careers were analysed, it was found that young people in year 9 (age 14) were drawn to careers which were featured on TV programmes portrayed in a glamorous way. This coincides with the time at which GCSE options need to be chosen. However, during year 11 young people were more realistic about options and began to think about more ordinary options, i.e. those which could help them with their career (Mitchell, Levin and Krumbotlz 1999; ETB 2005). In a sense, this demonstrates the power that the media have on young people. The next section describes the three different ways in which the IT industry is portrayed in the media and reinforced by parents, teachers and others.

3.2.2 Perception of the IT industry as a whole

The BCS states that the IT industry is dynamic, fast and provides opportunities for all (BCS 2006). However, the image that is projected of the IT industry conflicts with the BCS claims. The media is flooded with negative images of the IT job market and various claims that 'jobs have been outsourced to India' (Lowe 1995; Slaughter and Ang 1996). This gives the impression that there is no clear place for those who are considering entering the IT industry. A typical example of this is shown below (Figure 3-1) on a BBC website, where Norwich Union announced that jobs were to move to India.

Figure 3-1 BBC News cutting to demonstrate job moves.
Image taken from: http://news.bbc.co.uk/1/hi/business/3255606.stm

Although this news story was written in 2003, a more recent study by Alison Mitchell found young people do believe that there is a lack of opportunities for those who choose to go

into the IT industry (Mitchell, 2006). Pupils and parents assume that there will not be enough jobs for them once they have completed their degree (Wilder, Mackie and Cooper 1985).

This is reinforced by a study conducted by the Education Technology Board (ETB), which found that parents in particular did not feel informed about careers such as those in science and technology. They were unclear as to whether the jobs were in demand or not (ETB, 2005).

Linked to this, there are confusing images often presented of the types of job available within the IT industry. Therefore it can be confusing for individuals to aspire to do certain jobs within the IT industry because they may not know what opportunities exist (Joshi, Schmidt and Kuhn 2003; Carter 2006). This is discussed in the next section.

3.2.3 Careers in the IT industry

The media projects the image that IT careers require longer hours and limited personal time (e.g. time for family) with little understanding that programmers often work in teams or that there are jobs such as those in business analysis, where communication with the general public is necessary (McDowell, Werner, Bullock and Fernand 2003). Figure 3-2 shows a website article with images such as ‘being chained to a mouse’, which portray jobs with computers as hard going and stressful. The title ‘I felt chained to my computer’ gives the perception that all jobs with computers are stressful. Even though this article did not mention IT careers specifically, it reinforces the idea that jobs with computers (especially with the image), which are linked to jobs in the IT industry, must be hard going.

Figure 3-2 Example of how the IT jobs are portrayed.
Image taken from: http://news.bbc.co.uk/1/hi/health/2936217.stm

To some extent, this type of article demonstrates that if someone works with computers they must be working in the IT industry. This unclear understanding is demonstrated by young people who indicated, when questioned, that a secretary is a possible career path within the IT industry (Francis, 2002). A possible reason for this is that secretaries are people who use computers that young people interact with on a daily basis (at school, dentist, etc.).

The other extreme is that a career in the IT industry is only about programming (Kinzie, Delcourt and Powers 1994). Figure 3-3 shows Bill Gates in front of a blue screen of code at a conference. Bill Gates is the 'face of Microsoft' and is a well-known example of someone who works in the IT industry. The image below provides another aspect of what the industry is about: code – which is unfamiliar – and Bill Gates talking about the code. This creates a gap between those who work in technology and those who use technology.

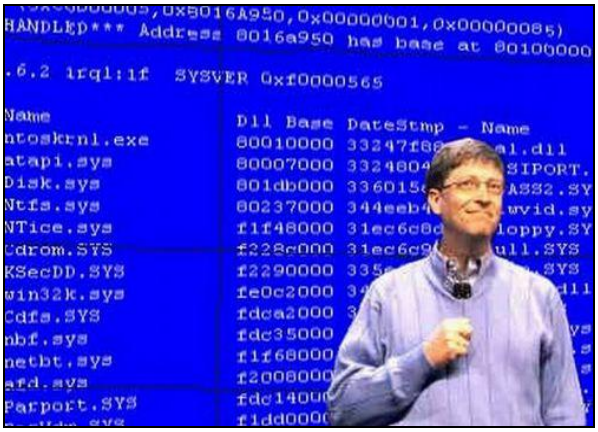


Figure 3-3 Image of Bill Gates and code.
Taken from: www.uberreview.com/wp-content/uploads/billgates.jpg

3.2.4 The type of person who works in the IT industry

A common perception of the type of person who works in the IT industry is the 'IT Geek'. It is a colloquial term used to describe someone who understands and works with the technical side of computers but has limited social understanding. The term 'computer geek' is defined as: '*1. an unfashionable or socially inept person. 2. a knowledgeable and obsessive enthusiast. E.g. computer geek*.' (OED 2006). Keefe (2005) states that it is the geeky image that is putting women off a career in IT:

> '*... in terms of attracting women, the simplistic approach is the fact that IT still has that geeky, computer nerd image attached...*'

Figure 3-4 shows a fictional IT geek character, someone (normally male) sitting in a dark room, wearing glasses and pasty skinned.

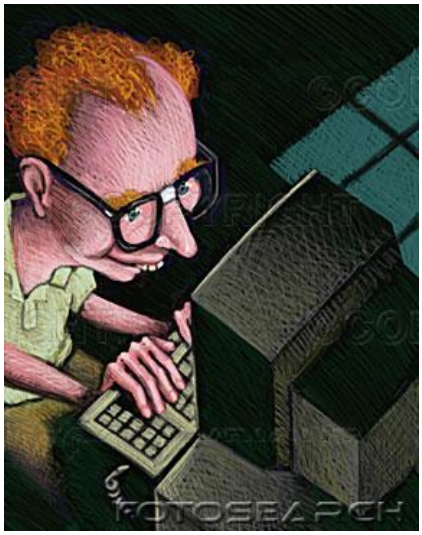


Figure 3-4 Image of an 'IT Geek'.
Taken from: http://www.kewanshunn.com/images/news/computer_geek.jpg

The way in which the media portray women in computing differs. A few of these images can be seen as humorous but derogatory at the same time, portraying the idea that women have no clear place in the IT industry. Parents were of the view that non-traditional gender careers were increasingly open to their children, but they still expressed the view that girls would be unlikely to be attracted to male-dominated jobs such as engineering (ETB, 2005). They felt this because they perceived a lack of support within male-dominated industries. Women have been known to be mocked within organisations, which could demonstrate why there is the perception that there is a lack of support (as well as the low numbers). Figure 3-5 is a common one that is often sent around in e-mail forwards.

Figure 3-5 Image often sent around in e-mail forwards.
Taken from: www.technimo.com/photo/data/515/348Female_IT_experts.jpg

Another example is in the movie *Sex in the City*, where the character called Louise has a degree in computer science but is hired to revamp a website and manage e-mails. This movie portrays Louise's web design as a 'tech savvy' skill but the computer science graduate's skills do not extend beyond this in the movie.

At the other extreme, in the programme *24*, the character called Chloe is a senior intelligence analyst with the Los Angeles Counter Terrorist Unit. She demonstrates high skill with computer hardware and spends most of her time behind a computer. She has a number of friends even though she lacks certain social skills (see Figure 3-6).

Figure 3-6 Image of Chloe from *24.*
Taken from: http://entimg.msn.com/i/300/celeb/Chloe_24_300x298.jpg

A final example created by 'American TV teen programmes' is the popular TV show *Beauty and the Geek*. This programme attracted 11,000 viewers and was on Channel 4's Top Twenty programmes for the final week it was aired (S4/C 2008). The geek is usually a male (in an IT job) and the beauty is a female. The geek is depicted as clever and intelligent but lacking in social skills, whereas the females on the show are the opposite. As viewers follow the programme, they see perceptions of both sides change, which is positive, but it is only through constant interaction that this takes place. In other words, without getting to know the geek, the females on the programme would not have changed their perceptions. There are no clear, consistent roles for women in computing in the media, which could be translated to society as a whole. Rather, they are variable, and their statuses change depending on the narratives. These inconsistent roles bring about inconsistent perceptions.

Asch (1946) stated that 'implicit personality theory' is applied to the way that individuals perceive others. This means that someone who possesses a particular characteristic is likely to possess several other characteristics that are connected; some traits are regarded as more important than others. Rosenberg, Nelson and Vivekananthan (1968),

performed a multi-dimensional analysis of how a variety of different traits related to one another (Rosenberg, Nelson and Vivekananthan 1968). Two major dimensions emerged:

- Intellectual: concerned with mental ability ranging from: “good intellectual” traits at one end to “bad intellectual” traits at another
- Social: concerned with sociability, and ranging from good social to bad social (Hayes 1993)

The two opposites depict the way in which those who work in computing are portrayed. This is especially the case with those who program and have the image that they sit in a room coding on their own. This unsociable and good-intellectual image is reinforced by the media and the public. The next section describes the type of work that takes place in the IT industry.

3.3 The IT industry

It is clear from the sections above, that the broad spectrum of work available in the IT industry is not portrayed accurately to the public unless they have experienced it or heard about it first-hand. The wide range of roles can be demonstrated by professional bodies such as the BCS and IEEE who have come together to produce the Skills Framework for the Information Age (SFIA). SFIA provides a point of reference for different IT careers. This includes the skills needed to work in the different areas of the IT industry. Such a framework is necessary since the IT industry is constantly changing, which makes it hard to define and the framework is constantly being updated. The framework is two dimensional, which consists of the type of work versus the responsibility that goes with it. Figure 3-7 shows the work in the IT industry according to the SFIA framework:

Strategy and Planning	**Development**	**Business Challenge**	**Service Provision**	**Procurement and Management Support**	**Ancillary Skills**
•Information Strategy •Advice and guidance. •Business / Information Systems Strategy and planning. •Technical strategy and planning.	•Systems development. •Human factors. •Installation and integration.	•Systems development. •Human factors. •Installation and integration.	Management of information relating to the software, hardware and assets of the business.	•Infrastructure. •Operation. •User support.	•Supply management. •Quality. •Resource Management. •Sales and Marketing.

Figure 3-7 SFIA Framework example
Adapted from: www.sfia.org.uk

Industry use this framework for measuring staff proficiency and skills, but this thesis will be using it to demonstrate the broad spectrum which defines computing in the UK. The next section compares public perceptions of computing to that outlined by SFIA.

3.4 Gaps between reality and perceptions

This section demonstrates the gap between the IT industry as described by SFIA and how the public perceive the IT industry. This chapter has identified how the public perceive the IT industry and what the IT industry does. Those who work in the IT industry are perceived to be programmers, secretaries and system administrators (Nielsen, Hellens and Wong 2001), which fit into the Development and Ancillary Skills parts of the SFIA framework.

In the table below, the areas circled define how IT careers are perceived. It is clear that perception of careers is limited and does not include the full spectrum of roles, which are described by the SFIA. Figure 3-8 demonstrates this and the next paragraphs provide explanation for what happens in these roles.

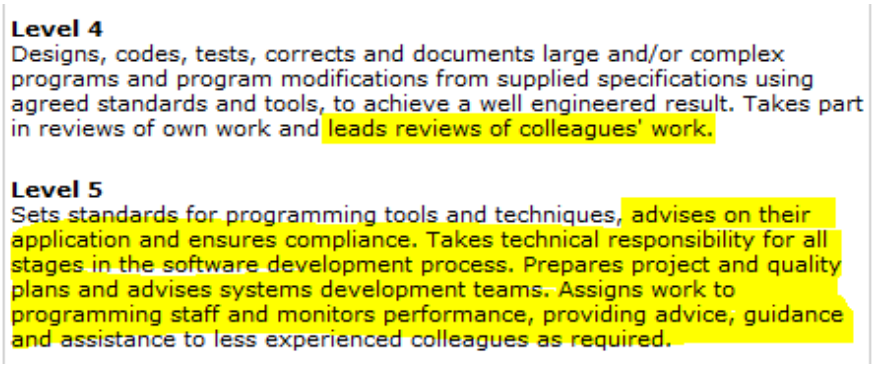
Strategy and Planning	Development	Business Challenge	Service Provision	Procurement and Management Support	Ancillary Skills
•Information Strategy •Advice and guidance. •Business / Information Systems Strategy and planning. •Technical strategy and planning.	•Systems development. •Human factors. •Installation and integration.	•Systems development. •Human factors. •Installation and integration.	Management of information relating to the software, hardware and assets of the business.	•Infrastructure. •Operation. •User support.	•Supply management. •Quality. •Resource Management. •Sales and Marketing.

Figure 3-8 How the IT industry is perceived by the public

3.4.1 Development

Development in the SFIA framework is split into three categories: Systems development, Human factors, and Installation and integration. The job of a programmer falls into the 'systems development category', which means being able to understand the technical side of computers associated with being able to code or program, and these people are viewed mainly negatively (Stockdale and Stoney 2007). For instance, 'those who work in computing lack social skills.' This conflicts with the SFIA framework which indicates that higher level

programmers need to be able to lead teams of people and also liaise with other members of their team such as business analysts, project managers and user support staff. Being able to communicate is a vital part of being a programmer or any other aspect of IT. However, this is not the way it is portrayed by the media, as shown in the sections above. Figure 3-9 is an extract of the SFIA skills description for *Development*, which demonstrates that to achieve the higher levels of the framework, programmers have to work in teams rather than in isolation to get the result they want from their code.



Level 4
Designs, codes, tests, corrects and documents large and/or complex programs and program modifications from supplied specifications using agreed standards and tools, to achieve a well engineered result. Takes part in reviews of own work and leads reviews of colleagues' work.

Level 5
Sets standards for programming tools and techniques, advises on their application and ensures compliance. Takes technical responsibility for all stages in the software development process. Prepares project and quality plans and advises systems development teams. Assigns work to programming staff and monitors performance, providing advice, guidance and assistance to less experienced colleagues as required.

Figure 3-9 Example of SFIA Levels
Taken from: http://scripts.bcs.org/sfiaplus/levels/prog.htm#5

3.4.2 Ancillary Skills

Ancillary Skills include jobs that provide support to an organisation: marketing and sales delivery, quality, resource management, and supply management. These are often perceived to be subsidiary to the main purpose of the technical provision. This is demonstrated in the television series *The IT crowd*, a programme about an all-male technical support team. This technical team is accompanied by a female who was originally head of department and changed to that of ‘relationship manager’ as her knowledge of technology was limited. The males in the technical team seemed to be in awe of this one woman. However, her role was made to seem less important as what she was doing was not portrayed to be intelligent and she was the one who was often asking for technical help rather than receiving it. Although this does not portray every IT department it does, however, portray in a comical way a typical IT department today.

3.5 Conclusion

Chapter 3 has discussed the way in which the IT industry is perceived and how it compares with reality. It showed that there are various ways in which the IT industry is

portrayed, and that these provide an inaccurate portrayal of life in IT careers. In particular, this chapter has identified the way that women may be perceived ***in*** the IT industry and ***how*** women may perceive the IT industry. We found that the images and perceptions were often negative.

Chapter 4 will describe the ways in which young people use the computer both at school and out of school. The chapter concludes that these factors could influence the way in which young people decide and think about the IT industry.

Chapter 4 Experiences of computers: Literature Review

'NCB Official: Can you tell us why you first became interested in ballet?
Billy: Don't know [pauses]
Billy: Just was.
NCB Official: Well was there any particular aspect of the ballet which caught your imagination?
Billy: The dancin'.'

Billy Elliot (2000)

Chapter 4 explores the way in which young people use computers both in school and outside of school. In view of increased access and exposure to technology outside of school, this chapter aims to find out why the majority of women are still not choosing IT careers or courses. It begins with a breakdown of different courses at GCSE level, A-level and degree level and how the course content, and the way in which these courses are delivered, could influence decisions and perceptions to take further courses in IT. The chapter then discusses experiences with the computer out of school. In particular, it explores the distinct difference in the way in which male and female students use the computer outside of school.

4.1 The gap between formal and informal experiences of computers

There is a distinct gap between how ICT is experienced at a formal educational setting and what is experienced out of an informal setting with computers. Traditional curriculum

models (e.g. ICT national curriculum) are described as hierarchical, reliant on assessment and regulated. Such researchers as Sakellariou and McFarlane have argued that these traditional methods of teaching and assessment are outdated in contrast to the way that young people use the computer outside of school (McFarlane and Sakellariou 2002). The use of computers outside of school is described to be varied and exploratory due to the increased availability of technology. Informal learning (learning outside of a formal school environment) is said to be a lifelong process whereby individuals gain opinions and knowledge from daily experience and influences such as family and friends (Marsick and Watkins 2001).

Although both formal and informal learning have different qualities, one cannot work without the other. A literature review conducted by Hodkinson, Colley and Malcom found that learning situations contain attributes of formal and informal learning. They are interrelated in different situations. The review states that learners who are beginning something, normally need formal learning as they do not have the relevant experience, however those who have gained experience, rely on informal learning to expand and maintain their knowledgebase (Hodkinson, Colley and Malcom 2003). The idea behind coursework or project work is often for pupils to go out and explore beyond what they have been shown in the classroom. For example, when applied to driving skills, formal lessons and examinations are needed, but learners will only able to accumulate the best experience by going out and driving on their own in real traffic.

The mixture of formal and informal experiences often makes learning experiences with technology difficult to separate out. This is especially the case with the increase of technology young people have access to. In a 2008 study conducted by Ofcom, it was found that there was an increase in the take up of the internet, mobile phones, MP3 players and digital cameras since 2005 amongst households with children. The study found that by the age of five, many young people are able to use the internet proficiently and had access to different types of technology. Since 2005, there has been a significant increase in the availability of technology in young people's bedrooms; for 12-15 year olds this 15% (1 in 7) (Ofcom 2008).

Such users are often defined as 'digital natives'. Prensky defines digital natives as:

'*Our students today are all 'native speakers' of the digital language of computers, video games and the internet*.' (Prensky, 2001)

Prensky's paper argues that it is for this reason that it is important to understand the way in which young people, i.e. 'digital natives', are taught ***with*** technology and ***about*** technology so they are not put off considering technology careers. Although Prensky's paper

focuses on degree level students, the argument could be transferred to the context of young people in secondary schools and sixth forms (Prensky 2001).

Currently the predominant IT resource that most schools enjoy is rooms of computers. Wireless broadband is usually not available but all schools in the UK do have access to the internet. Young people carry mobile devices, IPods and other advanced technology devices (Twining 2002).

The Ofcom study also shows there is a clear gender divide in the way that technology is used at home. Boys said that they would miss games and games consoles if they were taken away from them, whereas girls said they would miss mobile phones (Ofcom, 2008). This is a clear indication of the way in which both boys and girls prefer to use technology. Females prefer to use the computer as a communication tool, whereas males prefer to use the computer as an entertainment medium.

To understand if this contrast is a potential factor in what dissuades females from technology careers, it is necessary to understand their experiences at school and out of school. The following sections will focus on computer use and teaching at school in order to understand what digital natives are being taught in 2008/2009 at different levels of their education: GCSE, A-levels and degree level.

4.2 Experiences of computer courses in formal education 2008/2009

The following sections describe what young people are being taught in ICT lessons at school. At school, all pupils (regardless of gender) are taught ICT to the same specification. This is governed by the Qualifications and Curriculum Authority (QCA) (BECTA, 2004). There are differences between the numbers of males and females who decide to continue studying IT-related courses at different levels of education: GCSE, A-level and degree level.

The exact figures will given in this chapter; however, it has been described as a ‘pipeline effect’ (Gurer and Camp 2001) whereby the numbers start off high at GCSE level then decrease during degree level. The ‘Women in IT Scorecard Report’ states that the numbers of females currently studying ICT GCSE and A-level computing are reducing (BCS, e-skills and Intellect, 2009). The statistics in the Report focus on GCSE and A-level courses provided by the Joint Qualifications Council (JQC), who accumulate figures from all the main Examining Boards. However, there are additional ICT courses, e.g. the Digital Applications Award, that focus on the graphics and multimedia aspects of ICT, which are not taken into account.

The next sections will examine both the courses for which the JQC have collected data, and those they have not collected data for. This will also provide an understanding of the choices that schools are faced with when they consider the different options available for their students. We also identify documented reasons in the literature for not taking GCSE ICT, A-level computing, and degree level courses.

4.2.1 IT Courses taught at GCSE and A-level

This section describes the different ranges of courses available during GCSE and A-level that young people take whilst at school. In addition to studying specialist GCSE and A-level courses, all pupils also have to take corresponding key skills modules in English, Maths and IT. This is to make sure that young people are competent at skills such as being able to use the computer to write reports (QCA 2001).

Those pupils taking GCSE ICT, and A-level courses in ICT and Computing, do not need to take ICT key skills, as they are able to demonstrate the learning outcomes in their course. Externally marked portfolios and tests are used to assess young people taking Key Skills. The key skills learning objectives are shown in Appendix 1.

4.2.2 Computer courses taught at GCSE and the way they are taught

There is a wealth of choice available for schools at GCSE level, which could pose a problem for teachers, as they have to select what is best for their schools and their students. Often this depends on resources and expertise. Table 4-2 lists the courses that the main Examining Boards in England (OCR, Edexcel and AQA) all deliver: the ICT long course, short course, and applied ICT, with a breakdown of male and female students. These courses have both an exam element and a coursework element to them. The course descriptions are in Appendix 2.

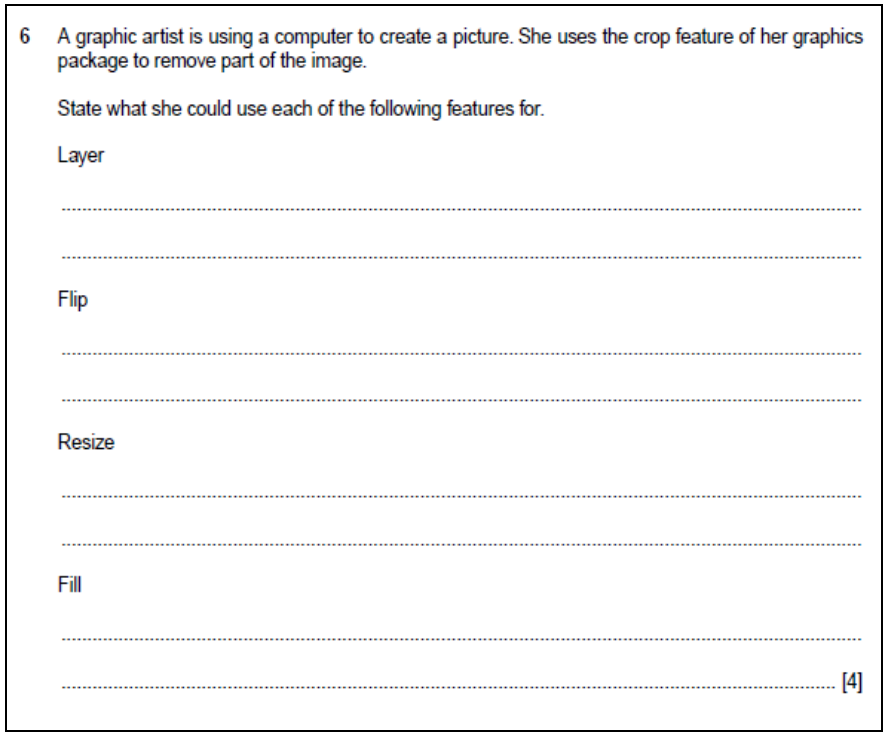
Name of Course	**Male Candidates**	**Female Candidates**
GCSE ICT *Long Course*	55.6% (47567)	44.4% (38038)
GCSE ICT *Short Course*	45.1% (36940)	54.8% (44350)
Applied ICT/ Double ICT	58.1% (9329)	41.9% (6733)

Table 4-1 GCSE courses with male and female student numbers (JCQ 2008)

The numbers of girls taking ICT at GCSE level varies. The GCSE ICT short course requires the least amount of time and fewest assignments; this is the most popular with girls. Boys prefer the courses that take up more time, especially the Applied ICT course. The aim of the GCSE ICT course is for pupils to think about how to solve a problem through analysing it, designing a solution, implementing, testing it and evaluating it. None of the Examining Boards specify the software on which to complete coursework or exam preparation. (The coursework can all be completed using Microsoft Office applications.) The coursework gives more marks for the accompanying documentation and thought processes than the implementation. However, the implementation takes up the most time and uses software which is familiar to young people, thus giving the impression that the course is primarily about learning how to use different Microsoft Office applications. This is demonstrated in this example of coursework set by AQA for GCSE ICT.

> '*Based on the Lancre Theme Park, the aim was for candidates to use their ICT skills to help the way the Park operated so that visitors had a more enjoyable experience and the Park made more profit. The requirement was that the analysis was first completed and then presented for marking, before candidate(s) moved on to design and then implement solutions*.'

The example above provides an idea of how the tasks could be linked to Microsoft Office. The exam is similar as is demonstrated below. The vocabulary is that of Microsoft Office applications such as *Photoshop*, *Publisher* and *PowerPoint*. Figure 4-1 is a typical example from an OCR ICT examination paper.



6 A graphic artist is using a computer to create a picture. She uses the crop feature of her graphics package to remove part of the image.

State what she could use each of the following features for.

Layer

.....

.....

Flip

.....

.....

Resize

.....

.....

Fill

.....

..... [4]

Figure 4-1 GCSE ICT Examination paper (OCR 2007)

There is limited research into what young people feel about GCSE ICT lessons and what they are taught. However, a recent study by Mitchell states that young people find ICT lessons 'boring' and do not see the point of them (Mitchell, Levin and Krumbotlz 1999). More research needs to be conducted into the attitudes of young people towards ICT lessons. The next sections focus on the courses that are different to the conventional GCSE courses because they are coursework-based and more specialised.

Courses without an exam element

Some courses have no examination component but are assessed only through coursework. These courses all have a core unit that requires the candidate to demonstrate basic skills in Microsoft Office. Subsequent units are different to GCSE because they are specific and specialised. They also allow deeper exploration in different areas. For example, the 'Diploma in Digital Applications' (DiDA) is a practical course that allows pupils to learn about authoring computer games and multimedia. In contrast, 'IT Practitioners' is a course which is again very specific and allows pupils to gain a deeper knowledge of some areas of IT. The ability to learn these aspects of computing in such depth is not available in GCSE modules. Unfortunately, there are no published figures of male/female uptake of these courses. A description and list of these courses is in Appendix 3.

Course choices which schools make

The choices that schools make about courses they wish to offer pupils, depends on the expertise of staff and the software available to them. For example, if the software to design computer games or the graphics software is not available to them then it is not possible to run the course. Another factor is the shortage of experienced ICT teachers who have a computing or IT degree. This often means that pupils may not have an option of taking the more specialised courses (BECTA 2004; QCA 2005). The next section discusses the lack of GCSE teachers in more depth.

Teachers at GCSE and their influence on female students

A shortage of experienced ICT teachers who have a computing or IT degree means that young people are not provided with good quality ICT programmes of study. The teachers who do teach ICT are those who do not specialise in the subject but understand how to use Microsoft Office (BECTA 2004; QCA 2005). The implications of this are that pupils are restricted to studying certain courses, rather than being provided with a choice. Females on ICT courses may not feel confident if they see a teacher struggling with ICT, as a teacher is seen as a role model (Townsend 2002). If this happens, teachers may seek assistance from other pupils, mainly male, who are therefore given more attention. This can be traced back more than twenty years, when it was common for boys to be given priority on the computer (Lovegrove and Segal 1991). Today, trainee teachers are made aware of boys' enthusiasm on the computer and are advised to give an equal chance to both boys and girls in the classroom (Simpson 1999). Newly qualified teachers have to pass a mandatory ICT skills audit in order to complete their teacher training. This was introduced in 2002 for all teachers (TDA 2010). The audits are in the following areas: numeracy, literacy and ICT. The ICT tests consist of presentations, e-mailing, text editing, spreadsheets and web browsers (TDA 2010). To become a teacher in ICT, the candidate is required to have a degree in the subject they wish to teach (TDA 2010). However, there are still instances today where girls are less dominant on the computer and the teacher reinforces this behaviour by not encouraging the girls to push forward (Fossum, Voyles and Haller 2007).

Peer group influence at GCSE level

Peer groups have an impact upon decisions. Young people tend to discuss career decisions with each other, but are unlikely to base their decisions on their friends' views. However, they will be aware of what their friends think and feel about them. Especially at a young age, they will be self-conscious about doing something out of the norm. Thomas and Allen determined that friends were the second most influential group of people when it came to influencing perceptions (Thomas and Allen 2006). Tskanka and Kordaki proposed that the media and friends are the key drivers influencing girls into choosing particular careers. Since friends often expressed their views regarding careers, girls therefore were more likely to be negatively influenced by their friends' lack of interest in their activities (Tsagala and Kordaki 2005). The next section considers what is taught during A-level if young people decide to pursue these courses further.

4.2.3 A-levels

This section describes the experiences young people have of A-level IT and computing courses. Like the GCSE, there are theoretical courses with exams and vocational courses that are assessed only by coursework. It is clear from Table 4-2 below that computing at A-level does not attract females. The proportion of females who took computing in 2008 was 9%, whereas the numbers taking GCSE Applied ICT and GCSE ICT were a lot higher. There could be many reasons for the high number of female students taking GCSE ICT, such as secondary schools making the course compulsory or the course becoming more popular. Similar to the GCSE short course, it seems that a higher proportion of females take the single applied course (similar to the A/S). A description and list of these courses are in Appendix 4.

Name of Course	Male Candidates	Female Candidates
Computing A/S level	88.9% (6955)	11.1% (866)
Computing A-level[11]	90.5% (4588)	9.5% (480)
ICT A/S level	62.4% (12029)	37.6% (7237)
ICT A-level	61% (7607)	38% (4670)
ICT Applied Single	59.3% (2052)	40.7% (5553)
ICT Applied Double	78.7% (2052)	21.3% (557)
BTech IT Practitioners[12]	Results not published	
Diploma[13]	Results not published	

Table 4-2 A-level courses: exam and coursework (JCQ 2008)

A-level IT and A-level computing have different aims and objectives. Whilst computing has an emphasis on the practical side of the discipline, A-level IT focuses on how different organisations can make the best use of IT. McBride states that both the IT and computer A-level are out of date, and are not able to maintain levels of change to keep up to date with technology. McBride cites object orientated design and the Unified Modelling Language, which are referred to in the Computing course specification but not assessed or focused on (BCS 2006; McBride 2008). However, although these are mentioned in the QCA specification, the course is often reliant on the teachers' knowledge who may be more confident with the 'data-flow diagram' approach than UML, for example (AQA 2008).

Another aspect, which has often been criticised, is that 'proper programming languages' are not taught for practical coursework projects or exams (McBride 2008). However, the AQA exam board's examiners' report observed that there were an increasing number of students using VB.net and PHP, with some using Pascal/Delphi and C++, ASP and Java. The report commented that students had difficulty in defining the aims and objectives of the problem their system/program was going to solve. In other words, there was too much

[11] EDEXCEL does not offer this

[12] EDEXCEL only

[13] ORC only

emphasis on programming and not enough on systems analysis and making sure that the system actually solved a problem (AQA 2008).

The Diploma and BTech courses provide the opportunity for young people to learn about aspects of the IT industry in greater depth. This is because these courses are often worth more than one A-Level and therefore more time is needed for them. Often, it is the only course that the candidate may have taken at college. The courses are of practical, hands-on nature. Depending on the college, they could lead on to qualifications in Cisco and Microsoft Certification. These are geared towards someone who knows that they want to work with computers in a practical way once they have finished their course. The next sections describe reasons that may put off female students who are studying A-level computing and IT.

Confidence with computers and programming

It has been noted in the literature that it is common for female students to lack confidence in computing and IT. Cooper and Weaver suggest that low self-confidence in computing is due to 'computer-anxiety', which means that females find it difficult to work in front of others or are afraid of making mistakes in case they feel embarrassed (Levenson 1990; Cooper and Weaver 2003). This is further demonstrated by a study that Levenson carried out where males who had not even studied computer science perceived themselves to be knowledgeable in it, whereas females who had studied computer science did not rate themselves in that category (Levenson 1990).

Maths and Careers Advice

During GCSE level, it is not made clear to young people who seek careers advice that some universities require mathematics to take computing and so it becomes a requirement for an A-level course in computing. Students in the study by Munro and Elsom said that they wanted more career suggestions, and advisors often told pupils to 'follow' their interests. The survey showed that the majority of careers advisors in the survey came from a humanities and social sciences background. Few had an engineering degree and none had a maths or physical sciences degree (Munro and Elsom 2000). During upper secondary school (years 10-11), young people are advised to make a careers appointment and discuss their career choices with a careers advisor (Munro and Elsom 2000). Beck, et al. found that this served as a barrier since young people wanted information at the time they requested it (Beck, Fuller and Unwin 2006).

Parental and family influences

Parents can influence young peoples' career perceptions and ideas, especially in science and engineering (Dick and Rallis 1991). Parental styles have a significant influence on the career decisions of young people (Roe 1956). This extends to the whole family unit, since interactions with other family members have an impact on behaviour (Carr, 2000). Lopez and Andrews take this further by suggesting that certain interactions with family may help towards career decision-making, whereas others may contribute to career indecision (Lopez and Andews 1987).

There are gender differences in career decision-making influenced by parents and family. In the 1970s, researchers found that a mother's occupation influenced career decisions of women (Almquist and Angrist 1971).

With computers at home, parents are able to encourage or discourage computer usage as well as encouraging young people to think about computing careers (Kracke 2002). Changing perceptions is difficult, but parents could do more to help their children understand that computing is a valid option that they could take (Margolis and Fisher 2002). Trice et al. found that primary school children were influenced by direct suggestions of careers by parents. While children may have cited siblings and grandparents, it was their parents' advice which they actually followed (Trice, McClellan and Hughes 1992).

Interest in computing can begin at home. Research conducted by Margolis and Fisher found that students were often first introduced to computing at home by a parent; either by a parent who uses a computer themself or brings one home for their child. This study found that male students owned their own computer at an early age. Females currently in computing courses, said that they first got that 'spark' by observing somebody else (father or brother) and were encouraged to try it for themselves and actually trying it (Margolis and Fisher, 2003). The next section looks at experiences on computing degrees.

4.2.4 Degree level

There are over 900 computing and IT courses available in the UK in different institutions. Computing and IT at degree level in this thesis will be defined in line with the QAA. The QAA is an independent funded body established to help measure the quality of higher education courses.

‘*It is difficult to define Computing with any degree of precision given the dynamic change that is happening within it. Certain areas within the field such as Artificial Intelligence, Computer Science, Information Systems, Software Engineering, Multi-media, and Networks, form familiar domains of activity which are represented strongly within Computing. The overall field is wide- ranging and it is important that those working in unusual and innovative areas recognise that they also reside within the field of Computing*.’ (QAA 2000)

Professional associations such as the BCS and IET accredit computing and have specifications that certain IT modules must adhere to. The advantage of this is that these associations are well known within organisations, which means those taking the course are confident that they are doing a course that fulfils the requirement of a professional body.

One specific problem for young people could be understanding what each course means or contains, which could be due to the differences between A-level and degree level courses (Dagiene 2006). Classifying the different computing and IT degrees is often problematic as there is a wide range of courses to choose from. However, this wide range can be confusing for those making the decisions; in particular, females may be reluctant to apply if they do not understand what every aspect on the course means (Durndell, Haag and Laithwaite 2000).

The university admissions system (UCAS) uses a classification system, called Joint Academic Coding System, which is a way for universities to best describe their course, and is shown in Table 4.3 below. The advantage of such a system is that it does give clarity. However, it also means that applicants would need to understand the terminology of the courses they might want to apply for. This could be a reason why females would be more inclined to pick a course such as Information Technology, as the terminology may be more familiar to them.

Computer Science	G500 Information Systems	G600 Software Engineering	G700 Artificial Intelligence
G400 Computer Science	G510 Information Modelling	G610 Software Design	G710 Speech and Natural Language Processing
G410 Computer Architecture & Operating Systems	G520 Systems Design Methodologies	G620 Programming	G720 Knowledge Representation
G411 Computer Architectures	G530 Systems Analysis and Design	G621 Procedural Programming	G730 Neural Computing
G412 Operating Systems	G540 Databases	G622 Object Oriented Programming	G740 Computer Vision
G420 Networks and Communications	G550 Systems Auditing	G622 Object Oriented Programming	G750 Cognitive Modelling
G430 Computer Science Foundations	G560 Data Management	G623 Declarative Programming	G760 Machine Learning
G440 Human-Computer Interaction	G590 Systems Analysis and Design not elsewhere classified	G690 Software Engineering not elsewhere classified	G761 Automated Reasoning
G450 Multi-media Computing Science			G790 Artificial Intelligence not elsewhere classified
6490 Computing Science not elsewhere classified			

Table 4-3 Joint Academic Coding System for computing (UCAS 2008)

4.2.5 Female participation on computing and IT courses

The number of those choosing IT at degree level is higher than those taking computing. The number of females enrolled onto computing courses has steadily decreased, as is evident from Figure 4-2 below. The number of males has also decreased; however, female numbers are decreasing at a much faster rate than males.

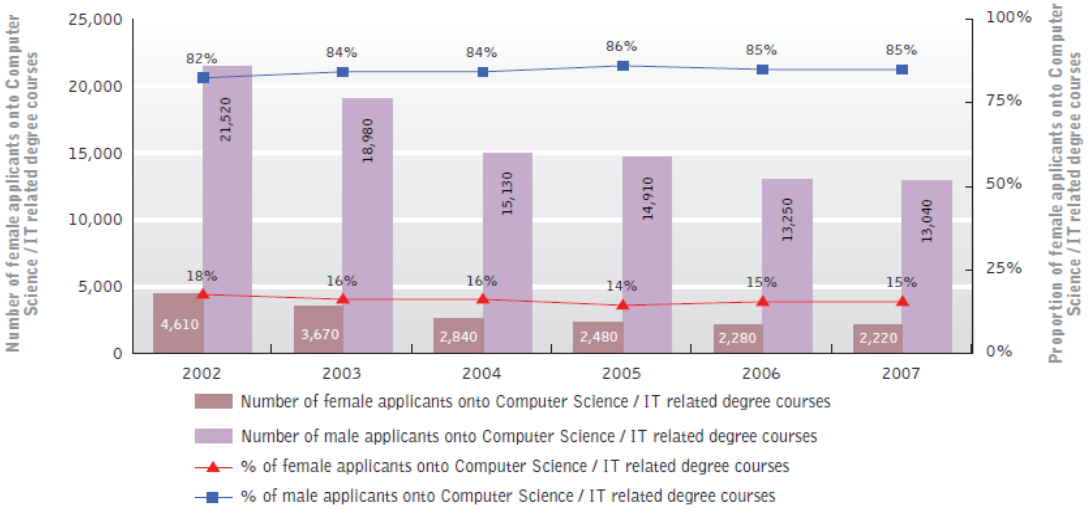


Figure 4-2 Numbers of males and female students taking IT and computing courses (BCS, e-skills and Intellect 2009)

Those who are currently on a computing course have varied experiences of computing. Margolis and Fisher (2002) demonstrate that females found programming modules to be the hardest to get through. However, once they 'battled' through these, they felt that they could manage the rest of the course. Females have mentioned feeling isolated on computing courses and felt that they needed to prove themselves against the males. Women in industry felt that once they got through the initial hurdles, they enjoyed being with people who could program and felt a sense of 'camaraderie' on the course (Clarke and Teague 1996). Prior programming experience seemed to be a factor in confidence levels. Pair programming is also said to help with this. Those who say they have prior computing experience were more likely to take a course in computing (Carter 2006).

4.3 Experience of computers outside of school

The number of young people who have access to technologies outside of school, such as the internet, mobile phones and digital cameras, is increasing. Technology is considerably cheaper and intuitive compared with a decade ago when young people would have first used a computer at school or (rarely) at home. This section will focus on computer use outside of school and its possible impact on career decisions.

4.3.1 Computer use outside of school

Learning out of school is often referred to as informal learning. Informal learning is typically associated with lifelong learning, in the workplace and at home. Coombs and Ahmed describe this in the following way:

> '*… the lifelong process by which every individual acquires and accumulates knowledge, skills, attitudes and insights from daily experiences and exposure to the environment – at home, at work, at play: from the example and attitude of families and friends; from travel, reading newspapers and books; or by listening to the radio or viewing films or television. Generally, informal education is unorganized, unsystematic and even unintentional at times, yet accounts for the great bulk of any person's total lifetime learning – including that of a highly 'schooled' person.*' (Coombs and Ahmed 1974)

The statistics mentioned in the introduction to this chapter indicate that due to the amount of technology available, informal learning with technology can take place anywhere and at any time. However, informal learning was often held in low regard because learning outcomes are not measured and structured which gave doubts about its effectiveness (Hodkinson, Colley and Malcom 2003). However, it is recently becoming more accepted, especially in ICT and is suggested as a way of engaging young people with technology (McDowell, Werner, Bullock and Fernand 2003).

Some research has shown how being on the computer for a considerable time can influence the attitudes of young people towards computers. Comber and Colley found that confidence grows with more experience, as does a positive experience towards computers. Young people are daily surrounded by technology, so their experience with technology is vast, but despite its pervasive nature, there still appear to be issues with confidence and with positive attitudes towards computers (Comber, Colley, Hargreaves and Dorn 1997).

Understanding how young people use computers outside of school in the UK holds is not easy, and the work conducted in this area is limited. A literature review commissioned by FutureLabs states that studies in this area are often commissioned by museums or broadcasters (Sefton-Green 2005). Although FutureLabs's report provided a systematic review of this area, and Ofcom conducted study of digital media use outside of school (Ofcom, 2008), these are not specifically related to career-decisions in computing or to gender (Buckingham 2005).

What is evident from these studies is that experiences out of school allow pupils to explore technology for enjoyment rather than for educational merit. It gives young people the freedom to do what they want to do, which can be in the form of games, social networking and other IT-related activities.

4.3.2 Male and female approaches to these activities

The main difference to the use of computers out of school between males and females is that females are more likely to use the computer for a particular purpose, such as social networking or homework, rather than just for fun. Computer-related activities outside of school can also include downloading music, updating blogs and chatting online (Singh 2001).

Games and gender differences

Computer games are becoming increasingly popular (Ivory 2006). There is a considerable gender difference in the number of males and females 'playing' computer games, despite the popularity of computer games rising.

Males in particular spend more time on computer games. Camp states that computer games are designed for the interest of males rather than females as they promote violence, competition and have brutal graphics (Camp 1997). Research demonstrates that males are far more interested in violence (within computer games) than females (Slater 2003). The lack of suitable (non-violent) games may help explain lack of interest in computer games (Subrahmanyam and Greenfield 1998). Klawe states that females prefer games that would support collaboration with other players, and have an element of collaboration and strategy (Klawe 1998).

Computer games have often relied upon stereotypical and out-of-date characters, which portray females as victims who are rescued by the powerful male (Dietz 1998). In addition, females are often represented by emphasising the way in which they look, through their clothes or in a sexual way (Downs & Smith, 2005; Schleiner, 2001). These factors can dissuade females from playing computer games.

Competitiveness is said to be a factor in what deters females from computer games. Swain and Jones state that, within sports psychology, it is competitiveness that puts females off sports. The reasons for this are based upon low self-confidence amongst females (Swain and Jones 1991). According to Agostto, most computer games available involve competition. This could be a contributing factor to attracting fewer females to playing games (Agosto

2002). Recently there appears to be an increase in games aimed at females, such as *Sims*. *Sims* was a top selling game and females enjoyed playing it because it allowed creativity (Jennings, Mawhinney and Fustos 2002). However, there is still research to be done to investigate whether these games influence positive career perceptions in IT for females.

4.3.3 Social Networking

Using online social networks is a popular out of school activity for young people (Boyd 2007). Online social networks provide a way to communicate and share information with friends and colleagues.

Social networking sites are said to help web literacy. Research such as the Digital Youth Study (2009) has found that being able to use a social network helps develop 'technological skills and literacy needed for the contemporary world', e.g. Digital learning project and Digital Youth Study.

The attractions of joining a social networking site include: learning new things, doing home work with friends, and playing games (Freedman 2007). Different types of social networking site attract different age groups. Caverlee and Webb found that MySpace attracts younger teens and they are active users of it. 'Active' is here defined by the number of 'friends' the users have, the time they have been using MySpace, and the types of activity (Caverlee and Webb 2008). MySpace and other social networks help to develop learning in how to: communicate online, create an online identity, create web pages (even if this is a MySpace page) and post links. A study by the MacArthur Foundation suggests that online spaces were where young people hang out, as well as a place where they can study a subject in-depth. For example, young people who are passionate about a certain topic such as gaming, are able to connect with others around the world that have the same interests[14].

4.4 Conclusion

Chapter 4 has explored the way in which young people used the computer both at home and at school. The chapter described what young people studied as part of their GCSEs, A-levels and degree level. It was shown that the main GCSE courses focused heavily on the user aspect of computers. However, there were courses such as DiDA which gave a different

[14] http://news.bbc.co.uk/1/hi/technology/7740895.stm

viewpoint focused on game design and website design. The chapter then discussed the way in which programming on the A-level computing course is something which female students could be put off by due to computer anxiety. It then demonstrated the wealth of options degree level students had, if they decided to choose IT or computing. Computer experiences outside of school and the theory of informal learning were then discussed. Gender differences amongst male and female students were stark in their use of computers outside of school, especially of computer games and social networking.

Chapter 5 discusses the key research questions and the methods used to investigate them. The design of the study described in the next chapter aims to provide a cross-sectional picture of gender and age differences, and how perceptions differ in relation to attitudes to IT.

Chapter 5 Research Design

'Elle Woods: 'Who wants to talk animal testing?'
Timothy McGinn: 'Write a bill, Britney.' '
Legally Blonde 2 (2003)

Chapters 3 and 4 discussed the various perceptions of the IT industry, the different experiences young people have of computers, and how these can be influencing factors in the way that women can be dissuaded from considering IT careers. Chapter 5 explores the key research questions and describes the methods used to investigate them further. The design of the study, which takes a mixed method approach, is discussed, followed by an account of how the study was conducted. The sampling and procedure for each method will be outlined so it is clear how the experiments were piloted and then carried out.

5.1 Research questions

Chapters 2, 3 and 4 have identified various reasons why women choose not to study IT or computing, how the IT industry is portrayed, and how computers are experienced both at home and at school. The literature review helped provide a background and focus for the research questions as well as the research design for this thesis. The main research question in this thesis is: *How does experience impact the way in which female students at different educational stages perceive their futures in the IT industry?* The research questions can be separated into two main objectives, which are perceptions and experiences.

Experiences

I. How does the IT experience at formal education shape the way female students at different educational stages view the IT industry?
II. How does the IT experience *out of a formal education setting* shape the way in which female students at different educational stages view the IT industry?

Perceptions

III. How do female students at different educational stages perceive the IT industry?
IV. How do female students at different education stages perceive themselves in the IT industry?

In order to research these areas in sufficient depth, it was decided to take a mixed method approach. This meant that questionnaires and then interviews were conducted.

Summary of Approach

First, questionnaires were distributed to male and female students studying for their GCSE ICT, A-level computing and IT, and IT degree level students. This was conducted to provide a preliminary understanding of the main differences between males and females regarding the various experiences and perceptions that have influenced their attitudes to IT. The second phase of the study was to conduct in-depth interviews with this age group in order to understand the emotive reasons behind why young people felt how they did about computing and to what extent this influenced their eventual career aims. The design of this study aimed to provide a picture of gender and age differences. A key text for this was Bryman's Social Research methods (2004).

Justification for the methods used within this study

The methods chosen to carry out the research in this study were questionnaires and interviews, a mixed method approach. The reasons for the methods chosen were the type of research question posed at the beginning of this chapter and the need to collect both quantitative and qualitative data. The research questions focus on understanding 'how' participants felt about certain aspects of their lives. Thus, interviews were conducted to 'bring to life' the statistics and as a way of identifying any anomalies, i.e. those that did not fall within the majority.

Questionnaires helped us understand to what extent young people differed in their computer education. There were various ways that qualitative work could have been undertaken.

Focus groups could have been used, but it was decided that this was not appropriate because the aim of this research is to understand how participants felt about computing at certain points in their lives. Their opinions and views might have changed if they were together in a group of people, so people might feel pressured to agree with the dominant view. Since this study is focused on individual personal experiences, being with others might not have given each person a chance to voice their concerns. Focus groups can also be difficult to control and manage. There is also the issue that it might be difficult to encourage a range of people to participate. Within this study, it was important to build a bond with the participants in order to obtain rich data about their personal lives.

5.1.1 *Strengths and Weaknesses of Questionnaires and Interviews*

Questionnaires

The advantage of questionnaires is that they allow the participants to think about their answers, rather than have the possibility of feeling intimidated. Questionnaires are also cheap to administer to a large number of people, especially if done online, and there is the advantage of uniformity. They are thus able to measure the attitudes and opinions of participants. Questionnaires also allow for anonymity, which could help the response rate as participants can be honest.

There are shortcomings when it comes to questionnaires. It is difficult to obtain a sufficient response, especially when there is no motivation for participants to respond. Questionnaires are difficult to create well, so if they are made badly they can mislead the participant, which is even more important considering that it is difficult to obtain follow-up answers. Then there is the fear by participants and researcher that too much will be read into the answers when analysing the questionnaire results.

How will questionnaires be maximised for the study?

Questionnaires were distributed to schools and were distributed to a varied group of participants. They were piloted to make sure that they requested the data that was needed, and they were anonymised so participants felt secure in writing their true thoughts. To gain a

sufficient response, the researcher went to the schools personally and negotiated with them for the questionnaires to be distributed and collected on the same day. This meant that there was a high response rate, which meant the results given provided a measure of the attitudes and opinions of the participants.

Interviews

The advantage of interviews is obtained when there is a good bond between the interviewer and interviewee. Participants are able to talk about opinions in detail, as well as elaborating complex issues which can be discussed and clarified. The advantage of interviews is that they are flexible in their approach, which allows the interviewer to probe, to gain more depth. Interviews are easy to record.

The disadvantage of interviews is that they often depends on the 'skill' of the interviewer and whether they are experienced enough to get the required depth. Another weakness is that the interviewer may present 'unconscious' signals that could influence the participant. Interviews are time-consuming and can be expensive, as the interviewer has to travel to many venues to do the interviews. It is also very difficult to repeat interviews and participants may be asked different questions, and samples could be small. Analysis of qualitative work is difficult, as there is a lot of depth just from one transcript. Sometimes it is difficult to generalise. It is also difficult to know if the participant is lying.

How will interviews be maximised for the study?

In order to make the most of the interviews, the researcher was trained to get the best possible data in order to help answer the research questions. There was obviously no way to tell if participants were telling the truth or not, but the honest and frank responses provides enough evidence to demonstrate that they were not very intimidated by the researcher. The interviews also correlated with the results of the questionnaire (Bryman 2004).

5.2 Design of study and approach

It was decided that a mixed method approach, which is a combination of both qualitative and quantitative data collection, would provide the best possible data for the research questions. The researcher was entirely convinced that the methods used would help answer the research questions sufficiently.

5.2.1 Reasons for choosing specific schools

The reason for choosing the schools, colleges and universities, was dependent on their availability and access to the participants. Convenience Sampling was used as they were schools, colleges and universities that the researcher had developed an understanding with whilst undertaking this degree. A single sex girl's school had intended to take part, but the school had to drop out, and a decision had to be made to either search for a new single sex school or to continue with the study with the mixed schools. The decision was made to continue with the schools as they were because it was important that the study finished in the required timeframe.

5.2.2 Mixed method approach

The mixed method approach meant that both qualitative and quantitative data collection methods were used to best answer the research questions. In this study, questionnaires were used to obtain quantitative data and interviews were used to obtain qualitative data. Using a mixed method approach provides some triangulation and therefore increased the reliability of the quantitative data collected (Cresswell, 2002; Tashakkori and Teddlie, 1998). The interviews added context to the questionnaires by bringing the responses 'alive', as there is the opportunity to probe and therefore add more depth to the data. Morse describes the mixed method approach in the following way:

'*to obtain different but complimentary data on the same topic*'

(Morse 1991)

Similar studies conducted to investigate student experience and the decline of women in computing have used similar mixed method approaches of questionnaires and interviews to answer their research questions (Durndell, et al., 1990; Mayer-Smith, et al., 2000). The reason for using a mixed method approach for this study was to compare male and female student experiences in computing as well as getting an understanding for how participants felt. The next section describes how the mixed method approach was applied to this study.

5.2.3 Use of questionnaires and interviews

The questionnaires helped to provide numerical information to understand whether there was a difference between the ways in which young people used technology, and the ways in which they perceived themselves using technology. Without the questionnaires, it would have been difficult to probe into this further at the interview stage. In essence, the need to do these questionnaires was to confirm that there were differences and what these differences were.

Interviews were then used to delve deeper into these differences, so as to understand the feelings and motivations behind why young people felt a certain way. The script for the interview was based on the results of the questionnaire and helped narrow what needed to be asked. Figure 5-1 demonstrates the main themes of the questionnaire and shows what needed to be probed in the interviews in order to answer the research questions effectively.

Questionnaire themes/ questions	What was probed on further in interviews
Gender and age differences in school experiences during ICT lessons: •Males/Females 'rated' ICT in a similar way. I.e. negative and positive points. •Males/Females found different things hard/easy. •Thoughts regarding past courses were negative.	•How did what they find hard/easy relate to their past experiences of computers or their experiences at home? • How does each age group find their current course? •How does each age group find their past course? •Students who chose further IT courses gave ICT at GCSE a negative rating, why was this but what made them carry on?
Gender and age differences in out of school experiences on the computer. •Clear differences in out of school computer usage between genders and between ages.	•Why they use the computer in this way outside of school? •How do these differences relate back to course choice? •How do these differences relate to how confident young people feel on the computer. •What do young people do on the computer outside of school and why don't they do other activities?
IT Career perceptions •Biggest gender difference at GCSE level.	•Why perceptions changed as students got older? •Does this change future career plans? •Have older students always felt this way or is it through their increased experience (at home or at school)?
Future career plans •Even though perceptions had changed, females still remained unsure about their role in computing even as they became older.	•Why? •Was this the same as males? •What made females feel unsure about their role in the IT industry? •Why were males more sure about their role in the IT industry? •What put young people off carrying on IT courses?

Table 5-1 Link between the questionnaire themes and the focus of the interviews

5.2.4 Limitations to using a mixed method approach

There are flaws to using a mixed method approach, which were resolved. It is important that equal weight is given to both quantitative and qualitative areas; therefore, both

areas need to be rigorously analysed. The implication of this is that either a research team is needed who are proficient in all areas, or a researcher who is able to analyse both aspects (Creswell 2002). This proved to be a limitation for this study. Although the researcher was able to discuss key findings and results with colleagues, the analysis of the results was conducted solely by the researcher. If this study were to be repeated by a funded research team, the use of a research team who are able to discuss and analyse both qualitative and quantitative data would be ideal.

Tashakkori and Teddie state that there could be problems if there are conflicts between the questionnaires and interviews (Tashakkori and Teddlie 1998). Although not occurring in this study, it would have caused concern had it happened. It would have been interesting to understand why such conflicts in data had occurred. The next section describes the way in which the questionnaire was designed.

5.3 Questionnaire design process

5.3.1 Questionnaire pilot studies

The design of the questionnaire went through two iterations with two pilot studies.

1. The first pilot questionnaire was created and shown to teachers and pupils to get their feedback on the layout and the language used in the questionnaire. It was also shown to an expert in questionnaire design (Dr Ray Langsten, American University in Cairo). This provided a different perspective since the feedback he gave made it relate better to the target audience. This involved one teacher and six pupils (2 GCSE pupils, 2 key stage 3 pupils, and 2 degree level students). The expert pointed out that the initial questionnaire was not clear enough and was only required to collect data that was needed to answer the research questions. This proved useful when re-designing the questionnaire in the next stage. During the pilot questionnaire stage, part of the original procedure was also to interview and give questionnaires to key stage 3 pupils. Key stage 3 was omitted from the final study, as the participants were unable to take part due to work commitments by pupils and teachers. It was then decided to perform another pilot to make sure the questionnaire was able to obtain the data effectively.
2. Using this feedback, the questionnaires were amended accordingly and re-distributed to a wider and larger sample size. They were distributed to two schools in South East London

who were willing to take part in the pilot; one was mixed sex one was single sex, as well as to a university. The response rates in this pilot study were high: key stage 3 had a response rate of 91%, GCSE had 89%, and university questionnaire had 100%. The main reason for this high response was their distribution and collection by the researcher on the same day. The aim of the questionnaire was to test the tool rather than to obtain data, and the presence of the researcher in the classroom helped with this. The details of the schools, and the numbers of participants used for this pilot study are given in Appendix 6.

To summarise the feedback received, it was apparent that the younger participants still found the questions and the vocabulary used quite difficult to understand. For example, different schools had different names for the same thing: ICT was called by two different names (IT or ICT), the font was too small, and the questionnaire took longer than the estimated 10 minutes to fill out. Due to a miscommunication with one of the teachers, 680 took part in this pilot study, who printed more forms and distributed them at a later date before returning them. Although this meant that there was a larger sample size, it also meant that analysing these quickly proved problematic as it was a pilot study to test the 'tool' rather than the actual study. The feedback from the questionnaire pilot study is available in Appendix 5.

5.3.2 Addition of A-level students to the sample

A final set of questionnaires was distributed to A/S Level and A-level students. The pilot results of the GCSE and degree level questionnaire, provided useful data comparing the two age groups. However, on closer inspection, these two age groups alone were not providing the depth needed to answer the research questions. It also became clear that A-level students should also be interviewed to understand what happens during this stage.

5.3.3 Final Questionnaire Sampling

GCSE, A-level and degree level participants were asked to take part in this study. The reason for the different age groups was to understand how the breadth of experience between the age groups influenced perceptions. Table 5-2 describes the age groups who took part in the study.

Age group	There is a need to have this age group because:
GCSE ICT *Ages: 15-16*	• This is when pupils are given the chance to take a qualification in ICT. • GCSE is a time for a first 'official' opportunity to get an understanding of what ICT is. • Pupils need to choose what happens after GCSEs and whether GCSEs will motivate computing or ICT at A-Level.
A/S Level and A-Level IT and Computing *Ages: 17-18*	• Pupils start thinking of what they want to specialise in at degree level. • This is where we see how A-Level students make choices. • We need to get an understanding of what other factors influence degree choices.
Degree Level *Ages: 18+*	• Because it would be good to reflect on why pupils chose the course and the university.

Table 5-2 Justification of the use of certain age groups in this study

5.3.4 What was asked?

The questionnaires consisted of both open and closed questions, related to the research questions. These have been identified as themes. Each theme began with closed questions so that opinions could be understood. This was followed by open questions to understand the reasons why participants answered in the way that they did for the closed questions. Table 5-3 provides a summary of what was asked in the final questionnaire. The actual questionnaires are in Appendix 8 (GCSE Level), Appendix 9 (A-level and A/S Level) and Appendix 10 (Degree level).

Summary of questionnaire
• Demographics: asks for age and gender **Theme 1: <u>Experience of IT at School</u>** 1. Participants were asked about their opinions on their favourite subjects in order to understand how ICT compares to other subjects. 2. Participants were asked to see if ICT GCSE is compulsory at their school. 3. Participants are asked how they find ICT at school and why, as well as asking what they enjoy about ICT lessons at school.
Theme 2: **<u>Experiences of computers out of School</u>** 1. Experiences out of school: this asks where participants use the computer out of school, who they prefer to use the computer with out of school hours, and what activities do pupils prefer to do out of school hours.
Theme 3: <u>Plans for the future</u> 1. This asks: when participants are thinking about their future, where participants go for careers advice. 2. Subjects they plan on taking in the future. 3. Future career plans.
Theme 4: <u>Perceptions</u> 1. This asks whether the participants could imagine themselves working in computing when they are older, asks for different careers, asking for a definition of what computer science is and where they got this information from. 2. This asks how participants working with computers would feel working in computing.

Table 5-3 Themes of the questions asked in the questionnaires

5.3.5 School, College and University participants

Some colleges and schools requested that their details remain confidential. Table 5-4 provides as much data as possible, without identifying the institutions involved.

Level and courses	Institution Details
GCSE Level Courses	
GCSE Level ICT GCSE Students (Full and Short Course)	• Mixed Community College (Hampshire). • Science and Engineering Status College. Engineering status funding, the school has been able to invest in ICT equipment. • Participates in student associates scheme.
Information and Communication Technology (BTEC). GCSE Level Course.	• Mixed Comprehensive School (Hampshire). • Business and Enterprise Status. • Due to Business and Enterprise Status, the school has been able to invest in ICT equipment. • Participates in Computer Clubs for Girls.
A-Level ICT and Computing Courses: Both colleges have taken pupils from the schools being interviewed at GCSE level.	
A-Level Computing and ICT Course	• Mixed Further Education College (Hampshire). • The college engineering department enter engineering competitions yearly.
A-Level/AS Level Computing and ICT Course	• Mixed Further Education College (Hampshire). • The college offers both ICT and Computing. • High level of vocational courses on offer.
Degree Level Courses	
University of Southampton. (Computer Science and ITO Degree)	• 420 UCAS entry points are needed to study computer science at Southampton. • 97% of students said they were satisfied with their courses on the national student survey[15].
South Bank University, London. (Computing and IT Degree)	• 185 UCAS entry points are needed to study computing at South Bank. • 89% of students said they were satisfied with their course on the national student survey.
Solent University, Southampton (Computing and IT Degree)	• 190 UCAS points are needed to study computing at Solent. • 70% of students were satisfied with the quality of their course in computing.

Table 5-4 Justification for sample group

5.3.6 Numbers of participants who answered the questionnaires

The questionnaires were distributed at the institutions in person, and were given out and collected on the same day, which meant that those who were given a questionnaire to fill in gave one back. This meant that the response rate was 100%, although 4 questionnaires

[15]http://www.unistats.com/nStudentSurvey.do;jsessionid=593D1B2AB3777C6EB544DD553FC77F13.worker1?t=20110426034033871

contained missing data as participants were unable to finish this in time. Table 5-5 provides these figures. The numbers of questionnaire participants for each educational stage are limited and a larger sample size would have added to the rigour of the study but this was constrained by time, availability of the participants, and numbers of participants taking the courses.

Course	**Male**	**Female**	**Total**
GCSE ICT full Course	20	7	**27**
GCSE ICT short Course	8	9	**17**
Business Communication Systems	22	11	**33**
A/S Level	12	12	**24**
A-Level Information Technology	19	15	**34**
A/S Level computing	14	6	**21**
A-Level computing	5	5	**10**
Degree level IT (University of Southampton)	6	5	**11**
Degree level IT (South Bank University)	6	6	**12**
Degree level IT (Solent University)	7	7	**14**
Degree level Computer Science (University of Southampton)	19	21	**40**
Degree level Computing (South Bank University)	6	6	**12**
Degree level Computing (Solent University)	7	7	**14**
Total			**269**

Table 5-5 A table to demonstrate those who took part in the main questionnaire study

5.3.7 Analysis of questionnaire data

Microsoft Excel was used to help present the data. Key themes and comparisons were then drawn out to help devise an interview script, which is in Appendix 11. Excel was used to present the graphs and charts in this thesis.

5.4 Interviews

Semi-structured interviews were used as they allow flexibility with the interviewee. This meant that, although there was an interview script, it was more of a guide and it was possible to go ‘off on a tangent’ and probe into new areas if necessary.

5.4.1 Pilot interviews

To test whether the interview questions were easily understood, pilot interviews were conducted with a participant of each gender in the different age groups. This also helped the researcher to get into the frame of mind of having to talk to different age groups. This has proven to be an important part of the process since it was vital to be able to bond with the participants. While listening to the audiotapes of the pilot interviews, it was found that there were problems with the script and the responses were not as insightful as predicted. The questions were then re-written to try to get more depth and again piloted with some university friends and a schoolteacher. The teacher reassured the researcher that the questions were fine but the age groups (especially at GCSE and A-level stages) are often quite shy, so it was the interview technique that may have been at fault. At this stage, it was decided that the researcher would go on a two-day foundation counselling course in order to help with interviewing techniques and probing of information. This proved useful as it helped with listening techniques as well.

5.5 Final interview sampling

A total of 180 interviews were conducted across the different age groups, and both sexes. The interviews and questionnaire data collection were all completed in the same institutions, which helped with consistency.

The interviews were conducted in order to probe further. 180 pupils (90 females and 90 males) were interviewed at key turning points: GCSE level (15-16), A-Level (17-18) and Degree level. Originally, only those at the University of Southampton were going to be interviewed (as they had been the ones which were given the questionnaires), however it was decided later on that it would be good for comparison to interview students from other universities. These were in other areas of the UK, and required a lower UCAS point entry. Each interview lasted no more than 25 minutes. The findings from the interviews, along with the questionnaire results, were enough to give sufficient depth to answer the research questions proposed at the beginning of this chapter. This section provides the details of how the interviews were carried out.

5.5.1 Exemplar interview questions

- What do you perceive a career in computing to be like?
- What activities do you do on the computer outside of school?
- What activities do you do on the computer at school?
- Do you take part in any computer clubs/groups?
- What made you choose your degree course/A-level course or GCSE course?

5.5.2 Numbers of interview participants

The number of participants who took part in the interviews is shown in Table 5-6.

Course	**Male**	**Female**	**Total**
GCSE ICT full Course	5	5	**10**
GCSE ICT short Course	5	5	**10**
Business Communication Systems	5	5	**10**
A/S Level	5	5	**10**
A-Level Information Technology	5	5	**10**
A/S Level computing	5	5	**10**
A-Level computing	5	5	**10**
Degree level IT (University of Southampton)	5	5	**10**
Degree level IT (South Bank University)	5	5	**10**
Degree level IT (Solent University)	5	5	**10**
Degree level Computer Science (University of Southampton)	5	5	**10**
Degree level Computing (South Bank University)	5	5	**10**
Degree level Computing (Solent University)	5	5	**10**
Total			**130**

Table 5-6 Numbers of participants who took part in interviews

5.5.3 Recruitment of pupils and university students

The teachers and lecturers acted as a gateway to the sample in order to recruit participants. At the universities, snowball sampling occurred. Students told their friends about being interviewed and students got in touch to say that their friend had been interviewed and they also wanted to take part. In this case, students at the university acted as a gateway to other students.

Participants were interviewed individually, which gave the opportunity to probe to get more depth. The interviews were flexible and participants were encouraged to provide detailed answers, using real life examples rather than generalisations. This helped to reveal more about attitudes and behaviours to careers.

This method gave the depth required in order to answer the research questions. Fisher and Margolis conducted in-depth interviews in order to understand the experiences of students who are studying computing at degree level (Margolis and Fisher, 2003). The advantage of using the interview method is that it is less intrusive and is like a conversation. This technique allows deeper probing and allows for a certain amount of trust to be built between participant and interviewer. This study took the same approach and used a semi-structured interview approach for the required depth. This is considered in the next section.

5.5.4 Interview script

An interview script is a memory prompt of what needs to be asked. Bryman suggests the following is the best way to create a script (Bryman 2004).

1. Have the questions in an appropriate order.
2. Create questions in a way which answers the research questions.
3. Easy to understand.
4. Do not forget demographics.
5. Understand and familiarise yourself with the environment so you understand the context.
6. A good quality microphone.

The actual interview script used is given in Appendix 11. However, below are bullet points which identify the main issues to be brought out in the question:

1. Demographics.
2. Perception of computing careers.

3. Self-perception of computing careers.
4. Formal and informal learning experiences.
5. Experiences of computing clubs.
6. Why certain decisions have been made.
7. What future plans the participant has made.

5.5.5 Interview pilot studies interview technique

Initial pilot interviews were conducted with 5 participants from each age group and gender, in order to make sure that the participants understood the questions, and to get into the frame of mind of talking to the different age groups. This proved to be an important part of the process, being able to connect with participants to get enough depth to the data. Listening to the recorded responses at this point revealed that they did not prove as insightful as expected. The questions were then re-written to make them simpler; however, it was still difficult to get the depth. This was resolved through attending a foundation counselling course where the techniques discussed below were given.

Interview Technique

During the counselling course, various techniques were suggested to encourage the participant to open up and trust the researcher.

5.5.6 Listening techniques

In order to gain the trust of the participant in such a short time, it was important to show that the interviewer is listening. The researcher was taught how to use her body language through establishing eye contact. The researcher was told to make sure that she encouraged the participant by either saying ‘ah ok’ or ‘cool’ or ‘yeh’. This was to indicate to the participant that what they were saying was important and that the researcher was listening.

5.5.7 Being respectful of opinions

The hardest part of the interviews was learning not to give opinions to the participant. For example, if the participant indicated that they felt that the IT industry was ‘geeky and boring’, it was difficult at first not to try to correct the participant. However, the researcher

learnt that in order to gain the participant's trust and get the best data, it was important that the researcher respected the opinions of the participant.

5.5.8 Reflecting

The researcher was told that it would be a good idea to reflect on the interview after it had been conducted, in order to think about how the participant was feeling. Although it was a good idea to reflect after the interview, as this was a research study rather than a counselling session, it was important both to take notes and record the interview.

5.5.9 Recording and transcription

The interviews were transcribed in order to decode key themes. It was important to get an understanding of the manner in which something was said as well as what was said. The use of a Dictaphone meant that it was easier to pay attention to the interview as it was happening rather than having to write notes.

5.5.10 Analysis of data

The data was analysed with the help of Nvivo (Qualitative data analysis software). The interviews were recorded, and transcribed on the day or the day after they had been conducted. Interview notes were also completed after each interview. The interviews were analysed using Nvivo, which helped with finding emerging themes in the transcripts and helped to organise key quotes.

All interviews were recorded, transcribed and inserted into Nvivo for analysis. The transcriptions were content-analysed. The coding processes focused on finding patterns within the data. The data was first approached using an iterative process to help identify the themes, patterns and grouping of data. Data of 'similar types' were grouped and given a label. At this point the coding was completed and then became broader and put into themes to answer the research questions. The themes were compared with that of the questionnaires and how they answered the research questions.

5.6 Recruitment and reimbursement

Convenience sampling was used in order to collect the data. The teachers and lecturers acted as a gateway to the sample in order to recruit participants. Participants were reimbursed with ECS Goody bags and a choice between chocolate and note cards. The ECS Goody bags consisted of an ECS prospectus, pens, post-it notes and a note book. The teachers were given the chance to have their classes attend either an ECS open day or a career talk given at the school. Teachers all chose to attend an ECS open day, which took place during 2009.

5.7 Confidentiality and ethical considerations

It was important that the experiments were ethical so that the experiment did not waste the time of the participants or to cause them any distress. In order to make sure that the study is ethically sound the following protocols were adhered to.

- Ethics approval was sought from the School of Electronics and Computer Science ethics committee. Feedback was received on how to make the study more ethically sound.
- All participants were asked to sign a declaration form, which is in Appendix 14, which informed participants that they could leave the study at any time and that all findings were confidential.
- Approval from the appropriate people was sought; in this case, the head teacher and the head of ICT at school, or university head of department
- Those taking part in the study were to be made aware of this and were given the opportunity to not take part. It made clear that they did not have to complete the study.
- Confidentiality was assured
- Clear instructions for the participants were given with regard to completing the questionnaire
- All data from the interviews were anonymised
- The interviews were recorded using a digital audio recorder
- The interview data was kept secure
- The interviews were transcribed as early as possible by the researcher
- The recordings and associated data are to be kept after the final PhD examination and submissions. One year should be sufficient for this purpose. Following that time, data will be destroyed.

5.8 Confidentiality issues and disclosure

When conducting the interviews, participants were assured of confidentiality. In three cases this was misinterpreted, because three participants did disclose sensitive information about themselves. This had to be relayed to a teacher as it was appropriate to do so. Subsequently, when assuring confidentiality, it was important to mention that the data will be confidential; however, anything that could put a minor in danger had to be told to an authority figure.

5.9 Limitation of study

The samples in this study are not representative of the population and it should be kept in mind that no attempt has been made to make population estimates in this study. In other words, no generalizations with regards to the results of the data have been made. The aim of this study is not to document or assume that every school or child in the UK is of a certain opinion. But there will be the assumption that the trends are an indicator of what is happening with regards to female students' experiences of IT and computing.

The sample is limited but it is appreciated that a wider range of schools would have been needed for a more rigorous study.

5.10 Conclusion

Chapter 5 has revisited the key research questions which support this thesis. It outlined the design of the study and a justification for the mixed method approach to respond to the research questions listed earlier in the chapter. The sampling and procedures for this study were then presented.

Chapter 6 will present the findings. It begins with the results of the GCSE level participants. Splitting the results by different educational levels means there is clarity in understanding how the attitudes of the different ages and genders change as exposure to different technological experiences increase.

Chapter 6 Results: GCSE Level

'Mrs Wilkinson: This'll sound strange, Billy, but for some time now I've been thinkin' of the Royal Ballet School.

Billy: Aren't you a bit old, miss?

Mrs Wilkinson: No, not me... you! I'm the bloody teacher!'

Billy Elliot (2000)

The results of the questionnaires are presented in the following three chapters. This chapter presents the results from GCSE level participants, which follow these themes.

Theme 1: Experiences of computers at school: *aims to demonstrate the way in which young people experience ICT at school and what kinds of experiences differ between male and female students*.

Theme 2: Experience of computers out of school: *aims to get an understanding of how these experiences are different to those out of school*.

Theme 3: Future Career Plans: *aims to understand what resources male and female participants use to help them make their career decisions*.

Theme 4: Perceptions of studying further computing and IT courses: *aims to understand how male and female participants perceive technology careers*.

Each theme will begin with the results obtained from the questionnaire in order to provide a broad sweep and understanding. The questionnaire is available in Appendix 7. The chapter begins with the demographics.

The data will be presented question-by-question, the order they were presented in the questionnaire. Despite the small numbers involved, it was decided to use percentages to make

uneven numbers easier. In using percentages, numbers have had to be rounded up to ensure they total 100%.

6.1 Demographics

Three groups of participants at GCSE level completed the questionnaires. Table 6-1 shows the numbers of participants who took part and the description of the courses.

	Male Participants	**Female Participants**
GCSE Full Course (School 1): This course is worth 1 GCSE. The examining board advises that 2 lessons a week (2 hours) are required. The course modules are: word-processing, databases, spreadsheets, desktop publishing, communications software, simulation, data logging and computer control (Edexcel 2000).	**Questionnaire:** 20 Participants	**Questionnaire:** 7 Participants
GCSE Short Course (School 1): This course is half a GCSE. The examining board advises that 1 lesson a week (1 hour) is required. The course modules are: word-processing, databases and spreadsheets (Edexcel 2000).	**Questionnaire:** 8 Participants	**Questionnaire:** 9 Participants
Business Communication Systems (School 2): This course is worth 1 GCSE. The examining board advises that 3 lessons a week (3 hours) are required. The course modules are: the business environment, workplace organisation, human resources, communication, use of ICT in a business environment, computer applications in a business environment. The last includes: file management, word-processing, spreadsheets, charts, databases and graphics (Edexcel 2000).	**Questionnaire:** 22 Participants	**Questionnaire:** 11 Participants

Table 6-1 Demographics of GCSE level participants

The sample used in this chapter aims to give a snapshot of the breadth of courses available. However, when presenting and analysing these results, generalisations cannot be made as this sample is not representative of the population. One school was used for the GCSE ICT full and short courses, whilst a second was used for the Business Communication Systems course. Ideally, in a funded project where there was more time, more schools would have been investigated. Despite this, the results of this study helped provide an overview of issues that could be looked into further. The type of school, teachers and other factors, as well as gender, will be considered when presenting and commenting on these results. A background to the schools was provided in chapter 5. In summary, the school hosting the GCSE ICT participants did not receive a high rating from Ofsted in ICT teaching, grades overall were below the national average, and the school's equipment needed to be replaced. In contrast, the school hosting the Business Communication Systems participants was a specialist Mathematics and Computing school, the equipment was relatively up-to-date, and high praise was given by Ofsted. These issues will be taken into account when presenting the results. Although Ofsted reports are available for public viewing, it was decided to protect the confidentiality of the schools by not referencing their reports.

6.2 Theme 1: Experience of computers at School

The questions asked in this section aim to provide a deeper understanding of young people's experience of ICT at school, and investigate how these experiences differ between male and female participants. The questions presented in this chapter are those that help answer the following research question: '*How does experience impact the way in which female students at different educational stages perceive themselves in the IT Industry?*' Four sub-questions were identified. The results provided in this section are to the following questions from the questionnaire:

Question 1. *Please tick one box for each of the subjects you do at school to show what you think of them*. This question asked participants to state how they felt about the other subjects they were studying in order to understand where the GCSE ICT courses performed in comparison.

Question 2. *How do you find ICT at school?* This question asked participants to state how easy they found their ICT courses. This was to understand whether the level of difficulty of the course posed a problem for participants and was a factor in dissuading them to

carry on, as well as to understand whether there was a gender split in how participants found the course.

Question 3. *Why did you find ICT this way?* This was an open question in order to understand why participants found ICT easy or difficult.

Question 4. *List up to three activities that you enjoy in your ICT lesson*. The aim of this question was to understand what types of activities were favoured by young people.

Question 5. *List up to three activities that you don't enjoy in your ICT lesson*. The aim of this question was to understand what activities put young people off ICT lessons.

Question 6. *Why did you choose ICT at GCSE?* The aim of the question was to understand participants' motivation in choosing ICT as a subject, and why they made the decision to choose a particular course in ICT.

6.2.1 Question 1. How does ICT compare with other subjects at GCSE level?

The questionnaire began by asking how ICT could be compared to other subjects studied at GCSE level. Overall, the results demonstrate that male participants preferred ICT lessons far more than female participants. Participants had the opportunity to choose if they: 0 – '*didn't do the subject*', 1 – '*really hated the subject*', 2 – '*didn't like the subject*', 3 - the subject was '*ok*', 4 – '*liked the subject*' and 5 – '*loved the subject.*' There were 11 subjects altogether. The ratings of the subjects were averaged and this provided a 'league table' of subject preferences. Female participants ranked ICT near the bottom of the table as it was 3rd from the bottom, whereas for male participants ICT ranked 6th, which was in the middle of the table. Table 6-2 shows the mean of how male and female participants felt about their subjects.

	Ranking	**Female students**	Average	**Male students**	Average
Most Favourite	1	Drama	4.8077	Music	5.1154
	2	Music	4.7083	Art	4.9692
	3	History	4.1928	History	4.7692
	4	Art	4.1200	Drama	4.6538
	5	Geography	4.0385	Geography	3.6538
	6	Modern Languages	3.4615	**ICT**	**3.5385**
	7	English	2.8846	P.E.	3.1538
	8	Science	2.8462	Modern Languages	2.9615
	9	**ICT**	**2.6154**	Science	2.4615
	10	Maths	2.4167	Maths	2.4615
Least Favourite	11	P.E.	2.2308	English	2.3462

Table 6-2 Mean of how males and female participants preferred GCSE ICT lessons

Table 6-2 provides an overall summary of how participants found ICT in school. However if the results are split up by the type of course (GCSE full course, GCSE short course and Business Communication Systems) taken, it was clear that participants taking the Business Communication Systems course preferred their ICT lessons far more than those taking the GCSE ICT full and short courses. Therefore, female participants taking the Business Communication Systems course felt that they enjoyed the course, which was similar to their male counterparts also taking the course. Participants taking the ICT GCSE full and short courses were negative about the courses. The difference of preference between the different courses is noteworthy because it demonstrates that participants do enjoy ICT at GCSE level if the courses are applied to the real world (which the Business Communications Systems course is). In other words, there are courses available to take, which provide a positive experience of ICT lessons.

GCSE ICT Full Course

A higher number of female participants on the GCSE ICT Full course disliked the course compared with their male counterparts. The majority of female participants were more inclined to say that they '*hated*' the full course (43%), whereas the majority of male participants wrote that they '*liked*' the course (55%). The considerable split between male and female participants demonstrates the dislike female participants had of the course. It is also clear that neither gender '*loved*' the course. Table 6-3 shows the clear difference between male and female feelings with regards to ICT lessons.

	Number of Female participants	**Percentage**	**Number of Male participants**	**Percentage**
Hate it	3	43%	0	0%
Don't like it	2	29%	0	0%
It's OK	1	14%	9	45%
I like it	1	14%	11	55%
I love it	0	0%	0	0%
I don't do it	0	0%	0	0%

Table 6-3 How GCSE Full course participants felt about their ICT lessons when compared to other school subjects

GCSE ICT Short Course

The female participants on the GCSE ICT Short course did not regard ICT as a popular lesson. These views were similar to those on the full course. The majority of female participants taking ICT short course either '*hated*' the course (33%), '*didn't like it*' (22 %) or

found it '*ok*' (33%). In contrast, male participants were more positive about the course as the majority of participants (50%) indicated that the course was 'ok'. Table 6-4 shows the difference of opinion between male and female participants.

	Number of Female participants	**Percentage**	**Number of Male participants**	**Percentage**
Hate it	3	33%	0	0%
Don't like it	2	22%	1	12.5%
It's OK	3	33%	4	50%
I like it	1	12%	2	25%
I love it	0	0%	1	12.5%
I don't do it	0	0%	0	0%

Table 6-4 How GCSE Short course participants felt about ICT lessons when compared to other school subjects

Business Communication Systems

Female participants on the Business Communication Systems course were more positive about their course than the female participants taking the GCSE ICT full and short courses. This is demonstrated by 18% of female participants stating that they '*loved*' the course and 27% writing that they either thought it was '*OK*' or that they '*liked*' the course (36%). The differences between male and female participants studying the Business Communications Systems course are less prominent than those doing the GCSE ICT full and short courses. This is shown in Table 6-5.

	Number of Female participants	**Percentage**	**Number of Male participants**	**Percentage**
Hate it	1	9%	0	0%
Don't like it	1	9%	2	9%
It's OK	3	27%	9	41%
I like it	4	37%	4	18%
I love it	2	18%	7	32%
I don't do it	0	0%	0	0%

Table 6-5 How Business Communication Systems course participants felt about ICT lessons when compared to other school subjects

The difference between the participants who took the GCSE ICT course and the Business Communication Systems course was the different schools. It was clear that participants studying the GCSE ICT course didn't have a positive experience in comparison to those on the Business Communication Systems course, which could be due to the actual course content but could also be due to the equipment available within the schools or the school's attitudes to computing.

6.2.2 Question 2. How participants found ICT lessons

Participants were asked how easy or difficult they found ICT. This question was asked in order to understand if there was a gender split and if this could have been a factor in dissuading or encouraging participants to think about ICT in a certain way. Participants had the opportunity to choose if the course was: 1 – *'really easy'*, 2 - '*easy'*, 3 – '*quite difficult'* and 4 – '*really difficult'*.

The results showed that within the GCSE ICT full and short course there was a gender split as to how participants felt about the course. The majority of female participants found the course '*difficult*', whereas males felt that the course was '*easy*'. In contrast the female participants on the Business Communication Systems course had similar feelings about the course as their male counterparts (see table 6-6).

GCSE ICT Full Course

The majority of female participants taking GCSE full course ICT said that they found the course '*quite difficult*' (57%). The percentage of female participants saying that they found the course '*really easy*' was 29%. It was interesting that neither male nor female participants described the course as just '*easy*'. In comparison, male participants found the course '*really easy*' or '*quite difficult*'. Table 6-6 demonstrates a clear difference between the two in terms male and female participants and how they found the course.

	Number of Female participants	**Percentage**	**Number of Male participants**	**Percentage**
Really Easy	2	29%	14	70%
Easy	0	0%	0	0%
Quite Difficult	4	57%	6	30%
Really Difficult	1	14%	0	0%

Table 6-6 Perceived difficulty of GCSE ICT Full course

Short Course ICT

Female participants studying the ICT short course found ICT *'quite difficult'* (33%) or '*really difficult'* (33%). The majority of male participants described finding the course '*easy*' with few finding the course '*quite difficult'* or '*very easy'*. The contrast between male and female participants is demonstrated in Table 6-7 and is similar to those on the full course, whereas the difference between the female participants taking the full and short course is more distinctive.

	Number of Female participants	Percentage	Number of Male participants	Percentage
Really Easy	1	12%	5	63%
Easy	2	22%	2	25%
Quite Difficult	3	33%	1	13%
Really Difficult	3	33%	0	0%

Table 6-7 Perceived difficulty of GCSE ICT Short course

Business Communication Systems

Female participants taking the Business Communications Systems course felt the course ranged from *'really easy'* to '*quite difficult'*. This is shown in Table 6-8.

	Number of Female participants	Percentage	Number of Male participants	Percentage
Really Easy	4	36%	6	27%
Easy	5	45%	11	50%
Quite Difficult	2	18%	5	23%
Really Difficult	0	0%	0	0%

Table 6-8 Perceived difficulty of the Business Communication Systems course

6.2.3 Question 3: Why did you find ICT this way?

Participants were asked to write why they found the course '*really easy', 'easy', 'quite difficult' or 'really difficult'*. The results are split up by courses.

GCSE ICT Full Course

The majority (57%) of female participants (as stated in table 6-6) taking GCSE ICT as a full course indicated in the questionnaire that they found the course '*quite difficult'*. Participants who felt this way did so because they found the course 'boring' (2 participants), which is presented in extract 2 or felt that it was difficult to obtain a high mark in the subject (2 participants), which is presented in extract 1.

> GCSEFullQuestionnaireF2[Q3]:*'I find it difficult because I never know what to do to get the high marks.'* Questionnaire Extract 1 Female participant taking Full Course ICT

> GCSEFullQuestionnaireF1[Q3]:*'Its OK… I just find that it can sometimes be a little tedious or boring.'* Questionnaire Extract 2 Female participant taking Full Course ICT

GCSE ICT Short Course

The majority of male participants (63%) indicated that they found the course '*really easy'*. In the questionnaires, it was common for ICT to be described as a 'doss' subject, which implies that is easy to manage and easy to obtain a high grade. This is shown in Questionnaire Extract 3.

> GCSEShortQuestionniareM1[Q3]: *'It's a doss. I don't have to do much to get a high grade'.*Questionnaire Extract 3 Male participant taking Short Course ICT

Business Communication Systems Course

Both male and female participants had varied opinions of the course. Male participants tended to blame the course if they found it difficult(extract 4), whereas female participants blamed themselves (extract 5).

> GCSEBCSQuestionnaireM2[Q3]: *'The course is stupid. We shouldn't have to learn Flash'.* Questionnaire Extract 4 Male participant studying Business Communication Systems Course.

> GCSEBCSQuestionnaireF1[Q3]: '*I'm just not good at it. I just need more practice I think.'* Questionnaire Extract 5 Female participant studying Business Communication Systems Course.

6.2.4 Question 4: List up to three activities that you enjoy in your ICT lesson

In the questionnaires participants were asked to name three activities which they enjoyed in ICT lessons. This was an open question and it was clear that there were again amongst participants taking the different courses, as well as gender.

Participants on Business Communication Systems Course

The majority of both male and female participants stated two specific modules they enjoyed in their lessons: the website design module (females 45% and males 64%) and the

computer maintenance (females 45% and males 73%). Table 6-9 demonstrates what participants enjoyed on their course.

	Number of Female participants (participants had to choose as many as they wanted)	**Number of Male participants**
Website Design	5	14
Computer Maintenance	5	16
Checking E-mail and going on social networking sites	3	11
Microsoft PowerPoint	4	5
Using new equipment e.g. film editing.	5	14

Table 6-9 Favourite activities in class (Business Communication Systems)

The computer maintenance module lasted three lessons and they were able to open up a computer and learn about how it works. The participants wrote that three lessons were not enough for this module (extract 6). The website design module allowed participants to design a website. They enjoyed this as it was not something they were able to do before they started course and enjoyed using Flash which is what they used to design their websites. Participants indicated that they did not enjoy writing about what they learnt; the writing aspect of the module took four weeks and felt that this was tedious (extract 7).

> GCSEBCSQuestionnaireF3[Q4]: *'It was cool seeing inside a computer. I wish we were able to do more practical things'.* Questionnaire Extract 6 Female participant studying Business Communication Systems Course

> GCSEBCSQuestionnaireF7[Q4]: '*I really enjoyed website design because I didn't do that before'.* Questionnaire Extract 7 Female participant studying Business Communication Systems Course

6.2.5 Question 5: Name three activities you do not enjoy in lessons

In the questionnaires participants were asked to name three activities which they did not enjoy in ICT lessons. Similar to the previous question, this was an open question and there

were differences amongst genders. Interestingly, the questionnaire results did not show many differences between courses.

Boys in the class

Within the questionnaires, 7 female participants indicated that they felt distracted with male students in the class and felt that they got more attention from the teachers. Participants stated that they this hindered their enjoyment of ICT lessons (extract 8).

> GCSEICTQuestionnaireF3[Q4]: *'The guys are a bit annoying in lessons because they take over sometimes'.* Questionnaire Extract 8 Female participant studying ICT Course

Boredom in GCSE ICT lessons

In the questionnaires both male (9 participants) and female (11 participants) stated that they felt lessons were boring. Both male and female participants wrote that they felt that modules went on for too long and they did not understand the point of some of the modules (extract 9).

> GCSEICTQuestionnaireF3[Q4]: *'Lessons are just boring and repetitive'* Questionnaire Extract 9 Female participant studying ICT Full Course

Teachers knowledge of ICT

Participants stated in the questionnaire (this was more prominent amongst male participants) that teachers were often unable to help them. It was apparent that the female respondents felt that they could not experiment too much on the computer as they did not trust their teacher to help them resolve problems (see extract 10). The questionnaire extract below demonstrates this:

> GCSEICTQuestionnaireF3[Q4]: *'Its obvious the teacher doesn't know that much and is just blagging it'* Questionnaire Extract 10 Female participant studying ICT Full Course.

6.2.6 Question 6: Why did you choose ICT at GCSE level

All participants were asked via questionnaires why they decided to take ICT. The most prominent answer amongst male and female participants (regardless of their course) was that

IT was important as it would help them get a job and they had expectations that the courses would be exciting. Participants studying the GCSE ICT full and short courses wrote that they expected to have the opportunity to try new technologies, new applications and learn new concepts.

Importance of ICT to the future

In the questionnaires, participants wrote that they chose ICT GCSE because they thought it was an important course to take. In the questionnaires, participants mentioned that parents and teachers had advised them to take the course (extract 11). As well as perceiving the subject to be important there were certain expectations that young people had of GCSE ICT.

> GCSEICTQuestionnaireF4[Q5]: *'Miss told me that its important for college and things.'* Questionnaire Extract 11 Female participant studying ICT Course

Expectations

In the questionnaires, participants described certain expectations they had of ICT GCSE. They were expecting that they would learn about new technologies. This was mainly the case with participants on the GCSE ICT full and short courses (extract 11).

> GCSEICTQuestionnaireF5[Q5]: *'I thought we would be able to use better technology but its not different to what I have at home.'* Questionnaire Extract 12 Female participant studying ICT Full Course

This section has helped to provide a clearer picture of whether those who experience ICT in a certain way will perceive it in a certain way if the differences are related to the type course the participant is studying or the gender differences. Although this section has demonstrated that those on the Business Communication Systems course have more of a positive experience and those on the long and short course described it to be a boring and tedious course to be on. It was more the course content and modules the participants enjoyed. The distinct difference between the two groups of students is difficult to ignore. There is more for the participants on the Business Communication course to like in terms of course content. All three groups disliked the similar activities. There were the issues with regards to the confidence of male and female participants on the computer where the male participants perceived themselves to be confident and the female participants were not as confident.

6.2.7 Theme 1: Experiences at School summary of key findings

- Participants who studied for the ICT GCSE full and short course had a less enjoyable and favourable experience of their course. However, participants who studied the Business Communication Systems course rated the course far higher than those on the GCSE course. In this case, there was hardly a difference between the two genders. (Question 1)
- Female participants found all courses more difficult than their male counterparts. (Question 2)
- Participants on the Business Communication Systems course felt that the modules they enjoyed were the website design modules and the computer maintenance modules. These modules were popular because participants had not done them before and they were new (Question 4).
- GCSE participants felt that their course lacked in creativity (Question 5).
- There were varied reasons for choosing ICT as a subject. Participants mentioned being advised to do so by a parent or teacher. As well as understanding its importance for future careers (Question 6).

The next section demonstrates how young people use the computer out of a formal school setting. The results show less evidence amongst of differences amongst the participants due to the different courses they were studying but there were clearer differences between the genders.

6.3 Theme 2: Experience of using the computer out of school

The questions asked in this section aim to provide a deeper understanding of young people's experience of ICT out of school and how these experiences differ between male and female participants. The contrast between home and school experiences will also be compared. The questions presented in this chapter are those which help answer the following research question: '*How does experience impact the way in which female students outside of formal learning perceive themselves in the IT Industry?* Four sub questions were identified. The results provided in this section are to the following questions from the questionnaire:

Question 7. '*Where do you prefer to use the computer out of school hours?'* This question aims to understand where participants preferred to use a computer and if there was a gender split concerning this.

Question 8. '*Who do you prefer to use the computer with?'* The aim of this question was to understand who participants preferred to use the computer with out of school and if there was a gender split concerning this.

Question 9. *'What activities do you enjoying doing on the computer?'* This question again aims to get a deeper understanding of computer use out of school and aims to understand if there is a difference in what male and female participants prefer to do out of school on the computer and how much of an impact this can have on career decision making.

6.3.1 Question 7: Where participants preferred to use the computer

The first question in this section asks where young people preferred to use the computer. Participants had a choice between: 1 – '*home*', 2 – '*library*', 3- '*after school/breakfast club*' and using the computer at 5 – '*friends or family's house*'. The questionnaire results showed that female participants preferred use the computer: *at home or an after school or school breakfast club*. In comparison, male participants also preferred to use the computer at home but also at their friends and/or families houses. The next section presents the percentages on where female participants preferred to use the computer.

Female participants and where they preferred to use the computer

Table 6-10 presents where female participants preferred to use the computer outside of school. The most popular option for all female participants was to use the computer at *home.* Participants studying Business Communication Systems had a high preference for after *school clubs* and preferred using the computer in varied places. Like in the previous theme it needs to be taken into account that the Business Communications Systems course is in a specialist maths and computing school, which means that it might be more likely to provide *after school computer clubs*.

	Home	**Library**	**After School/ Breakfast club**	**Friend or family house**
GCSE ICT Full Course	72% *(5 Participants)*	14% *(1 Participant)*	14% *(1 Participant)*	0%
GCSE ICT Short Course	78% *(7 Participants)*	11% *(1 Participant)*	11% *(1 Participant)*	0%
Business Communication Systems	55% *(6 Participants)*	9% *(1 Participant)*	27% *(3 Participants)*	10% (*1 Participant)*

Table 6-10 Where female participants prefer to use the computer

Male participants and where they preferred to use the computer

Male participants indicated that they preferred to use the computer in varied locations and not just at home. This is shown in Table 6-11. The majority of male participants preferred to use the computer at *home, the breakfast/after school club or at a friend or family member's house*. This is in contrast to the female participants who preferred using the computer at home.

	Home	**Library**	**After School/ Breakfast club**	**Friend or family house**
GCSE ICT Full Course	30% *(6 Participants)*	15% *(3 Participant)*	0%	55% *(11 Participants)*
GCSE ICT Short Course	13% *(1 Participant)*	0% *(0 Participant)*	38% *(3 Participant)*	50% *(4 Participants)*
Business Communication Systems	32% *(7 Participants)*	9% *(2 Participant)*	41% *(9 Participants)*	18% (*4 Participant)*

Table 6-11 Where male participants prefer to use the computer

6.3.2 Question 8: Who do you prefer to use the computer with?

Participants were asked in the questionnaire who they preferred to use the computer with. Female participants preferred to use the computer *alone*, whereas male participants had a preference for wanting to use them with *friends*. The reasons for female participants wanting to use the computer alone mirrored the results of the previous section, that they did not feel confident using it in front of others. Table 6-12 shows the preferences of female participants and Table 6-13 shows the preferences of male participants.

Female Participants

The majority of female participants preferred using the computer *alone* and using the computer with *siblings* was also popular. Only ICT short course participants stated that they preferred to use the computer with their *parents* and it was only Business Communication Systems participants who preferred to use the computer either at a *friends* or *family member's house*. Table 6-12 shows the figures.

	Own	**Parent**	**Sibling**	**Friend or family house**
GCSE ICT Full Course	86% *(6 Participants)*	0% *(0 Participant)*	14% *(1 Participant)*	0%
GCSE ICT Short Course	67% *(6 Participants)*	22% *(2 Participant)*	11% *(1 Participant)*	0%
Business Communication Systems	73% *(8 Participants)*	0% *(0 Participant)*	9% *(1 Participant)*	18% (*2 Participants)*

Table 6-12 Who female participants prefer to use the computer with

Male Participants

In comparison to female participants, male participants preferred to use the computer with their *peers* or *family members* (excluding parents). Using the computer with *parents* was the least popular. Whereas using the computer *alone* or with *friends* or *family* were popular. Table 6-13 shows the figures and then shows an interview extract in order to provide further detail.

	Own	**Parent**	**Sibling**	**Friend or family house**
GCSE ICT Full Course	35% *(7 Participants)*	10% *(2 Participants)*	30% *(6 Participants)*	25% *(5 Participants)*
GCSE ICT Short Course	37% *(3 Participants)*	13% *(1 Participant)*	25% *(2 Participants)*	25% (*2 Participants)*
Business Communication Systems	27% *(6 Participants)*	0% *(0 Participant)*	32% *(7 Participant)*	41% (*9 Participants)*

Table 6-13 Who male participants prefer to use the computer with

6.3.3 Question 9: What do you prefer to do on the computer outside of school?

Participants were asked what activities they preferred doing on the computer outside of school. Female participants preferred using the computer for: *social networking, surfing the web* and *answering email*. Interestingly, female participants also named *computer games* as an enjoyable activity. In addition, male participants also preferred to use the computer for *playing games, fixing computers*, and a few enjoyed *programming*. Table 6-14 Table 6-15 and Table 6-16 show the results of both male and female participants. Interestingly, there was less of a difference in terms of the course participants took and the more profound difference was gender. Both male and female participants and the activities they preferred doing. The results are split by their respective courses.

What female participants studying full and short course ICT preferred to do on the computer outside of school

Female participants preferred activities such as *social networking, surfing the web* and *answering emails*. Table 6-14 and Table 6-15 show the results of the activities which female participants preferred and are split by their respective courses. Participants on both courses had similar preferences in terms of what they preferred to do on the computer outside of school. Female participants on the Business Communications Systems course preferred activities such as web design far more than those on the full course and short course.

Ranking	Number of participants or percentage	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
1	Social networking	5	2	0	0	0	0
	Percentage	71%	29%	0	0	0	0
2	Surfing the web	4	3	0	0	0	0
	Percentage	57%	43%	0	0	0	0
3	Email	3	2	1	1	0	0
	Percentage	43%	29%	14%	14%	0	0
4	Computer games	0	2	3	1	1	0
	Percentage	0	29%	43%	14%	14%	0
4	Graphic Design	0	2	3	1	1	0
	Percentage	0	29%	43%	14%	14%	0
4	Blogging	0	1	1	2	3	0
	Percentage	0	14%	14%	29%	43%	0
4	Writing Stories	0	0	1	1	3	2
	Percentage	0	0	14%	14%	43%	29%
4	Website Design	0	1	2	1	0	3
	Percentage	0	14%	29%	14%	0	43%
4	Programming	0	0	0	1	0	6
	Percentage	0	0	0	14%	0	86%
4	Fixing Computers	0	1	2	2	1	1
	Percentage	0	14%	29%	29%	14%	14%
4	Homework	0	0	0	3	4	0
	Percentage	0	0%	0	43%	57%	0

Table 6-14 What participants studying full and short course ICT preferred to do on the computer at school

Female participants studying ICT Short Course

Ranking	Number of participants or percentage	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
1	Social networking	7	2	0	0	0	0
	Percentage	78%	22%	0	0	0	0
2	Email	5	2	1	1	0	0
	Percentage	56%	22%	11%	11%	0	0
2	Surfing the web	5	4	0	0	0	0
	Percentage	56%	44%	0	0	0	0
3	Computer games	0	1	3	4	1	0
	Percentage	0	11%	33%	45%	11%	0
3	Graphic Design	0	1	4	2	2	0
	Percentage	0	11%	45%	22%	22%	0
3	Blogging	0	0	2	4	3	0
	Percentage	0	0%	22%	45%	33%	0
3	Writing Stories	0	0	0	2	5	2
	Percentage	0	0	0%	22%	56%	22%
3	Website Design	0	1	3	2	0	3
	Percentage	0	11%	34%	22%	0	33%
3	Programming	0	0	0	1	0	8
	Percentage	0	0	0	11%	0	89%
3	Fixing Computers	0	0	1	4	2	2
	Percentage	0	0%	11%	45%	22%	22%
3	Homework	0	0	0	6	3	0
	Percentage	0	0%	0	33%	67%	0

Table 6-15 What participants studying full and short course ICT preferred to do on the computer at home

What female participants studying Business Communications Systems preferred

Participants on the Business Communications Systems course preferred the same type of activities as participants on the GCSE ICT Full and Short courses however they also showed a preference for activities such as *website design*' which was also popular in schools.

Ranking	Number of participants or percentage	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
1	Social networking	9	2	0	0	0	0
	Percentage	82%	18%	0	0	0	0
2	Surfing the web	7	4	0	0	0	0
	Percentage	64%	36%	0	0	0	0
3	Email	6	2	2	1	0	0
	Percentage	55%	18%	18%	9%	0	0
4	Website Design	2	3	1	2	3	0
	Percentage	18%	28%	9%	18%	27%	0%
5	Graphic Design	1	4	2	2	2	0
	Percentage	9%	37%	18%	18%	18%	0
5	Blogging	1	1	2	4	3	0
	Percentage	9%	9%	18%	37%	27%	0
6	Computer games	0	2	3	2	4	0
	Percentage	0	18%	27%	18%	37%	0
6	Writing Stories	0	0	0	2	7	2
	Percentage	0	0	0%	18%	64%	18%
6	Programming	0	0	2	1	0	8
	Percentage	0	0	18%	9%	0	73%
6	Fixing Computers	0	0	2	5	2	2
	Percentage	0	0%	18%	46%	18%	18%
6	Homework	0	0	0	7	4	0
	Percentage	0	0%	0	36%	64%	0

Table 6-16 What participants studying Business Communication Systems preferred to do on the computer at home

What male participants preferred to do on the computer outside of school

Male participants preferred activities such as *gaming, social networking, surfing the web* and *answering emails*. There was a distinct difference with female participants, especially in terms of gaming.

Full Course GCSE ICT

Ranking	Number of participants or percentage	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
1	Computer games	10	8	2	0	0	0
	Percentage	50%	40%	10%	0%	0%	0
2	Social networking	8	9	3	0	0	0
	Percentage	40%	45%	15%	0	0	0
2	Email	8	7	5	0	0	0
	Percentage	40%	35%	25%	0%	0	0
2	Surfing the web	11	8	1	0	0	0
	Percentage	40%	55%	5%	0	0	0
4	Graphic Design	0	0	5	8	7	0
	Percentage	0	0%	25%	40%	35%	0
4	Blogging	0	0	0	15	3	2
	Percentage	0	0%	0%	15%	75%	10%
4	Writing Stories	0	0	0	0	18	2
	Percentage	0	0	0%	0%	90%	10%
4	Website Design	0	8	8	3	1	0
	Percentage	0	40%	40%	15%	5%	0%
4	Programming	0	8	2	2	0	8
	Percentage	0	40%	10%	10%	0	40%
4	Fixing Computers	0	5	5	5	5	0
	Percentage	0	25%	25%	25%	25%	0%
4	Homework	0	0	0	0	20	0
	Percentage	0	0%	0	0%	100%	0

Table 6-17 What male participants studying GCSE ICT preferred to do on the computer at home

Short Course GCSE ICT

Ranking	Number of participants or percentage	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
1	Computer games	7	1	0	0	0	0
	Percentage	87%	13%	0%	0%	0%	0
2	Social networking	6	2	0	0	0	0
	Percentage	75%	25%	0	0	0	0
3	Email	5	3	0	0	0	0
	Percentage	62%	38%	0%	0%	0	0
3	Surfing the web	5	3	0	0	0	0
	Percentage	62%	38%	0	0	0	0
4	Graphic Design	2	3	2	1	0	0
	Percentage	25%	37%	25%	13%	0%	0
5	Website Design	1	3	2	0	0	2
	Percentage	12%	38%	25%	0%	0	25%
6	Blogging	0	0	0	3	5	0
	Percentage	0	0%	0%	37%	63%	0
6	Writing Stories	0	0	0	0	8	0
	Percentage	0	0	0%	0%	100%	0%
6	Programming	0	0	1	2	2	3
	Percentage	0	0	12%	25%	25%	38%
6	Fixing Computers	0	0	2	2	1	3
	Percentage	0	0%	25%	25%	12%	38%
6	Homework	0	0	0	5	3	0
	Percentage	0	0%	0	62%	38%	0

Table 6-18 what male participants studying GCSE ICT Short Course preferred to do on the computer at home

Business Communications Course

Ranking	Number of participants or percentage	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
1	Computer games	17	3	2	0	0	0
	Percentage	77%	14%	9%	0%	0%	0
2	Social networking	16	5	1	0	0	0
	Percentage	73%	23%	4%	0	0	0
3	Surfing the web	14	8	0	0	0	0
	Percentage	64%	36%	0	0	0	0
4	Email	10	11	1	0	0	0
	Percentage	45%	50%	5%	0%	0	0
5	Website Design	5	8	9	0	0	0
	Percentage	23%	36%	41%	0%	0%	0%
6	Blogging	4	5	8	5	0	0
	Percentage	18%	23%	36%	23%	0%	0
7	Graphic Design	7	8	5	2	0	0
	Percentage	9%	36%	32%	23%	0%	0
8	Writing Stories	0	0	0	1	21	0
	Percentage	0	0	0%	5%	95%	0%
8	Programming	0	2	5	7	0	8
	Percentage	0	9%	23%	32%	0	36%
8	Fixing Computers	0	5	10	3	2	2
	Percentage	0	23%	45%	14%	9%	9%
8	Homework	0	0	1	14	7	0
	Percentage	0	0%	4%	32%	64%	0

Table 6-19 What male participants studying Business Communication Systems preferred to do on the computer at home

6.3.4 Theme 2: Summary of experiences of computers out of school

- The results in this section have emphasised a distinct difference between the way in which male and female participants use computers out of an educational setting as well their attitudes to computers outside an educational setting. Female participants preferred to use the computer alone in their homes and did activities which had a purpose, whereas male participants enjoyed using the computer with others, using the computer as an exploratory tool for fun and in varied locations. (Question 6)
- Female participants preferred to do activities which they perceived had a point to them, such as checking their emails and updating their Myspace pages. Male participants

preferred to play computer games as well as activities such as update their Myspace pages. (Question 7)

6.4 Theme 3: Perceptions of the IT industry

This section describes the way in which the GCSE participants perceived the IT industry and how these perceptions are informed by their prior experiences in terms of education and in terms of their computer use at home. The results in the next section demonstrate the difference between all male and female participants with regards to doing GCSE level courses.

The questions asked in this section are to provide a deeper understanding of how young peoples' perception of the IT industry and whether it enthuses or dissuades them from thinking of IT as a possible career option. The questions presented in this chapter are those which help answer the following research question: '*How does experience impact the way in which female students perceive themselves in the IT Industry?* Four sub questions were identified. The results provided in this section are to the following questions from the questionnaire:

Question 10. '*Do you perceive yourself entering the IT industry?'* The aim of this question was to ask whether participants perceived themselves in the IT industry and if there was a gender split in the findings.

Question 11. '*How would you feel if you were working with computers in the IT industry?'* The aim of this question was to understand how participants perceived themselves in the IT industry e.g. if they perceived themselves to feel happy or sad and if there was a gender split in the findings.

The questions probed in the areas mentioned above to provide more contexts and gain a deeper understanding of how young people perceive the IT industry.

6.4.1 Question 10: Do you perceive yourself entering the IT industry?

There was a split between how male and female participants perceived themselves in the IT industry. A higher majority of female participants (36%) from the Business Communication Systems course perceived themselves in the IT industry than those from the

other courses. This proved interesting as in the previous sections it was mentioned that it was this group felt the most positive about their course. The results are shown in Table 6-14.

	Percentage of females who said YES	**Percentage of females who said NO**	**Percentage of males who said YES**	**Percentage of males who said NO**
GCSE ICT Full Course	1 participant (14%)	6 participants (86%)	7 participants (65%)	13 participants (35%)
GCSE ICT Short Course	0 participants (0%)	9 participants (100%)	3 participants (33%)	6 participants (67%)
Business Communication Systems	4 participants (36%)	7 participants (64%)	4 participants (36%)	7 participants (64%)

Table 6-20 If participants could see themselves entering the IT industry

The first question asked how participants could imagine themselves working with computers when they were older. The results of this demonstrate that not only there was a gender difference but also a difference in the different courses the participants took.

6.4.2 Question 11: How would you feel if you worked in the IT industry?

Participants had mixed feelings about working in the IT industry. Both GCSE full and short course participants felt similar about their IT feelings. The percentages are shown in the next tables with the GCSE ICT participants grouped together and the Business Communication Systems participants grouped together. There is a stark difference between the ways in which both perceive themselves in the IT industry.

GCSE Full Course						
	Ranking	**Number of females who said YES**	**Percentage (%)**	**Ranking**	**Number of males who said yes**	**Percentage (%)**
Be happy	4	2	29	5	14	70
Be fashionable	5	1	14	7	9	45
Be glamorous	5	1	14	9	3	15
Be attractive	6	0	0	8	5	25
Be rich	2	5	71	1	18	90
Be clever	1	6	86	2	17	85
Be creative	5	1	14	6	13	65
Have lots of friends	4	2	29	5	14	70
Have a family	5	1	14	4	15	75
Be a geek	3	4	57	3	16	80

Table 6-21 How GCSE level participants would feel if they worked in the IT industry

GCSE Short Course						
	Ranking	**Number of females who said YES**	**Percentage (%)**	**Ranking**	**Number of males who said yes**	**Percentage (%)**
Be happy	5	1	11	3	5	63
Be fashionable	0	0	0	7	1	13
Be glamorous	0	0	0	5	3	38
Be attractive	5	1	11	3	5	63
Be rich	2	7	78	1	7	88
Be clever	1	8	89	2	6	75
Be creative	4	2	22	6	2	25
Have lots of friends	5	1	11	5	3	38
Have a family	3	3	33	4	4	50
Be a geek	1	8	89	1	7	88

Table 6-22 How GCSE short course participants would feel if they worked in the IT industry

Business Communication Systems						
	Ranking	**Number of females who said YES**	**Percentage (%)**	**Ranking**	**Number of males who said yes**	**Percentage (%)**
Be happy	5	5	45	2	19	86
Be fashionable	6	4	36	7	11	50
Be glamorous	7	3	27	5	9	41
Be attractive	8	2	18	6	10	45
Be rich	2	9	82	3	18	82
Be clever	1	10	91	1	20	91
Be creative	1	10	91	3	18	82
Have lots of friends	3	8	73	4	16	73
Have a family	4	7	64	5	15	68
Be a geek	2	9	82	5	15	68

Table 6-23 How Business Communication Systems course participants would feel if they worked in the IT industry

Positive feelings about working in the IT industry

Female participants who said that they could perceive themselves in the IT industry perceived themselves as *being happy, having lots of friends, having a family, doing problem solving tasks and being smart* if they worked in the IT Industry. They were also keen to say that they would be *fashionable and glamorous* if they were in the IT industry. None perceived themselves as being *attractive* if they worked in the IT industry. In other words

these girls understood that they would not have to lose their identity just because they could see themselves in the IT Industry.

Negative feelings about working in the IT industry.

Female participants, who did not perceive working in the IT Industry, felt that they would be *unhappy, boring and geeky*. Female participants indicated that they would be lonely if they went into the IT Industry.

6.4.3 Theme 3: Summary of how participants perceived the IT industry

- Participants studying for the Business Communication Systems course were more likely to perceive themselves in the IT industry than those doing the GCSE full and short course (Question 10).
- Participants from different courses had different perceptions of the IT industry compared to female participants studying for the Business Communications Systems course. Female participants doing the GCSE full and short course, perceived that they would be less happy in the IT industry (Question 11).

6.5 Theme 4: Perceptions of further courses in computing or IT

Participants were asked where they went to for careers advice, younger participants often relied on their parents, however during university, and participants had a varied bank of people who helped them make decisions. The following questions were asked in this theme:

Question 12. *'Who/what to you go to for careers advice'*

Question 13. *'Would you like to study IT/Computing after your GCSEs?' Please explain your answer.*

6.5.1 Question 12: Who/what do you go to for careers advice?

Participants were asked where they receive their careers advice from and the majority of both male and female participants indicated that it was their *parents*. There was little difference between male and female participants apart from, a larger proportion of male participants indicated that they would go to *friends*. Tables 6-24 to 6-26 provide a breakdown of the percentages.

GCSE Full course				
	Number of females who use	**Percentage (%)**	**Number of males who use**	**Percentage (%)**
Parents	6	86	15	75
Siblings	2	29	11	55
Other family	1	14	4	20
Friends	1	14	7	35
Career guides	3	43	3	15
Career Advisors	1	14	4	20
Teachers	4	57	5	25
TV Programmes	0	0	2	10
Magazines	1	14	0	0

Table 6-24 Where GCSE Full Course Participants went to for careers advice

GCSE Short course				
	Number of females who use	**Percentage (%)**	**Number of males who use**	**Percentage (%)**
Parents	7	78	5	63
Siblings	4	44	4	50
Other family	2	22	3	38
Friends	3	33	1	13
Career guides	1	11	2	25
Career Advisors	2	22	1	13
Teachers	4	44	1	13
TV Programmes	0	0	0	0
Magazines	0	0	0	0

Table 6-25 Where GCSE Short Course participants went to for careers advice

Business Communication Systems Course				
	Number of females who use	**Percentage (%)**	**Number of males who use**	**Percentage (%)**
Parents	10	91	18	82
Siblings	5	45	15	68
Other family	2	18	12	55
Friends	4	36	5	23
Career guides	2	18	1	5
Career Advisors	2	18	2	9
Teachers	5	45	3	14
TV Programmes	0	0	0	0
Magazines	2	18	0	0

Table 6-26 Where Business Communication Systems participants went to for careers advice

6.5.2 Question 13: Would you like to study IT/Computing after your GCSEs?

Participants were asked if they would like to study IT or computing once they had completed their GCSEs. The majority of both male and female participants indicated that they would not like to continue with IT or computing. Tables 6-27 to 6-29 show the numbers of participants who would like to continue with a course in IT or computing at A-level.

GCSE Full course				
	Females	**Percentage (%)**	**Males**	**Percentage (%)**
Yes	2	29	12	60
No	5	71	8	40

Table 6-27 Numbers of GCSE Full Course level participants who would like to continue with IT or computing at A-level

GCSE Short course				
	Females	**Percentage (%)**	**Males**	**Percentage (%)**
Yes	0	0	2	25
No	9	100	6	75

Table 6-28 Numbers of GCSE Short Course participants who would like to continue with IT or computing at A-level

Business Communication Systems course				
	Females	**Percentage (%)**	**Males**	**Percentage (%)**
Yes	5	45	16	73
No	6	55	6	27

Table 6-29 Numbers of Business Communication Systems participants who would like to continue with IT or computing at A-level

Participants who decided said they would like to continue with an IT course wrote the following reasons in the questionnaire:

Its easy’	(19 male participants) (1 female participant)
Its important for the future’	(1 male participant) (2 female participants)
‘I want to learn more about computers’	(2 male participants) (1 female participant)
I want to work in web design when I am older	(2 female participants)
I want to test computer games when I am older’	(4 male participants)

Table 6-30 Reasons for wanting to continuing with IT and Computing at University

6.5.3 Theme 4: Summary of how participants perceived their future courses in IT or computing

- The majority of male and female participants stated a preference for going to parents to seek careers advice. (Question 12)
- A high majority of female participants did not want to do computing when they had finished their GCSEs, whereas just under half of male participants stated that this is something they would like to do. A key reason for male participants to want to continue was that the course was easy. (Question 13)

6.6 Summary of GCSE results

Male and female participants at GCSE level had differing experiences of computers both at school and at home, which influenced the way in which they viewed themselves in the IT industry and if they wanted to continue to study for an IT or computing A-level. The key findings of these results demonstrate that participants who studied the ICT GCSE full and short course had a less enjoyable experience of it. This was because they were being taught how to use Microsoft Office applications, which is what participants considered to be 'boring'. It was interesting, that a high majority of female participants on this course perceived that they would be unhappy if they were to have a job in the IT industry and also felt that they would not like to continue further with an A-level in IT or computing.

In contrast, both male and female participants on the Business Communication Systems course felt their course was enjoyable and could perceive themselves in the IT industry. Participants especially enjoyed learning about website design as it was something they felt was 'new' and had not learned about before taking the course. A majority of female participants taking this course felt that they would be happy if they worked in the IT industry. There were varied reasons for choosing GCSE ICT and Business Communication Systems to study. Participants mentioned being advised to do so by a parent or teacher. As well as understanding its importance for future careers. This is reinforced by the questionnaire findings which state that for GCSE level participants, parents were a valuable resource for careers advice.

On the whole, the results from the GCSE level female participants indicated that they did find the courses they were studying difficult. However, this was more of an issue for female participants studying GCSE ICT full and short courses. A high majority of female

participants did not want to do computing or IT at A-level when they had finished their GCSEs, whereas just under half of male participants stated that this is something they would like to do. A key reason for male participants to want to continue was that the GCSE course was perceived as 'easy'.

Male participants may find their GCSE course easier due to the way in which they used the computer out of school. Male participants enjoyed using the computer with others, using the computer as an exploratory tool for fun and in varied locations. In comparison female participants preferred to use the computer alone in their homes and for specific reasons rather than 'just to have fun'. The results showed that female participants preferred to use the computer for a specific purpose e.g. social networking and email, rather than playing computer games (which did not rank highly with female participants) (See table 6-3 and 6-4).

6.7 Conclusion

Chapter 6 has presented the results from questionnaires and interviews from GCSE level participants. There were distinct differences between the types of courses which participants took. Participants on the Business Communication Systems course felt more positive about their experience and in turn had a more positive perception of the IT industry in comparison to those who took the long and short GCSE ICT course. There were distinct differences between male and female participants and how this influenced their thoughts and attitudes. Female participants preferred to use the computer in an isolated way as they felt unconfident about using it in front of others. Chapter 7 presents the A-level results for A-level participants studying A-level computing and A-level IT.

Chapter 7 Results: A-level

'Programming today is a race between software engineers striving to build bigger and better idiot-proof programs, and the Universe trying to produce bigger and better idiots. So far, the Universe is winning.'

Rick Cook: The Wizardry Compiled (1989)

Chapter 7 presents the results for the A/S level, A-level computing and IT participants. Like chapter 6, the results will be structured according to the following themes: experience at school, experience out of school, perceptions of the IT industry and perceptions of taking further courses in IT or computing. The chapter begins by providing the outline of the courses the participants took and the sample sizes. The results in this chapter begin with understanding how participants remembered their previous course (ICT GCSE) before going on to present the results of their current experiences. It then discusses how participants used the computer out of school. The chapter then discusses how participants perceive themselves in the IT industry and who they ask for help when making career decisions.

7.1 Formal learning of computing and IT

The results in this chapter are presented in the form of themes, which are in the following order:

1. **Theme 1:** Experiences of computers at school: *aims to demonstrate the way in which A-level participants remember GCSE ICT at school and if this motivated them to carry on IT or Computing A-levels. As well as prior experiences at school, there is also a focus on*

how participants found their A-level course in IT or Computing and whether this would motivate participants to carry on IT or Computing on to degree level.

2. **Theme 2:** Experiences of computers out of school: *aims to understand the way in which A-level participants use the computer outside of school and how this influences attitudes to computing careers.*
3. **Theme 3:** Future career plans: *aims to understand what resources male and female students use to help them make career decisions as well as understanding what factors are taken into account when making decisions regarding computing careers.*
4. **Theme 4:** Perceptions of taking further courses in IT or computing: *aims to understand how male and female students perceive technology careers.*

Each theme will begin with the data obtained from the questionnaire results and will go onto provide more context using the interview results. The A-level participants taking part in this study are from a sixth form college where ICT GCSE Full course was compulsory for all. The chapter begins with the demographics. The data will be presented question by question, the order they were presented in the questionnaire. Despite the small numbers involved it was decided to use percentages in order to make uneven numbers easier. In using percentages numbers have had to be rounded up to ensure they add up to 100%

7.2 Demographics

There were four different groups of participants at A-level who took part in the questionnaire and interviews. Table 7-1 provides the numbers of participants who took part and the description of the courses participants took.

	Male Participants	**Female Participants**
Advanced Subsidiary Information Technology: The course provides the student the opportunity to understand how to apply ICT to solve real life problems. The units focus on the software life cycle, IT systems and their components.	Questionnaire: 12 Participants	Questionnaire: 12 Participants
Advanced Level Information Technology: This course is an advanced continuation of the Advanced Subsidiary course. Students on this course have the opportunity to learn about the skills needed in the IT profession such as group work and project management.	Questionnaire: 19 Participants	Questionnaire: 15 Participants
Advanced Subsidiary Computing: This course provides the student the opportunity to have a general grounding in computer systems, learn about the core principles of programming and problem solving. Students specifically learn about: hardware, software, programming skills and the software life cycle.	Questionnaire: 14 Participants	Questionnaire: 6 Participants
Advanced Level Computing: This course provides the opportunity to learn about operating systems, computer architecture, representation, structure and manipulation of data. High level language programming paradigms, low level languages and how databases function.	**Questionnaire:** 5 Participants	Questionnaire: 5 Participants

Table 7-1 Demographics of A-level participants

7.3 Theme 1: Experience of computers at school

The aims of the questions asked in this section were to provide a deeper understanding of young people's previous and current experiences of IT and computing at school. There is an emphasis on how this differs between male and female participants. The questions presented in this chapter are those which help answer the following research question: '*How does experience impact the way in which female students at different educational stages perceive themselves in the IT Industry?* Four sub questions were identified. The questionnaire begins with asking about previous experiences at secondary school before going on to focus upon current experiences. The questionnaire is in Appendix 8.

Questions asking participants to reflect on their prior GCSE experiences

Question 1. '*Please tick one box for each of the subjects you remember doing at secondary school and what you thought of them'.* This question asked participants to state how they felt about the other subjects they were studying in order to understand how the GCSE ICT course performed in comparison.

Question 2. '*How did you find ICT at school?* The aim of this question was to understand if the level of difficulty of the course posed a problem for participants. As well as to understand if there was a gender split in how participants found the course.

Question 3. *'List up to three activities you remember enjoying in your ICT lesson at school?* The aim of this question was to understand what activities participants enjoyed within their lessons.

Question 4. *'List up to three activities you do not remember enjoying in your ICT lesson at school?* The aim of this question was to understand what activities participants did not enjoy within their lessons.

How A-level participants remembered their GCSE subject.

7.3.1 Question 1: Subjects you remember doing at secondary school and what you thought of them

The questionnaire began by asking how ICT could be compared to other subjects participants studied at GCSE level. Overall both male and female participants indicated that

they liked their prior ICT lessons. Participants had the opportunity to choose if they: 0 - '*didn't do the subject*', 1 – '*really hated the subject'*, 2 – '*didn't like the subject*', 3 - the subject was '*ok*', 4 – '*liked the subject*' and 5 – '*loved the subject'*. There were 11 subjects altogether. The rankings of the subjects were averaged and this provided a 'league table' of subject preferences.

	Ranking	**Female students**	Average	**Male students**	Average
Most Favourite	1	Art	4.195	P.E.	3.70
	2	Maths	4.130	Maths	3.56
	3	**ICT**	**4.120**	**ICT**	**3.50**
	4	Geography	3.556	Geography	3.45
	5	Science	3.012	Science	3.00
	6	Drama	3.012	Music	2.30
	7	English	2.450	Art	1.23
	8	Modern Languages	2.225	English	1.11
	9	P.E.	1.250	Drama	1.02
Least Favourite	10	Music	1.045	Modern Languages	1.02

Table 7-2 Mean of how male and female participants rated ICT GCSE

Table 7-2 provided an overall summary of how A-level participants remember finding ICT GCSE. The overall results demonstrate that participants felt that ICT at GCSE level was an enjoyable subject. It was also interesting that both male and female participants held ICT in high standing at GCSE level, which was 3rd most popular. However, if the results are split up by course (A-level & A/S Level Computing and A-level & A/S Level Information Technology) it is clear that the participants taking IT A/S and A-Level enjoyed ICT at school far more than those studying A-level Computing. The split between the courses could demonstrate the different motivations for choosing to take the respective courses at A-level. Table 7-3 to 7-7 provides the percentages of how participants felt about their ICT courses broken down by the A-level they were taking.

A/S Level IT and A-level IT

Male participants were more negative than female students about their previous IT course experience. The figures shown in Table 7-3, demonstrate that '33%' of female participants indicated that they *liked* their prior course. It was interesting that male participants did not rate their prior experiences as highly. The differences between male and female participants taking the courses are clear because female participants were more

positive than male participants. This could indicate that female participants were more reliant on their experiences at school rather than male participants

In comparison the results of the A-level participants were similar to the A/S level group, which show that male participants did not enjoy their prior IT course, whereas almost 37% of the female participants reflected back and indicated that they enjoyed it. This is interesting as it questions why male participants decided to choose a course they '*hated*'. This indicates that for female participants, their prior experience at GCSE level may have contributed to them choosing A-level IT. Table 7-3 shows the clear difference between male and female participants.

A/S Level IT				
	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	2	17	3	25
Didn't like it	2	17	1	8
It was OK	4	33	7	58
I liked it	3	25	1	8
I loved it	1	8	0	0
I didn't do it	0	0	0	0

Table 7-3 How A/S level IT participants remember their GCSE in ICT when compared to other school subjects

A-Level IT				
	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	2	14	7	36
Didn't like it	3	20	4	21
It was OK	5	33	6	32
I liked it	5	33	2	11
I loved it	0	0	0	0
I didn't do it	0	0	0	0

Table 7-4 How A-level IT participants remember their GCSE in ICT when compared to other school subjects

A/S Level Computing and A-Level

Male and female participants studying A/S Level computing had different views of their prior experiences. Interestingly, a higher majority of female participants had negative feelings about their prior GCSE course. Although male participants felt negatively about their

prior course it was not as high as the female participants. Table 7-5 shows the clear split between male and female participants and how they felt about ICT lessons at GCSE.

In comparison to the A/S level participants, the majority of both A-level male and female participants remember the course in a positive way. This contrasts with the participants who were studying A/S level computing. Table 7-6 shows the similarities between male and female participants.

A/S Computing				
	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	1	17	2	14
Didn't like it	1	17	2	14
It was OK	2	32	4	29
I liked it	1	17	4	29
I loved it	1	17	2	14
I didn't do it	0	0	0	0

Table 7-5 How A/S level computing participants remember their GCSE in ICT when compared to other school subjects

A-Level Computing

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	1	20	0	0
Didn't like it	1	20	1	20
It was OK	1	20	2	40
I liked it	1	20	1	20
I loved it	1	20	1	20
I didn't do it	0	0	0	0

Table 7-6 How A-level computing participants remember their GCSE in ICT when compared to other school subjects

7.3.2 Question 2: How did you find ICT at school?

The aim of this question was to ask how confident participants felt during GCSE ICT. The results are presented in Tables 7-7 to 7-10 and grouped by course.

A/S Level IT and A-level IT

Neither male nor female participants during IT A/S and IT A-level found GCSE ICT too difficult. The percentage of female participants that found the course '*really easy'* was 42%. It was interesting that neither male nor female participants described the course as 'really difficult'. Table 7-7 and 7-8 demonstrates clear differences between both male and female participants and how they both found the course.

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Really Easy	5	42	7	58
Easy	6	50	5	42
Quite Difficult	1	8	0	0
Really Difficult	0	0	0	0

Table 7-7 How A/S IT participants perceived difficulty of the GCSE ICT course

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Really Easy	8	53	13	68
Easy	6	40	6	32
Quite Difficult	1	7	0	0
Really Difficult	0	0	0	0

Table 7-8 How A-level IT participants perceived difficulty of the GCSE ICT course

A/S Computing and A-level Computing

Participants studying A/S and A-level Computing felt that their prior formal IT education was either *'easy'* or *'really easy'*. Participants in this group did not show that they found the course difficult. Table 7-9 and Table 7-10 provides the breakdown.

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Really Easy	4	67	10	67
Easy	2	33	5	33
Quite Difficult	0	0	0	0
Really Difficult	0	0	0	0

Table 7-9 How A/S Level computing participants perceived difficulty of the GCSE ICT course

	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Really Easy	3	60	4	80
Easy	2	40	1	20
Quite Difficult	0	0	0	0
Really Difficult	0	0	0	0

Table 7-10 How A-level Computing participants perceived difficulty of the GCSE ICT course

7.3.3 Question 3: List up to three activities you remember enjoying in your ICT lesson at school?

Participants were asked to name three activities which they enjoyed the most about their GCSE level course. The types of enjoyable activities which participants remembered enjoying were similar to the current GCSE Level participants in the previous chapter. These were activities which were 'hands on' and new' such as 'website design. There were different trends amongst participants of different courses. The next section shows this for both IT and computing students.

Participants studying A/S and A-level IT

Participants studying A/S and A-level IT indicated that learning about Microsoft office was something which they enjoyed. This was surprising as the current GCSE level participants indicated that this was the most 'boring' aspect of the course.

Male participants preferred activities such as using social networking in class or gaming in class. Female participants preferred activities such as Microsoft PowerPoint and website design. Table 7-11 shows the different activities which participants indicated and the percentages.

IT A-LEVEL AND A/S Level students

Activity	**Number of Female participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Checking E-mail and going on social networking sites	5	18.5	7	23
Microsoft PowerPoint	4	15	3	10
Microsoft Word	4	15	3	10
Website Design	5	18.5	8	25
Computer Games	3	11	10	32
Microsoft Publisher	3	11	0	0
Mail Merge	3	11	0	0
Microsoft Excel	0	0	0	0

Table 7-11 What A-Level and A/S Level IT participants remembered enjoying in their lessons

Participants studying A/S and A-level Computing

Eight male participants studying A/S and A-level Computing could not write three activities they enjoyed whilst at school. In comparison, female participants were able to name three aspects of their course which they enjoyed.

Participants also indicated that they enjoyed social networking and game playing. Activities related to Microsoft Office were rated lowly in comparison to website design and activities such as game playing. Female participants did not rate game playing as high as male participants, however it was higher than the Microsoft Office activities (apart from MS PowerPoint).Table 7-12 shows the data for this.

Activity	**Number of Female participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Checking E-mail and going on social networking sites	3	27	4	21
Microsoft PowerPoint	1	9	3	15
Microsoft Word	1	9	2	11
Website Design	4	37	4	21
Playing games on the computer	1	9	6	32
Microsoft Publisher	1	9	0	0
Mail Merge	0	0	0	0
Microsoft Excel	0	0	0	0

Table 7-12 What A-Level and A/S Level Computing participants remembered enjoying in their lessons

7.3.4 Question 4: List up to three activities you do not remember enjoying in your ICT lesson at school?

Participants were asked to name three activities which they enjoyed the least about their GCSE level course. Again, like the previous sections, these activities included unexpected elements, such as not being able to sit next to their peer group or the teacher being unhelpful. This could indicate that the work was less of an issue with participants but it was the atmosphere which posed the main issues. However, participants did indicate that the courses were boring and repetitive. The next sections will look at the IT courses and Computing courses separately.

Participants studying A/S and A-level IT

Females remarked on the teacher being unhelpful. Table 7-13 shows the activities which participants indicated that they did not enjoy in lessons. Writing coursework was something which male participant showed a dislike to as well as the computers not working in the lessons.

IT A-LEVEL AND A/S Level students

Activity	Numbers of Female participants	Percentage (%)	Numbers of Male participants	Percentage (%)
Microsoft Access	2	7	4	13
Not being able to sit with Peer group	2	7	2	6.5
Exams	2	7	5	16
Writing Coursework	2	7	1	3
Teacher being unhelpful	3	10.5	4	13
Repetition	3	10.5	4	13
Boredom	8	30	9	29
Computers not working	5	19	2	6.5

Table 7-13 What A-Level and A/S Level IT participants remembered not enjoying in their lessons

Participants studying A/S and A-level Computing

Participants studying A/S and A-level Computing felt strongly about not being able to sit with their peers, but indicated that the boredom and repetition was something which they disliked within their GCSE lessons. In this respect, female and male participants were of a similar opinion, they differed on their views to learning about MS Access and the helpfulness of the teacher. These results were interesting as it was clear that participants expressed a

strong dislike to some aspects of their prior IT courses, however these participants also carried on their courses to A-level standard. The next section focuses on how participants feel about their current courses. Table 7-14 shows what computing participants did not like about their IT lessons.

Computing A-LEVEL AND A/S Level students

Activity	Numbers of Female participants	Percentage (%)	Numbers of Male participants	Percentage (%)
Microsoft Access	1	9	2	11
Not being able to sit with Peer group	1	9	3	15
Exams	1	9	3	15
Writing Coursework	1	9	3	15
Teacher being unhelpful	1	9	2	11
Repetition	3	28	2	11
Boredom	2	18	2	11
Computers not working	1	9	2	11

Table 7-14 What A-Level and A/S Level Computing participants remembered not enjoying in their lessons

7.3.5 Theme 1: Summary of how A-level participants remembered GCSE ICT

- As a whole, both male and female participants ranked GCSE ICT as an enjoyable subject. It was interesting that female participants studying A/S level and A-level IT indicated that they enjoyed the GCSE. However, A/S level and A-level male participants indicated that they did not enjoy the GCSE. Interestingly, female participants studying for computing A/S and A-level indicated that they enjoyed their IT course, whereas the majority of male participants stated that they did not like the course. (Question 1).
- The majority of A/S and A-level participants who studied both computing and IT found GCSE ICT 'easy'. (Question 2).
- All groups of participants enjoyed learning about web design on their GCSE ICT course. But also liked to go on the computer to check email and social networking sites. (Question 3).
- The majority of all participants expressed a dislike in Microsoft Access. Female participants remembered that they did not like that they were separated from their peer group. (Question 4).

Questions asking participants to reflect on current course experiences

The results in this section are to the following questions of the questionnaire:

Question 5. *'How do you currently find the IT/Computing course you are studying*?' This question was to understand the current level of difficulty, if there were differences amongst the courses and differences between males and females.

Question 6. *''Why did you find ICT this way?'* This was an open question in order to understand why participants found ICT easy or difficult.

Question 7. *'List up to three activities that you enjoy in your ICT lesson'.* The aim of this question was to understand what types of activities were favoured by young people.

Question 8. *'List up to three activities that you don't enjoy in your ICT lesson'.* The aim of this question was to understand what activities put young people off ICT lessons.

Question 9. *'Why did you choose IT/Computing at A-level?*' The aim of the question was to understand participant's motivation in choosing IT or Computing as a subject and why they made the decision to choose a particular course in IT or Computing.

7.3.6 Question 5: How easy do you find computing and why you feel this way?

This question asks how participants found their current course.

IT A/S Level and IT A-level

A high majority of participants found the IT A/S course '*really difficult*'. However a higher percentage of male participants were more inclined to say that they found the course either '*really easy*' or '*easy*'. Male participants could have been over exaggerating to 'boast' about their skills, which needs to be taken into account when analysing this data. Although female participants did mention they found the course '*easy*', they were more inclined to say that they found the course either '*quite difficult*' or '*really difficult*'. This could be an indication of lower confidence levels or lack of support. Table 7-15 shows the breakdown of how participants found the course.

Participants currently taking Information Technology A-level reflected back on their A/S level in a more positive way than the participants who were currently studying for their A/S level. Table 7-21 shows the percentages. The next section explores why participants felt this way.

IT A/S Level

	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Really Easy	1	8	2	17
Easy	3	25	2	17
Quite Difficult	3	25	4	33
Really Difficult	5	42	4	33

Table 7-15 How 'easy' IT A/S Level participants found their course

	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Really Easy	3	20	6	32
Easy	4	27	6	32
Quite Difficult	3	20	4	21
Really Difficult	5	33	3	15

Table 7-16 How easy IT A-level participants remember finding their prior AS-level course

Computing A/S level and A-level

A high majority of female computing A/S participants indicated that they were finding their current computing course '*really difficult*'. Although this was the case for both male and female participants the results for the female participants were striking, especially considering the majority of these had indicated that they found their prior course easy. Table 7-16 shows the percentages.

	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Really Easy	0	0	1	7
Easy	0	0	3	21.5
Quite Difficult	2	33	3	21.5
Really Difficult	4	67	7	50

Table 7-17 How 'easy' Computing A/S Level participants found their course

How Computing A-level found their prior A-level course

There are differences between male and female participants, with the greatest being between participants who found the course '*easy*' or '*really difficult*'. This again was interesting because participants in this group decided to carry on the course and it was

surprising that participants had decided to carry on a course which they found *difficult* (which was indicated by 60% of female participants). The next section discusses why participants found the course difficult but continued on regardless of how difficult they found the course.

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Really Easy	0	0	1	20
Easy	1	20	2	40
Quite Difficult	1	20	1	20
Really Difficult	3	60	1	20

Table 7-18 How easy Computing A-level participants remember finding their prior AS-level course

7.3.7 Question 6: Why do you find the course this way?

The aim of this question was to find out why participants found their course a certain way.

IT A/S Level and A-Level.

Current A/S Level IT participants were asked to state why they found the course '*really easy', 'easy' quite difficult'* or '*really difficult*'. The majority of participants who felt that the course was difficult indicated that this was because it was different to the GCSE course. This was because they were learning new concepts and they had to think about how these were applied to the real world (see extract 13).

> ASLevelITQuestionnaireF3[Q6]:'*Now we have to learn about IT and business like what a server is and things like that. It's totally different to before'.* Questionnaire Extract 13: A/S-level IT female participant.

Male participants who found the course '*really easy' or 'easy'*, mentioned that they had help from parents and siblings, which could indicate why they found the course '*really easy' or 'easy'* (see extract 14).

> ASLevelITQuestionnaireF7[Q6]:'*My dad works as a project manager and he helps me with what I find difficult'.* Questionnaire Extract 14: AS-level IT male participant.

These male participants had external sources of support to help them with their course, which could be contributing factor to them finding the course '*easy*'.

In comparison current A-Level IT participants were asked why they found their prior course in a certain way. It was clear from female participants that they found the course '*easy*' because they had help and support at home as well as feeling that they could cope with the lessons. However female participants also indicated that they remember finding their prior course '*really difficult*'. It was interesting that there was a high majority of female participants who remembered finding the course '*difficult*', as these were the participants who carried on the course to A-level. Participants indicated that they remembered finding the course difficult but that didn't mean they didn't enjoy it (see extract 15).

> A-LevelQuestionnaireF1[Q6]: *'I remember it being difficult because it was different to what I had done before. But it was still interesting, which is why I carried it on'.* Questionnaire Extract 15: IT A-level female participant.

Computing A/S Level and A-Level.

Both current male and female A/S level participants who took computing found the course difficult. More male participants felt that computing was easier than female participants. Female participants highlighted the lack of support which accounted for the difficulty. Male participants emphasized that their prior experience in programming was a reason for them finding the course easy (see extract 16).

> ASComputingQuestionnaireM1[Q6]: *'its not that hard really… I've been coding my own websites for ages'.*Questionnaire Extract 16: A/S level computing male participant.

The fact that the male participants did have that prior programming experiences gave them an advantage and the female participants (who did not indicate about prior experience in programming) felt that the course was much harder.

Current A-level female participants stated in the questionnaires that they found their prior A/S level course difficult because they did not enjoy various modules of the course, in particular the programming assignment. Participants felt that the teachers were unsupportive. However they persisted with the course because they were interested in the various different concepts they were learning and were starting to understand the bigger picture. These

participants also had the support of their family and they were mentioned in the surveys (see extract 17):

> AlevelComputingQuestionnaireF6[Q6]: *'Yeh I remember it being really hard! My dad said it would be more useful to carry on computing and not Performing Arts.'* Questionnaire Extract 17 A-level Computing female participant.

7.3.8 Question 7: List up to three activities that you enjoy in your A/S level and A-level courses

Information Technology Students A/S and A-level

The ranges of answers given by participants were limited. Participants would mention individual modules, but they were mentioned in terms of tasks such as '*homework*' or '*revision*'. It was surprising that female participants mentioned '*computing theory*' as what they preferred to do and male participants mentioned coursework as their favorite activity.

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Theory	6	49	1	8
Coursework	2	17	7	58
Homework	2	17	2	17
Revision	2	17	2	17

Table 7-19 Activities which participants enjoyed about their A/S level (IT A-level)

In comparison, current A-level participants who did the IT A/S level course enjoyed different aspects of their prior course. The biggest difference between male and female participants was 'being with friends'. Male participants felt that this was the most enjoyable aspect of the course. The most popular aspect of the course for both male and female participants was being able to learn about new concepts. This may have been a contributed to why these participants to carry on the A-level. Table 7-20 shows the activities which participants remembered as enjoyable.

	Number of **Female** participants	Percentage (%)	Number of **Male** participants	Percentage (%)
Being with my friends	1	6	2	10
Coursework	3	20	8	42
Learning about new concepts	7	47	6	32
Homework	4	27	3	16

Table 7-20 What IT A-level participants remembered as their favourite activities on the computer

Computing A/S Participants

The results provided in Table 7-21 were show that a higher percentage of female participants indicated that they enjoyed '*theory*', '*homework*' and '*revision*'. It was not surprising (based on the previous results) that they did not rank coding assignments as highly as the male participants in this study.

	Number of **Female** participants	Percentage (%)	Number of **Male** participants	Percentage (%)
Theory	3	50	1	7
Coding assignment	0	0	7	50
Learning about programming	1	17	4	29
Homework	0	0	1	7
Revision	2	33	1	7

Table 7-21 Activities which participants enjoyed about their Computing A/S level

Computing A/S level and A-level participants

Interestingly, female participants named their most enjoyable activity to be learning about theory concepts of computing. It was interesting that female participants enjoyed learning about theory, however did not enjoy the practical aspect of the course. Table 7-22 shows what activities the participants enjoyed.

	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Programming in class	0	0	1	20
Theory	2	40	1	20
Coursework: Theory	2	40	0	0
Homework	1	20	0	0
Coursework: Programming	0	0	3	60

Table 7-22 What Computing A-level participants remembered as their favourite activities on the computer

Questions specifically for A/S level students

7.3.9 Question 8 (A/S level): Are you planning to carry it on to A-level?

This question asked if IT participants at A/S level were planning to carry on their course to the second year so they could complete the full A-level. Table 7-23 and Table 7-24 shows that the numbers of female participants who wanted to carry on the A-level were considerably lower than male participants in this study. The next section asked participants to explain their decision.

Information Technology

	Yes	Percentage (%)	No	Percentage (%)
Female	7	58	5	42
Male	9	75	3	25

Table 7-23 Percentage of A/S IT participants who would carry on to study A-level

Computing

	Yes	Percentage (%)	No	Percentage (%)
Female	3	50	3	50
Male	11	79	3	21

Table 7-24 Percentage of A/S Computing participants who would carry on to study A-level

7.3.10 Question 9 (A/S level): Please explain your decision

A higher number of female participants studying IT A/S indicated that they would like to carry on study IT A-level rather than those studying the Computing A/S. There were

various reasons for participants not wanting to carry on the course. There were reasons such as:

- Participants did not want a career in computing
- Participants did not enjoy the course
- Participants preferred other courses
- Participants would get higher marks on other courses.

The main difference between computing and IT level participants was that the computing A-level participants described coding as their main reason for not wanting to continue with the course. Participants who wanted to continue with the course indicated that they enjoyed the course but also they had a subject which they disliked more.

- *Question 9 (A-level): 'List up to three activities that you don't remember enjoying in you're A/S Computing or IT lesson'.*

The results of this section are interesting as these participants decided to carry on the course, despite what they did not enjoy.

Information Technology

Female participants found it difficult not being with their friends on their course, whereas there were not as many male participants who felt this way. Male participants felt the most strongly about computers not working, which was similar to male participants who are currently studying the A/S level. Female participants also felt that that coursework was an activity they did not enjoy, interestingly; male participants did not feel the same way. Table 7-25 shows these figures and what activities participants did not enjoy.

	Number of <u>Female</u> participants	**Percentage (%)**	**Number of <u>Male</u> participants**	**Percentage (%)**
Not being with peer group	7	47	2	11
Coursework	5	33	3	16
Theory	3	20	1	5
Homework	0	0	4	21
Computers not working	0	0	9	47

Table 7-25 What IT A-level participants remembered as their least favourite activities

Computing

The most striking difference between male and female participants was not being with their peer group. It was clear that this was something which female participants found

difficult but due to them carrying on with the course, it was evident that they were able to get through this. Interestingly, a higher percentage of male participants indicated that they disliked programming coursework. In comparison, female participants showed a dislike to programming in class. This could demonstrate that although participants felt lonely in lessons, they did not mind the programming aspect of the course as they have continued. Table 7-26 shows the percentages of what activities participants did not favor. The next section asks participants what made them continue on with the A-level course.

	Number of Female participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Not being with peer group	7	47	2	11
Coursework	5	33	3	16
Theory	3	20	1	5
Homework	0	0	4	21
Computers not working	0	0	9	47

Table 7-26 What Computing A-level participants remembered as their least favourite activities

7.3.11 Question 10 (A-level): Why did you carry it on to A-level?

Participants indicated in interviews and questionnaires that they carried the course on to A-level because they:

- Received a high mark in the course at A/S level.
- Enjoyed the course.
- Wanted to study computing at university.
- Wanted a career in computing.
- Thought it was useful.
- Preferred it to another subject.
- Were advised to do so by a teacher or parent.

7.3.12 Theme 1: Summary of how A/S level participants found their current course

- A similar majority of both male and female IT A/S participants felt that the IT A/S course was ‘really difficult’. It was difficult because the course was different to the GCSE course and there were new concepts to grasp. (Question 6 and 7)

- A majority of computing A/S level male and participants indicated that they found computing 'really difficult'. A higher number of female participants than male participants felt this was the case. Male participants found the course easy because they had prior knowledge in programming, which is what the female participants found difficult. (Question 6 and 7)
- Female participants studying A/S IT and computing both indicated that they enjoyed theory lessons. A large number of male participants enjoyed the homework and the programming assignments (Question 7).
- High numbers of female participants indicated that they would like to continue on IT at A-level. Whereas a small number of female participants indicated that they would carry on. (Question 8)
- Female participants who decided not to continue wrote in the questionnaire that they did not want a career in computing as one of the reasons for not wanting to continue further with the course. (Question 9)

Current A-Level participants: *Reflection of A-Level*

7.3.13 How easy do you find computing or IT A- Level

Information Technology

The majority of female participants taking information technology felt that the course was '*really difficult*'. This is similar to how these participants remember their IT A/S course. In comparison, male participants felt that the course was '*easy*'. Table 7-27 shows how participants felt about their course.

	Really Easy	**Easy**	**Quite Difficult**	**Really Difficult**
Female numbers	1	3	5	6
Percentage (%)	7	20	33	40
Male numbers	5	6	4	4
Percentage (%)	26	32	21	21

Table 7-27 How 'easy' or 'difficult' A-level IT participants found A-level IT

7.3.14 Question 6: Why do you find the course this way?

Through looking at the survey results, it was clear that female participants felt that the course was difficult because they did not feel confident about their ability, whereas male participants were the opposite. Female participants felt that because they did not understand every aspect of the course, the whole course was difficult. This is shown in survey extract 18 (by a female participant):

> AlevelITQuestionniareF[Q7] *'Its difficult because I don't understand what the teacher is on about. The module on Networking is difficult and the business module is something that I find difficult. I am also not good at exams.* Questionnaire Extract 18 A-level IT female participant.

Computing

It was clear that the majority of female participants studying computing felt that the course was '*really difficult*'. Whereas a majority of male participants felt that their current course was '*easy*'. The next section asks why this is the case.

	Really Easy	**Easy**	**Quite Difficult**	**Really Difficult**
Female numbers	0	0	2	3
Percentage (%)			40	60
Male numbers	1	1	2	1
Percentage (%)	20	20	40	20

Table 7-28 How 'easy' or 'difficult' A-level Computing participants found A-level Computing

7.3.15 Question 7: Why do you find the course this way?

Female participants studying A-level computing felt that the course was difficult due to their programming assignment. It was something that they found difficult and this meant that the whole course was difficult. The survey extract below shows this:

> AlevelComputingQuestionniareF1[Q7] *'I HATE PROGRAMMING!!!!!!'* Questionnaire Extract 19 A-level IT female participant.

7.3.16 Question 8 (A-level): List up to three activities that you enjoy in your lesson

It was interesting that by this stage, the majority of participants were not able to write down three aspects which they enjoyed in their lessons.

Information Technology

It was interesting that participants felt that in IT A-level that it was more about the course, rather than the atmosphere. The difference between male and female participants was that female participants preferred doing coursework and male participants preferred doing exams. However, both enjoyed theory lessons.

Activity	**Number of Female participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Theory	5	33	9	47
Exams	4	27	0	0
Revision	3	20	2	11
Coursework	3	20	8	42

Table 7-29 Activities which A-level IT participants preferred doing at A-level IT

Computing

Both male and female participants enjoyed theory in class and coursework, however the biggest difference came when participants wrote about coding. It was clear that a high number of females had a dislike for it, which is evident in the next section (see Table 7-30).

Activity	**Number of Female participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Programming in class	0	0	1	20
Theory in lessons	2	40	1	20
Coursework: Theory	2	40	1	20
Coursework: Programming	1	20	2	40

Table 7-30 Activities which A-level participants enjoyed doing at A-Level Computing

7.3.17 List up to three activities that you don't enjoy in your lesson

Information Technology

The biggest difference in what participants did not enjoy was homework. More female participants preferred homework, whereas male participants showed a dislike to it. Table 7-31 demonstrates this.

Activity	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Coursework	5	33.5	4	21
Theory	3	20	5	26
Homework	2	13	6	32
Exam revision in class	5	33.5	4	21

Table 7-31 Activities which A-level participants did not enjoy at A-level IT

Computing

A reoccurring trend with female participants studying computing was the programming aspect, as well as this not being with friends and not liking their teacher. It is clear from the survey results factors which are affecting female participants experience of IT.

Activity	Number of Female participants	Percentage (%)	Number of Male participants	Percentage (%)
Programming in class	1	20	1	20
Theory in lessons	0	0	0	0
Coursework: Theory	1	20	1	20
Coursework: Programming	1	20	1	20
Teacher	1	20	1	20
Not being with peer group	1	20	1	20

Table 7-32 Activities which A-level participants did not enjoy at A-level Computing

7.3.18 Question 10: Will you carry on the course to degree level?

The percentages provided in Table 7-33 and 7-34 demonstrate the low percentages of male and female participants who would like to continue further with both IT and computing degree level courses.

IT	Yes	Percentage (%)	No	Percentage (%)
Male	8	42	11	58
Female	2	13	13	87

Table 7-33 Percentage of participants studying IT A-level who would like to do a degree course in IT

Computing	Yes	Percentage (%)	No	Percentage (%)
Male	2	40	3	60
Female	0	0	5	100

Table 7-34 Percentage of participants studying computing A-level who would like to do a degree course in computing

7.3.19 Why is this the case?

Participants gave the following decisions for not wanting to continue with the A-level course:

- Participants did not want a career in IT
- They preferred to do another course.
- Advised not to.
- They did not enjoy the A-level.

7.3.20 Theme 1: Summary of how A-level participants found their prior A/S and current course

- Female participants remember A/S IT and computing to be really difficult, whereas computing participants remember finding the course easier than what the female participants stated.
- The majority of female participants studying computing at A-level did not enjoy programming in class or programming coursework. Male participants felt the opposite with programming being the most popular activity. This was similar with the current A-level participants.
- Participants indicated that they carried on the computing course for different reasons such as they received a high mark in an exam or felt that it was useful.
- A higher number of male participants felt that their IT and computing courses were 'easy' whereas the majority of female participants named the course 'difficult'.
- Female participants studying both computing and IT felt that they would not like to take computing at university.

7.4 Experience of computers out of school

The questions asked in this section aimed to provide a deeper understanding of young peoples' experience of ICT out of school and how these experiences differ between males and females. The contrast between home and school experiences was also compared. The results given in this section emerged from answers to the following questions from the questionnaire:

Question 10. '*Where do you prefer to use the computer out of school hours?'* This question aims to understand where participants preferred to use a computer and if there was a gender split concerning this.

Question 11. '*Who do you prefer to use the computer with?'* The aim of this question was to understand who participants preferred to use the computer with out of school and if there was a gender split concerning this.

Question 12. *'What activities do you enjoying doing on the computer?'* This question again aims to get a deeper understanding of computer use out of school and aims to understand if there is a difference in what males and females prefer to do out of school on the computer and how much of an impact this can have on career decision making.

7.4.1 Question 11: Where A-Level students prefer to use the computer

A/S level IT and A-level IT

It is clear that a majority of female participants preferred to use the computer at home (70%), whereas for male participants the places they preferred to use the computers varied. Males indicated that they preferred places such as after school clubs, cafes and friends houses. This is something which was similar to female participants during GCSE level. Figure 7-1 below demonstrates this difference.

It is clear that a high majority of female participants preferred to use the computer at home (60%), whereas male participants preferred a varied number of places. Table 7-35 and Table 7-36 below demonstrates this difference.

	Number <u>Female</u> of participants	**Percentage (%)**	**Number of <u>Male</u> participants**	**Percentage (%)**
Home	9	76	5	42
After school/breakfast club	1	8	1	8
Internet Café	1	8	1	8
Library	0	0	0	0
Friends or family house	1	8	4	34
Specific Computer club	0	0	1	8

Table 7-35 A/S Level participants, out of school location preference

	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Home	9	60	7	36
After school/breakfast club	2	13	2	11
Internet Café	1	7	2	11
Library	0	0	0	0
Friends or family house	3	20	7	37
Specific Computer club	0	0	1	5

Table 7-36 A- Level participants, out of school location preference

A/S and A-Level Computing

The findings are very similar to those doing A-level and A/S Level IT in that female participants preferred to use the computer at home. This indicated why female participants decided to choose to do courses in technology. A very high majority of female participants preferred to use the computer at home (67%), whereas for male participants the places they preferred to use the computer varied. Table 7-37 below demonstrates this difference.

In comparison the findings are very similar to those doing A-level and A/S Level IT and Computing in that females prefer to use the computer at home. It is clear that a very high majority of female participants preferred to use the computer at home (80%).Table 7-38 below demonstrates this difference.

	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Home	4	67	7	50
After school/breakfast club	0	0	2	14
Internet Café	0	0	0	0
Library	0	0	0	0
Friends or family house	1	16.5	4	29
Specific Computer club	1	16.5	1	7

Table 7-37 AS Level Computing participants, out of school location preference

	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Home	4	80	3	60
After school/breakfast club	1	20	0	0
Internet Café	0	0	0	0
Library	0	0	0	0
Friends or family house	0	0	2	40
Specific Computer club	0	0	0	0

Table 7-38 A Level Computing participants, out of school location preference

7.4.2 Question 12: What A-level participants preferred to do on the computer

Typically the female participants used the computer for a specific reason, such as social networking, e-mail and surfing the internet whereas male participants, used it as a way to pass the time

This was a general difference between male and female participants, male participants used the computer for fun as well as for specific purposes whereas female participants used them for a specific reason, which starts from a young age. Pupils were asked how they remember first using computers. Both males and females began their computing story at young ages by way of games. Males subsequently carried on playing these games whilst females didn't. As girls got older, unless they had family or friends encouragement they did not carry on with gaming. Even those studying A-Levels and a degree level in computing; only a small number mentioned gaming as a hobby.

7.5 Theme 2: Summary of findings

The way in which female participants use the computer outside of school differs to how male participants decide to use the computer. Female participants preferred to use the computer at home in order to protect their privacy, whereas male participant preferred do use the computer with others and do varied activities on the computer. (Question 11,12 and 13)

7.6 Theme 3: Perceptions of future careers and career resources

This section provides the results for the following questions:

Question 13: 'Who do you go to for careers advice?'

Question 14: Has your course influenced you to take future courses in IT or computing? Please explain your answer

Question 15: How would you feel if you worked in the IT industry?

A/S Level IT

It was interesting that male participants named magazines as a career resource with 40% of them choosing this option. It was clearly the most popular option. Female participants named parents (59%) and teachers (17%) as the most popular answers. This is emphasises again that parents are an influential role model for girls as well as experiences at school. Table 7-39 below shows the most popular resources for career advice.

	Number Female of participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Parents	7	58	6	50
Other Family	1	8	0	0
Career Guides	0	0	1	8
Teachers	2	17	0	0
Magazines	0	0	1	8
Siblings	1	8	2	17
Friends	1	8	2	17
Career Advisors	0	0	0	0
TV Programmes	0	0	0	0
	12	100	12	100

Table 7-39 A/S Level IT Career advice resources

A-level IT

Female participants stated parents (40%) and teachers (25%)the most useful in terms of careers advice. This is consistent across female participants in all groups. Table 7-40 shows the most popular resources for career advice for this group.

	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Parents	10	67	9	47
Other Family	1	7	2	11
Career Guides	0	0	0	0
Teachers	1	7	2	11
Magazines	1	7	1	5
Siblings	1	7	3	16
Friends	1	7	2	11
Career Advisors	0	0	0	0
TV Programmes	0	0	0	0

Table 7-40 A- Level IT Career advice

A/S Computing

Female participants stated that parents (almost 67%) were the most useful careers resource. Female participants in this group gave more varied responses about where they go to for careers advice unlike those studying IT. Table 7-41 shows the most popular resources for career advice for this group.

	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Parents	4	67	7	51
Other Family	0	0	2	14
Career Guides	0	0	0	0
Teachers	0	0	2	14
Magazines	1	16.5	0	0
Siblings	0	0	1	7
Friends	1	16.5	2	14
Career Advisors	0	0	0	0
TV Programmes	0	0	0	0

Table 7-41 A/S Level Computing Career advice resources

A-level Computing

Again, it was clear that the female participants stated that parents (almost 60%) and teachers were the most useful for career advice. And again participant sin this group gave

more varied responses about advice unlike those studying IT. Table 7-42 8 show the most popular resources for career advice for this group.

	Number Female of participants	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Parents	4	80	3	60
Other Family	1	20	0	0
Career Guides	0	0	0	0
Teachers	0	0	0	0
Magazines	0	0	1	20
Siblings	0	0	1	20
Friends	0	0	0	0
Career Advisors	0	0	0	0
TV Programmes	0	0	0	0

Table 7-42 A-Level computing Career Advice

7.6.1 Theme 3: Summary of results

- Male participants at IT level named magazine as a resource to obtain careers advice from. (Question 14)
- For A-level participants (both male and female participants) parents and teachers were also sources of advice for careers. This was similar to A-level and A/S level computing participants. (Question 14)
- Parental viewpoints were considered in making degree level choices (Question 14).

7.7 Theme 4: Perception of taking further courses in computing or IT

Question 16: How do participants perceive themselves working in the IT industry?
The rest of this section provides interview excerpts about computing careers and plans to study further courses in computing or IT.

7.7.1 Question 16: How participants perceive themselves in the Industry

Participants had varied perceptions of working in the IT industry. Interestingly, female participants studying the IT degree level course both indicated that they would be happy,

whereas female participants on the computing course did not feel this. Tables 7-43 and 7-44 show the percentages.

Information Technology						
	Ranking	Female	**Percentages (%)**	**Ranking**	**Male**	**Percentages (%)**
Be happy	3	2	7	2	5	16.5
Be fashionable	4	1	4	4	2	6
Be glamorous	4	1	4	5	1	3
Be attractive		0	0	3	3	10
Be rich	1	9	33	2	5	16.5
Be clever	2	8	30	1	6	19
Be creative	3	2	7	3	3	10
Have lots of friends	4	1	4	3	3	10
Have a family	4	1	4	5	1	3
Be a geek	3	2	7	4	2	6

Table 7-43 How participants studying information technology perceived they would feel if they worked in the IT industry

Computing						
	Ranking	**Female**	**Percentages (%)**	**Ranking**	**Male**	**Percentages (%)**
Be happy	3	1	9	2	3	16
Be fashionable	4	0	0	4	1	5
Be glamorous	4	0	0	5	0	0
Be attractive	4	0	0	4	1	5
Be rich	1	4	37	2	3	16
Be clever	2	3	27	1	4	20
Be creative	4	0	0	3	2	11
Have lots of friends	4	0	0	3	2	11
Have a family	4	0	0	4	1	5
Be a geek	2	3	27	3	2	11

Table 7-44 How participants studying computing perceived they would feel if they worked in the IT industry

7.7.2 Difference between those taking IT A-level and those taking Computing A-level in terms of their courses and career plans

Participants who took IT A-level believed that this was a serious career option to take, they felt that this would help them with finding an IT job or help their chances in finding another type of job. However those taking Computing A-Level felt that the course was not the type of course to help them find a job as it was more skills based.

- Participants taking IT felt that it was a natural progression from the A-level and believed that it was a career orientated option to take.
- Confidence on the course was a factor in continuing with the degree level course.
- A-level students were looking for a university in which they could fit in.

7.8 Summary of results

The findings in this chapter present found that participants wanting to take the degree level course were confident in their current A-level course. A higher number of male participants felt that their IT and computing courses were ‘easy’ whereas the majority of female participants named the course ‘difficult’. The majority of female participants studying both computing and IT felt that they would not like to take computing at university.

The majority female participants studying computing at A-level felt they did not enjoy programming in class or programming coursework. Male participants felt the opposite with programming being the most popular activity. This was similar with the current A-level participants.

Participants indicated that they carried on the A-level computing course for different reasons such as they received a high mark in an exam or felt that it was useful. A similar majority of both male and female IT A/S participants felt that the IT A/S course was ‘really difficult’. It was difficult because the course was different to the GCSE course and there were new concepts to grasp. Male participants found the course easy because they had prior knowledge in programming, which is what the female participants found difficult. Female participants studying A/S IT and computing both indicated that they enjoyed theory lessons.

High numbers of male participants indicated that they would like to continue on IT at A-level. Whereas a small number of female participants indicated that they would carry on. The way in which female participants use the computer outside of school differs to how male participants decide to use the computer. Female participants preferred to use the computer at home in order to protect their privacy; whereas male participants preferred do use the computer with others and do varied activities on the computer.

7.9 Conclusion

Chapter 7 provided the questionnaire and interview responses from A-level participants. It discussed GCSE experiences, current experiences and motivations for taking A-level computing and IT. This chapter demonstrated that female A/S level computing participants felt isolated on their course and could be an influencing factor in them not continuing onto computing A-level, whereas participants studying A-level IT, were far more positive about their course. The differences in the ways that male and female participants perceive the IT industry were also discussed and the differences in the way they use the computer out of school. This chapter has demonstrated that there are factors during A-level which can put participants off continuing computing and IT.

Chapter 8 provides the questionnaire for degree level participants. It discusses previous experiences on courses in order to understand how participants came to the decision to studying computing or IT at university.

Chapter 8 Results: Degree level

'We must be very careful when we give advice to younger people: sometimes they follow it!'

E.W.Dijkstra, The humble programmer (1972)

Chapter 8 provides questionnaire responses from degree level participants studying IT and computing at the University of Southampton, South Bank University and Solent University. The results will be structured by the following themes: experiences at school, experiences out of school, perceptions of the IT industry and future plans. The results begin with degree level participants focusing upon their previous experiences at GCSE level and A-level before focusing on current experiences. The way in which male and female participants used the computer out of school are then discussed. Like the previous chapter, the results in this chapter will present the results in the form of themes, as follows:

Theme 1: Experiences of computers at school and University: *Aims to demonstrate the way in which participants at degree level remembered their past experiences at school and if these were negative or positive. As well as prior experiences, there is an emphasis on the way in which participants are finding their current degree course and how these factors could potentially influence career choice.*

Theme 2: Experiences of computers out of school and university: *Aims to understand the way in which participants used the computer out of school when they were studying for their A-levels and GCSEs. This also asks how participants currently use technology out of school and if this influences their perception of the IT industry.*

Theme 3: Future career plans: *Aims to understand what resources participants use to help make career decisions.*

Theme 4: Perceptions of technology careers: *How participants perceive the IT industry and how this influences career decisions.*

Each theme begins with the questionnaire results in order to provide a broad sweep of results. The questionnaire is available in Appendix 9. The chapter begins with the demographics. The data will be presented question by question, the order they were presented in the questionnaire. Despite the small numbers involved it was decided to use percentages in order to make uneven numbers easier. In using percentages numbers have had to be rounded up to ensure they add up to 100%.

8.1 Demographics

There were six different groups of participants at degree level who took part in the study. Participants were from three different universities and took courses in Computing or IT. Table 8-1 shows the number of participants who took part and the description of the courses.

	Male Participants	**Female Participants**
University of Southampton: Computer Science: This course provides the student with the opportunity to spend time in a computer lab, group projects and through lectures to learn about software development, databases, compilers and operating systems & networks.	**Questionnaire:** 19 Participants	Questionnaire: 21 Participants
University of Southampton: Information Technology and Organisations: This course provides the student with the opportunity to apply computing knowledge to the management of small or medium business. In order to do this students are provided with modules in technology and business.	**Questionnaire:** 6 Participants	Questionnaire: 5 Participants
South Bank University: Computing: This course provides the student with the opportunity to gain knowledge and skills in areas such as software engineering, systems design, computer architecture, business systems and mathematics.	**Questionnaire:** 6 Participants	Questionnaire: 6 Participants
South Bank University: Business information technology: This course provides the students the opportunity to relate information technology to business. Specifically focusing on the analysis, design and implementation of business information systems.	**Questionnaire:** 6 Participants	Questionnaire: 6 Participants
Solent University: Computing: This course provides the student the opportunity to study software development, Software Development, Networking, Databases, Human Computer Interaction & Usability and Web Development.	**Questionnaire:** 7 Participants	Questionnaire: 7 Participants

Solent University: Information Technology: This course provides the student the opportunity to learn about and investigate the impacts of technology on business.	**Questionnaire:** 7 Participants	Questionnaire: 7 Participants

Table 8-1 Demographics of degree level participants

8.2 Theme 1: Experience of computers at school and university

The questions asked in this section helped to provide a deeper understanding of participants' experiences of ICT at school and current experiences. The results present similarities and differences between male and female participants. The questions presented in this chapter are those which help answer the following research question: '*How does experience impact the way in which female students at different educational stages perceive themselves in the IT Industry?* Four sub questions were identified. The results provided in this section are to the following questions from the questionnaires

Previous experiences at school

Question 1. '*Please tick one box for each of the subjects you remember doing at secondary school and what you thought of them'.* This question asked participants to state how they felt about the other subjects they studied in order to understand where the GCSE ICT course performed in comparison.

Question 2. '*How did you find ICT at school?* This was to understand if the level of difficulty of the course posed a problem for participants and was a factor in dissuading them to carry the course on. As well as to understand if there was a gender split in how participants found the course.

Question 3. *'Please write down the names of your A-level courses and state what you thought of them?* This question asked participants how they felt about A-level courses in order to understand how they felt.

Current experiences at school

Question 4. '*Please write down the name of the course you are currently studying and state what you think of it'.*

Question 5. *'How do you currently find the IT/Computing course you are studying*?' The question aimed to understand what the participant thought about their degree course, if there were differences amongst the courses and differences between male and female participants.

Question 6. *'Why did you choose IT/Computing at undergraduate level?*' The aim of the question was to understand the participant's motivation in choosing IT/Computing at degree level.

Question 7. *'Why did you choose the university you are currently at?'* The aim of this question was to understand what factors motivated the participants choice of university.

Previous Experiences at school

8.2.1 Question 1: How ICT at secondary school compared to other subjects at GCSE level

The questionnaire began by asking how ICT could be compared to other subjects the participants studied GCSE level. Overall both male and female participants indicated that they liked ICT lessons. Participants had the opportunity to choose if they: 0 - '*didn't do the subject*', 1 – '*really hated the subject'*, 2 – '*didn't like the subject*', 3 - the subject was '*ok*', 4 – '*liked the subject*' and 5 – '*loved the subject'*. There were 11 subjects altogether. The rankings of the subjects were averaged and this provided a 'league table' of subject preferences.

	Ranking	Female participants	Average	Male participants	Average
Most Favourite	1	Science	4.032	Science	4.33
	2	Maths	4.3	Maths	4.21
	3	**ICT**	**4.1**	**ICT**	**4.12**
	4	Modern Languages	3.1	Geography	4.11
	5	Geography	3.1	Music	2.12
	6	English	2.223	English	2.1
	7	Music	2.1	P.E.	2.01
	8	P.E.	1.25	Modern Languages	1.5
	9	Art	1.2	Art	1.4
Least Favourite	10	Drama	1.13	Drama	1.01

Table 8-2 Mean of how male and female participants rated ICT lessons

Table 8-1 provides an overall summary of how undergraduate participants remember finding ICT GCSE at school. The overall results demonstrate that participants felt ICT at GCSE level was an enjoyable subject. It is interesting that maths and science were rated highly by participants, which are similar to the A-level participants. This could signify that participants who continued the course to degree level had similar feelings about their A-level experiences. If the results are split up by course it was clear that participants who chose to study computing rated ICT a lot lower than those who chose to study IT.

8.2.2 How participants who chose computing and IT courses rated their GCSE ICT course

The split between the courses could demonstrate the different motivations for choosing to take the respective courses at undergraduate level.

Participants who chose to study computing degree level courses

The majority of both male and female participants who chose computing at degree level indicated that they did not enjoy their GCSE ICT lessons. This was evident for all computing and computer science participants regardless of university course or gender. This is interesting as it demonstrates that formal learning ICT experience at GCSE level was not a crucial factor for these participants. Tables 8-3, 8-4 and 8-5 provide a breakdown of how the participants who chose computing and IT courses ranked their GCSE ICT course.

University of Southampton	**Number Female of participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	7	33	8	42
Didn't like it	7	33	6	32
It was OK	3	14	2	11
I liked it	3	14	2	11
I loved it	1	6	1	4
I didn't do it	0	0	0	0

Table 8-3 How University of Southampton computing participants felt about their GCSE ICT courses

South Bank University	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Hated it	2	33	1	17
Didn't like it	2	33	2	33
It was OK	1	17	1	17
I liked it	1	17	2	33
I loved it	0	0	0	0
I didn't do it	0	0	0	0

Table 8-4 How South Bank University computing participants felt about their GCSE ICT courses

Solent University	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Hated it	2	29	1	14
Didn't like it	2	29	1	14
It was OK	1	14	1	14
I liked it	1	14	2	29
I loved it	1	14	2	29
I didn't do it	0	0	0	0

Table 8-5 How Solent University computing participants felt about their GCSE ICT courses

Participants Studying Information Technology, Information Systems and Information Technology & Organisations

Broadly speaking, a smaller number of participants expressed positive feelings regarding their previous IT GCSE experience, as the other two expressed negative feelings. Female participants were equally as positive about their prior experience in school, compared to male participants (see Table 8-6, 8-7 and 8-8).

University of Southampton	Number Female of participants	Percentage (%)	Number of Male participants	Percentage (%)
Hated it	1	20	2	32
Didn't like it	1	20	1	17
It was OK	1	20	1	17
I liked it	1	20	1	17
I loved it	1	20	1	17
I didn't do it	0	0	0	0

Table 8-6 How University of Southampton ITO participants felt about their GCSE ICT courses

South Bank University	**Number Female of participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	2	32	1	17
Didn't like it	1	17	1	17
It was OK	1	17	2	32
I liked it	1	17	1	17
I loved it	1	17	1	17
I didn't do it	0	0	0	0

Table 8-7 How South Bank University Business Information Systems participants felt about their GCSE ICT courses

Solent University	**Number Female of participants**	**Percentage (%)**	**Number of Male participants**	**Percentage (%)**
Hated it	1	14	1	14
Didn't like it	1	14	2	29
It was OK	1	14	1	14
I liked it	1	14	1	14
I loved it	2	28	2	29
I didn't do it	1	14	0	0

Table 8-8 How Solent University Business Information Systems participants felt about their GCSE ICT courses

8.2.3 Question 2: How easy did undergraduate participants find GCSE ICT?

The majority of both male and female participants who took degree level Computing and IT said they found their GCSE course '*easy*' or '*really easy*'. The percentages are shown in the tables 8-9 to 8-12.

Female (Computing Course)	**Really Easy**	**Easy**	**Quite Difficult**	**Really Difficult**
University of Southampton Computer Science participants	8	7	3	3
Percentage (%)	38	34	14	14
South Bank Computer Science participants	3	1	1	1
Percentage (%)	49	17	17	17
Solent University Participants	3	2	1	1
Percentage (%)	43	29	14	14

Table 8-9 How participants found their GCSE course (Female participants on computing courses)

Male (Computing Course)	**Really Easy**	**Easy**	**Quite Difficult**	**Really Difficult**
University of Southampton Computer Science participants	8	7	2	2
Percentage (%)	42	36	11	11
South Bank Computer Science participants	3	2	1	0
Percentage (%)	50	33	17	0
Solent University Participants	3	1	2	1
Percentage (%)	43	14	29	14

Table 8-10 How participants found their GCSE course (Male participants on computing courses)

When these figures are collated it is apparent that across all three universities male participants found their GCSE course equally as difficult as female participants. The figures in Table 8-11 are grouped by 'really easy' and 'easy' and then 'difficult' and 'really difficult'.

	'Really Easy' and 'Easy'	**'Quite Difficult' and 'Really Difficult'**
Male Participants	24 out of 32 (75%)	10 out of 34 (29%)
Female Participants	24 out of 34 (70.5%)	9 out of 32 (28%)

Table 8-11 How participants found computing

For participants studying Information Technology there were differences between male and female participants in that female participants found the course easier than male participants, however both found the course difficult.

Female (Information Technology)	**Really Easy**	**Easy**	**Quite Difficult**	**Really Difficult**
University of Southampton: Information Technology and Organisations	2	1	1	1
Percentage (%)	40	20	20	20
South Bank University: Information Technology	3	1	1	1
Percentage (%)	49	17	17	17
Solent University: Information Technology	3	3	1	0
Percentage (%)	43	43	14	0

Table 8-12 How participants found their GCSE course (Female participants on Information Technology courses)

Male (Information Technology)	**Really Easy**	**Easy**	**Quite Difficult**	**Really Difficult**
University of Southampton: Information Technology and Organisations	3	1	1	1
Percentage (%)	49	17	17	17
South Bank University: Information Technology	2	2	1	1
Percentage (%)	33	33	17	17
Solent University: Information Technology	2	3	1	1
Percentage (%)	29	43	14	14

Table 8-13 How participants found their GCSE course (Male participants on Information Technology courses)

In contrast to participants studying computing, there was a difference between male and female participants with regards to how difficult they found their prior ICT GCSE course. More female participants found the course easier than their male counterparts, but there was a similar number for the levels of how difficult they found the course. The figures are grouped by 'really easy' and 'easy' and then 'difficult' and 'really difficult'.

	'Really Easy' and 'Easy'	**'Quite Difficult' and 'Really Difficult'**
Male Participants	11 out of 19 (57.8%)	6 out of 19 (31%)
Female Participants	13 out of 18 (72.2%)	5 out of 18 (28%)

Table 8-14 How participants found Information Technology

8.2.4 Question 3: Name of your A-level courses and state what you thought of them

Memories undergraduate participants had of their Computing/IT A-level course

This section focuses on the questionnaire results and asked how participants felt about their prior A-level courses and how the courses served as motivational factors for taking courses in Computing or IT at undergraduate level. It was clear that there were particular prior A-levels, which participants took, which were IT A-level, Computing A-level and A-level Mathematics. A small number of participants took 'other' courses at A-level such as: GNVQ IT A-level, IT practitioners (A-level) and Multimedia GNVQ. The results are shown in Table 8-15.

Female Participants	**Computing A-level**	**IT A-level**	**Maths A-level**	**Other A-level course**
Participants taking Computing degree level	3	2	29	0
Percentage (%)	9	6	85	0
Participants taking IT degree level		17	1	
Percentage (%)	0	94	6	0
Male Participants				4
Participants taking Computing degree level	4	1	23	0
Percentage (%)	13	3	72	0
Participants taking IT degree level	1	17	1	0
Percentage (%)	5	90	5	0

Table 8-15 Percentages of the prior A-level course which participants took before their degree courses

8.2.5 Question 6: Why did participants choose computing or IT at degree level?

There were many different stories, reasons and issues with regards to choosing courses. Reasons ranged from: it was what the participants were interested in, their teacher or parent advised them to choose it, entry through maths, enjoyment of previous course or they thought that it would suit them best. There were not specific differences between the universities with regards to motivation but there were distinct differences amongst the courses.

Prior experience of A-level courses

Both male and female participants indicated that enjoyment of their A-level computing and IT course was a factor in continuing on to the degree level course. There was a clear difference in the influencing and motivating factors between female participants who carried on the IT degree courses. Female participants enjoyed their prior course and it was these participants who had taken an A-level course in IT (see questionnaire extract 1).

> DegreeSolentCompQuestionniareF1[Q6]: *'I enjoyed the computing A-level I did at college. It wasn't too difficult'.* Questionnaire Extract 20: Female participant from Solent University taking Computing.

Influence of Parents

In general, female participants who decided to study Computing or IT did so because of the positive influences and encouragement they have encountered from out of school and at school. Female participants studying for computing degree level courses at all universities indicated that their parents had been the main driving force behind them deciding to study computing at university. In particular it was fathers who encouraged their daughters. There were two groups of students, female participants who had taken a maths A-level and were influenced a lot later to take computing at degree level and participants whose fathers had been an ongoing influence to them to take computing (see questionnaire extract 21).

> DegreeECSCompQuestionniareF2[Q6]: *'My dad works at IBM and he always liked to explain technical concepts to me. So I got the other side of computing as well as the user side'*. Questionnaire Extract 21 degree level computing female.

The latter had been done through playing computer games, introducing them to new things on the computer, encouraging their daughter to help set up a computer and encouraging their daughter to think about computer careers. In some cases, it was fathers who had a computing/technical job, which influenced female participants to take it as they often bought their work home it.

Issue of mathematics

The majority of female participants (29 out of 34) who decided to study computing have done so because of their interest in maths. This is indicated in Table 8-5 which shows that 84% of female participants studied mathematics before deciding to study computing. These were female participants who enjoyed mathematics but were not sure about carrying it on at degree level, but were told that they could use their maths and apply it to computing. These female participants had not taken computing before and were not wary of it but curious about the degree.

Maths had either opened or closed the door to computing. It may be that computing at A-level is putting people off but maths and the curiosity about its relation to computers is

bringing people in. It has to be emphasised that all female participants who were doing computing because of maths had been introduced to computing by either a parent or teacher.

8.2.6 Theme 1: Summary

- Maths and Science GCSE was popular overall with all female and male participants at degree level.
- IT Degree level participants enjoyed their GCSE courses, however computing participants did not.
- All groups of participants found the course 'easy', however like A-level there was a difference between male and female participants because male participants did find the course 'easier' than the female participants overall.
- A high number of computing participants took maths rather than computing at A-level and a high number of IT degree participants took IT at A-level.
- Participants chose to do computing for the following reasons: previous course experience, parental guidance and maths entry.

8.3 Theme 2: Experience of using the computer out of education

The questions asked in this section aim to provide a deeper understanding of how degree level participants out of education use the computer and how these experiences differ between male and female participants. The contrast between home and education experiences will also be compared. The questions presented in this chapter are those which help answer the following research question: '*How does experience impact the way in which female students outside of formal learning perceive themselves in the IT Industry?* Four sub questions were identified. The results provided in this section are to the following questions from the questionnaire:

Question 14. '*Where do you prefer to use the computer out of university hours?'* This question aims to understand where participants preferred to use a computer and if there was a gender split concerning this.

Question 15. '*Who do you prefer to use the computer with?'* The aim of this question was to understand who participants preferred to use the computer with out of education and if there was a gender split concerning this.

Question 16. *'What activities do you enjoying doing on the computer?'* This question again aims to get a deeper understanding of computer use out of school and aims to understand if there is a difference in what males and females prefer to do out of school on the computer and how much of an impact this can have on career decision making.

8.3.1 Question 7: Where participants preferred to use the computer

The first question in this section asks where young people like to use the computer. This was to understand where they most felt comfortable. Participants had a choice between: 1 – '*home*', 2 – '*library*', 3- '*Computer lab'* and using the computer at 5 – '*friends or family's house*'.

Female participants and where they preferred to use the computer

Table 8-16 shows where female participants preferred to use the computer outside of school. The most popular option for all females was to use the computer at home and at the university computer labs.

	Home	**Library**	**Computer Lab**	**Friend or Family House**
Computing Participants	19	1	14	0
Percentages (%)	56	3	41	0
IT Participants	13	2	4	0
Percentages (%)	67	11	22	0

Table 8-16 Where female participants prefer to use the computer

Male participants and where they preferred to use the computer

Male participants indicated that they used the computer in varied locations and not just at home. This is shown in Table 8-17. The majority of males preferred to use the computer at home, the lab. This is in contrast to the female participants who preferred using the computer at home.

	Home	**Library**	**Computer Lab**	**Friend or Family House**
Computing Participants	15	1	16	0
Percentages (%)	47	3	50	0
IT Participants	12	2	3	0
Percentages (%)	73	11	16	0

Table 8-17 Where male participants prefer to use the computer

Overall when looking at the gender differences there is a clear course effect. For computing courses male participants there is more of a preference for using the computer in the computer lab at their universities and the female participants express a preference for using the computer at home. This is reversed for the IT course. There was no gender difference for using the library (see Table 8-18).

	Home		**Library**		**Computer Lab**		**Friend/Family House**	
	Female	Male	Female	Male	Female	Male	Female	Male
Computing (%)	56	47	3	3	41	50	0	0
Information Technology (%)	68	73	10	11	22	16	0	0

Table 8-18 Collated percentages of where participants preferred to use the computer

8.3.2 Question 8: Where do you prefer to use the computer?

Participants were asked who they preferred to use the computer with. Female participants preferred to use the computer alone, whereas males had a preference for wanting to use them with friends. Female participants only wanted to use them with friends in the lab. Table 6-12 shows the preferences of female participants and Table 6-13 shows the preferences of male participants.

Female Participants

The majority of female participants preferred using the computer alone or at the computer lab, which contrasts with A-level and GCSE level participants.

Table 8-19 shows the figures.

	Home	**Library**	**Computer lab**	**Friend or family house**
Computing Course	57% *(15 Participants)*	3% *(1 Participant)*	40% *(16 Participant)*	0%

IT Course	70.7% *(12 Participants)*	*11.7%* *(2 Participant)*	*17.6* *(3 Participant)*	0%

Table 8-19 Where female participants prefer to use the computer

Males Participants

In comparison to female participants, male participants preferred to use the computer with others. Using the computer with parents was the least popular. Whereas using the computer alone or with friends or family were popular. Table 8-20 shows the figures.

	Home	**Library**	**Computer lab**	**Friend or family house**
Computing Course	30% *(Participants)*	7% *(Participant)*	51% *(Participant)*	12%
IT Course	*(12 Participants)*	*(2 Participant)*	*(3 Participant)*	0%

Table 8-20 Where male participants prefer to use the computer

8.3.3 Question 9: What do you prefer to do on the computer outside of school?

Participants were asked what they preferred doing on the computer outside of school. Female participants preferred using the computer for social networking, surfing the web and answering email. Interestingly, female participants also named computer games as an enjoyable activity. In addition, male participants also preferred to use the computer for playing games, fixing computers, and a few enjoyed programming. Table 8-19 and Table 8-20 show the results of both male and female participants.

What female participants preferred to do on the computer outside of school

Female participants preferred to do activities such as social networking, surfing the web and emailing friends. The activities are ranked by popularity (see Table 8-21). Appendix 12 provides the participant numbers for this question.

Ranking	**Best Activity**	**I like this activity**	**Its OK**	**I don't really like it**	**I hate it**	**I've never done this**
1	Email	45	5	2	0	0
	Percentage (%)	87	10	3	0	0
2	Social Networking	41	5	6	0	0
	Percentage (%)	78	10	12	0	0
3	Website Design	25	10	15	2	0
	Percentage (%)	48	19	29	4	0
3	Surfing the Web	25	12	15	0	0
	Percentage (%)	48	23	29	0	0
4	Computer Games	21	10	9	10	2
	Percentage (%)	40	19	17	19	5
5	Blogging	15	21	12	2	2
	Percentage (%)	29	40	23	4	4
6	Graphic Design	12	15	13	8	4
	Percentage (%)	23	29	25	15	8
6	Programming	12	15	20	3	2
	Percentage (%)	23	29	38	6	4
7	Homework	5	16	25	6	0
	Percentage (%)	10	31	47	12	0
8	Writing Stories	0	0	6	36	10
	Percentage (%)	0	0	12	69	19
8	Fixing computers	0	0	0	39	13
	Percentage (%)	0	0	0	75	25

Table 8-21 Activities female participants preferred to do outside of school on the computer

What female participants preferred to do on the computer outside of school

Female participants preferred to do activities such as gaming, social networking, surfing the web and emailing friends.

Ranking	**Best Activity**	**I like this activity**	**Its OK**	**I don't really like it**	**I hate it**	**I've never done this**
1	Computer Games	48	3	0	0	0
	Percentage (%)	94	6	0	0	0
2	Website Design	41	5	5	0	0
	Percentage (%)	80	10	10	0	0
3	Social Networking	40	3	3	2	3
	Percentage (%)	78	6	6	4	6
4	Email	39	6	3	3	0
	Percentage (%)	76	12	6	6	0
5	Surfing the Web	32	10	9	0	0
	Percentage (%)	62	20	18	0	0
6	Graphic Design	26	12	13	0	0
	Percentage (%)	51	24	25	0	0
7	Programming	25	20	6	0	0
	Percentage (%)	49	39	12	0	0
8	Homework	10	9	15	17	0
	Percentage (%)	20	18	29	33	0
9	Blogging	9	41	2	0	0
	Percentage (%)	18	80	4	0	0
10	Writing Stories	0	0	0	49	2
	Percentage (%)	0	0	0	96	4
10	Fixing computers	0	15	20	10	6
	Percentage (%)	0	29	39	20	12

Table 8-22 Activities male participants preferred to do outside of school on the computer

8.3.4 Key findings

- Female participants studying both computing and IT preferred to use the computer at home and male participants preferred both home and the lab.
- Female participants were more varied in their activities.

8.4 Perceptions of the IT industry

The questions asked in this section helped to provide a deeper understanding of young people's perceptions of prior ICT GCSE experiences at school and current experiences. The

results present similarities and differences between male and female participants. The questions asked in this section are to provide a deeper understanding of how young peoples' perception of the IT industry and whether it enthuses or dissuades them from thinking of IT as a possible career option. The questions presented in this chapter are those which help answer the following research question: '*How does experience impact the way in which female students perceive themselves in the IT Industry?* Four sub questions were identified. The results provided in this section are to the following questions from the questionnaire:

- '*How participants perceived themselves in the IT industry*

8.4.1 How participants perceived themselves working in the IT industry

Participants were asked how they perceived the IT industry if they were to work in it themselves. Table 8-23 shows male and female participants responses.

Computing						
	Ranking	**Female**	**Percentages (%)**	**Ranking**	**Male**	**Percentages (%)**
Be happy	2	6	17	1	8	25
Be fashionable	3	3	9	6	2	6
Be glamorous	4	2	6	7	0	0
Be attractive	3	3	9	6	2	6
Be rich	2	6	17	4	4	13
Be clever	1	8	24	2	6	19
Be creative	4	2	6	6	2	6
Have lots of friends	5	1	3	5	3	9
Have a family	3	3	9	7	0	0
Be a geek	6	0	0	3	5	16

Table 8-23 How degree level participants perceived themselves in the IT industry

Information Technology						
		Female	**Percentages (%)**		**Male**	**Percentages (%)**
Be happy	2	4	22	1	5	25
Be fashionable	3	2	11	5	1	5
Be glamorous	5	0	0	6	0	0
Be attractive	4	1	6	4	2	11
Be rich	1	5	28	2	3	16
Be clever	3	2	11	2	3	16
Be creative	5	0	0	6	0	0
Have lots of friends	5	0	0	5	1	5
Have a family	2	4	22	3	2	11
Be a geek	5	0	0	3	2	11

Table 8-24 How degree level participants perceived themselves in the IT industry

Positive feelings about working in the IT industry

Female participants studying computing who said that they could perceive themselves in the IT industry perceived themselves as being happy (17%), having lots of friends (3%), having a family (9%) and being smart if they worked in the IT Industry.

8.5 Conclusion

Chapter 8 provided the questionnaire and interview results from degree level participants. This provided an insight into why these participants decided to take the course they did and what motivated them to do so. They provide an honest account of their experiences and perceptions. Results showed that parents were important in the decision making process, as were the experiences at school.

The next chapter discusses the key themes from the results of this study and the novel contributions which have arisen. Finally, the main conclusions of this study and future work are discussed.

Chapter 9 Discussion and Future Work

This chapter discusses the results presented in chapters 6, 7 and 8. It begins by revisiting the research questions outlined in the introduction, and discusses how the findings have helped answer them. Throughout this thesis, four themes have been used to help answering the research questions, which are: computer experiences at school, computer experiences out of school, perceptions of the IT industry, and perceptions of taking further IT or computing courses. These themes will be used to help clarify discussion points. The conclusions of this thesis have been taken from the views and opinions obtained, and these may not representative of every school or pupil in the UK. However, they does indicate areas which support literature findings as well as highlighting indicative trends specific to the UK which could assist with further research in this domain and IT education specialists.

9.1 Revisiting the Research Questions

The main research question in this thesis is:

'*How does experience impact the way in which female students at different educational stages perceive their futures in the IT industry?*'

In order to help answer these, four sub-questions were identified, which are under the headings 'perceptions' and 'experiences'.

Experiences

V. How does the IT experience in formal education shape the way female students at different educational stages view the IT industry?

VI. How does the IT experience *out of a formal education setting* shape the way in which female students at different educational stages view the IT industry?

Perceptions

VII. How do female students at different educational stages perceive the IT industry?

VIII. How do female students at different educational stages perceive themselves in the IT industry?

Through understanding the ways in which young people experience computers at school and at home, this thesis has identified how women perceive their futures in the IT industry. This has helped distinguish various factors, within school and out of the formal educational setting, which may encourage or dissuade women from taking courses in computing and IT. The scope of this research is based on the UK education system, and the results are specific to that. There are trends that may mirror and reinforce those in other education systems around the world, but the unique contributions found in this thesis are specific to courses taking place in the UK during 2007-2008. Therefore, this thesis provides a current status on student experiences and highlights current factors which could dissuade or encourage female students' views on further study or careers in the IT industry. The next stage of this discussion will primarily focus on the research questions. It begins by focusing on experiences within education. To help illustrate the findings, case studies and quotations will be used from the interviews. The names of the case study participants have been changed in order to keep the participants' identities confidential. These are: *Anna Smith*, *Charlie Andover* (GCSE Level), *Chloe Daniels*, *Sally Jacobs* (A-levels), *Sheila Webber*, *Maria Von Trapp* (Degree Level).

9.2 Experiences

9.2.1 How does the IT experience at formal education shape the way female students at different educational stages view the IT industry?

This thesis has identified various factors within formal education that have been shown to influence and dissuade female participants to study computing and IT at A-level and degree level. It also identified how formal education at different stages influences the way in which female students view the IT industry.

In the initial literature review, it was found that GCSE ICT lessons were a factor in reducing the enthusiasm of young people for computing careers and further courses in IT (Mitchell, Levin and Krumbotlz 1999). However, understanding the long term educational impact can be problematic as it is only through longitudinal studies that it is possible to be able to see how much of an impact school experience can have on students. Such a six-year study in the USA, conducted by Brainard and Carlin, found that experiences of formal education at school were a significant factor in encouraging or dissuading young people from taking IT careers and courses (Brainard and Carlin 1997). When applied here, this is an indication of the possible factors that have had an influence on participants in this investigation. This section focuses on how experiences at GCSE level and A-level have an influence on whether female participants decide to choose a degree course in computing or IT.

a. The influence of previous courses on female participants

The findings have shown that the courses participants took at either GCSE or A-level may have an influence on whether they decided to continue studying IT or computing at degree or A-level.

- There was a noticeable difference between the attitudes of GCSE students, studying the GCSE ICT full & short course, and those studying the Business Communication Systems GCSE course. This was demonstrated in Tables 6-3, 6-4 and 6-5, where there is a difference between the different courses and how participants felt about their ICT lessons when compared with other courses. The results showed that participants studying GCSE ICT felt that the course was not exciting. To illustrate this point, case study extracts will be used from *Anna Smith*.

Anna Smith, ICT Full Course, GCSE, Age 15

Anna is currently studying for her full course in GCSE ICT. She is in year 10. Anna took GCSE ICT at school because she was told by her parents and teachers that it was an important course to take for the future. She was told that that if she took the course now, she could 'get it over and done with.' Anna also chose sociology and triple science as part of her GCSE options. When Anna was asked about how ICT compared to her other courses, she described the course as useless and 'boring.' She did not understand the point of the course and was simply doing it to get the grade. She felt that her modules were boring, especially MS Word, Excel and Access modules. This was because she has these applications on her home computer and it is 'nothing new.'

The case study above was typical of participants studying the GCSE ICT course, in that they found the modules on Microsoft boring. This was especially prominent within the interviews (see interview extract 1) which is from another interviewee:

> GCSEF1: '*... In today's lesson, we have just got our Excel task and we have to do a spreadsheet system for a florist or sports shop. It's just boring, I just don't find that fun or I don't know how it's going to help me. I really hate it and it's difficult. ...*'

Interview Extract 1: GCSE Full Course female participant

The GCSE ICT participants in this study found it harder to gauge how learning about Microsoft Office could be a sufficient foundation for a further course in IT or Computing. According to an Ofsted report, female students were more inclined to choose courses that focused on office skills (Ofsted, 2009). The questionnaire results in this thesis reinforce the views of Ofsted, as it was found that participants who took the GCSE full and short course, only experienced Microsoft Office skills at school. Participants indicated that they found this 'boring' and 'pointless.' This is reinforced by interview data, which indicated that the female participants at GCSE level consider jobs in the IT industry to either be secretarial roles or ICT teachers (see interview extract 2), which is from the participant who was in the case study.

GCSEF3: '*I dunno…I just think that with what we are learning, it's like we are learning how to be a secretary. I don't want to be one of those*.'

Interview Extract 2: GCSE Full Course female participant

In contrast, both male and female participants who took the Business Communications Systems course felt the opposite because they experienced a different kind of curriculum that was more practical. To illustrate this point, case study extracts will be used from *Charlie Andover*.

Charlie Andover, Business Communications Systems, Age 16

Charlie Andover is 16 years old and she is studying Business Communication Systems. She attends a specialist maths and computing school. Charlie decided to take Business Communication Systems at school because she wanted to combine learning about computers and business. She said that she was told this by her dad who works at IBM. She was told that it would also be important for her future. The other courses she took were art and sociology. She said that she felt apprehensive about choosing Business Communication Systems because she didn't really know what to expect, because she hadn't heard of some of the modules before, and it sounded difficult. But she was also excited that they got to use the better computers at school. Overall, Charlie was complimentary of the course but she also said that there were 'boring bits' like learning Microsoft Office. Charlie really enjoyed learning about website design and computer maintenance. She enjoyed the website design course because she was able to apply it to use her skills for her final art project to make her art portfolio. She loved doing this as it was a really creative task.

Participants studying for the GCSE Business Communication Systems were more positive about their course. This could have been because they were in a school which had a focus on maths and computing, but also because by taking the course they were able to understand more about the practical application of computers (see interview extract 3), which is from another interview participant.

GCSEBCSF2: '*It's not so bad. Like the teachers tell us about computers and at first I don't see the point in it all. But when we learn about how real people in real businesses do what we are learning… I think it makes me feel like I am actually learning something relevant to my future*.'

Interview Extract 3: Business Communications Systems Course female participant

Participants also felt that this course was creative and helped them to understand new aspects of the computer. Website design was a prime example of this. This was also seen in the GCSE questionnaire results and is presented in Table 6-9 (see interview extract 4).

GCSEBC3: '*PowerPoint, well anything that we can use graphics with. That's why I enjoyed the website design. I liked doing the publisher stuff so I could make posters and leaflets and that sort of stuff*.'
Researcher: '*Oh ok cool. So what did you like about doing that?*'
GCSEBC3: '*It was creative*.'
Researcher: '*Do you think working in computing is creative?*'
GCSEBC3: '*Well it's just writing stuff down. So someone wants you to make a device or application, they design the spec, they do everything in computing you have to make something exact to what the other person has told you. It's like where's the room to breathe?*'

Interview Extract 4: Business Communication Systems course female participant

- Participants who were studying degree level IT indicated that their A-level in IT was an influencing factor for wanting to carry on the course. A number of female participants studying IT degree level (15 out of 21 participants), remembered their IT A-level as being enjoyable and in interviews they indicated that it was a course which they could relate to real life businesses. This can be seen in Tables 8-6, 8-7 and 8-8. To illustrate this point, case study extracts will be used from *Sally Jacobs.*

Sally Jacobs Studying Information Technology A-level, Age 17

Sally Jacobs is 17 years old and is studying Information Technology (IT) at A-level. Sally took IT at A-level because she really enjoyed the GCSE course. She wanted a similar but more advanced course at A-level so she felt that IT would be a good option to take. Sally is also studying economics, media studies and biology. She finds her IT course interesting but would prefer to have more practical elements within the course. The course itself does have a range of modules from which the school can select. However, Sally said her school has selected modules that are not practical. They are more business studies and case study based. Sally does enjoy learning about the business side and says she does not find it too difficult, but does not feel that this 'unleashes' her creative side.

Sally would have liked to have learnt far more about website design, multimedia and graphics as well as computer security. Although the course does cover it, it doesn't cover it in the amount of depth that she would have preferred. Sally is unsure about what career she would like to go into, but the idea of website design and graphics sounds like something that would interest her.

These participants felt that the mix between practical and theory was enough to help them grasp important concepts such as 'networking' and 'business.' This was also seen in the interview results and is discussed in section 7.3.14. This was surprising as the contents of the IT A-level course relates to business studies, which would typically be seen to be interesting to male students, as highlighted by Smyth and Darmody, who found that far more male students were attracted to business studies than females (Smyth and Darmody 2009). Relating the course to business, meant that there was a direct link with the IT industry (see interview extract 5), which is from the case study student.

> ALevelITF1: '*I like that we do different things. We had to do a module on analysing the problem, so we had to create a list of requirements of what the business needed and wanted from a system. I never knew that actually happened. My teacher then said that there are people with jobs that do exactly that. I wouldn't mind doing something like that*.'

Interview Extract 5: Information Technology A-level course female participant

This link provided participants with realistic ideas of future careers, which influenced them to continue with IT at degree level. These findings proved interesting, as the researcher had not found prior studies that showed an impact of previous courses on A-level participants. This was similar for both male and female participants.

In contrast, female participants taking A-level computing and degree level computing were not as satisfied with their experiences as those females taking A-level IT. This is evident within the questionnaire results as demonstrated in section 7.3.15. To illustrate this point, case study extracts will be used from *Chloe Daniels.*

Chloe Daniels, A/S Level Computing, Age 16

Chloe Daniels is 16 years old and is studying Computer Science at A/S level. Chloe took computing at A/S level because she enjoyed her GCSE ICT and wanted to learn more about how computers worked. She didn't want to do IT at A-level because she felt it would be similar to the GCSE course. She said that, although she enjoyed the GCSE course, she wanted to go beyond the applications. Her other A-level choices are Maths, Physics, German and Performing Arts. She is also doing an evening creative writing course as well as taking part in various sports and theatre activities in her spare time. Chloe said that she expected computing to be difficult and she expected it to be full of boys. She said that this was fine as the course was a means to an end. She finds the course difficult as she is new to many of the concepts and feels that the class is moving too quickly.

Chloe's experience was typical of other female participants studying computing at A-level. This was surprising, as previous studies have shown that if participants do have an exposure to computing concepts, then they are less likely to be frightened of it. Holden and Weeden discussed the positive impact of holding computing camps for high school children, and came to the conclusion that those who participated showed more of an interest in computing careers and courses (Holden and Weeden 2003). However, the data in this thesis found that the majority of female computing undergraduates surveyed did not have a computing background, but rather a maths background, as shown in Table 8-13.

b. Classroom atmosphere has an influence on female participants' opinions of the IT industry as well as their confidence levels

The results of this research indicate that the atmosphere in the classroom or learning environment has an influence on the opinions of female students of the IT industry, as well as confidence levels.

- Female participants who took computing at A-level felt the subject was interesting as well as manageable. However, there were instances where they felt outnumbered by the male students in their class. This was more prominent in the interviews, which will be expanded in the coming sections.

Chloe Daniels, A/S Level Computing, Age 16

She feels more behind than others in her class since, when she looked at her classmates' computer screens, she said that they were doing things on the computer she had never seen before. There is one other female student in her class with whom she works closely. Chloe said that they were discussing far more integration with the male students in their class, so they can learn what their classmates are doing. She also feels that the teacher pays more attention to the male students, and she and her friend are left to get on with the tasks on their own. They do ask the teacher for help, but she feels that the teacher patronises them, as do the male students.

Throughout the interviews, it was clear that the feeling of loneliness and isolation was a contributing factor to them not wanting to carry on with computing at university. The majority of female A-level computing students said that they were put off computing through their classroom experience; they felt isolated and did not feel capable of doing the degree course (see interview extract 6), which is from the case study student.

ALEVELComputingF3: '*Going to class can be a chore, 'cos it's a difficult course and I don't feel like I have many friends. There is one other girl in my class and if she is away then I am on my own. The guys in the class are just so clever. I am too scared to ask them for help.*'

Interview Extract 6: Business Communication Systems course female participant

This has been an ongoing concern in the women in computing domain as highlighted by Moorman and Johnson (2004) and Cottrell (1992) who stated that feelings of isolation in

computing lessons was a factor in females feeling discouraged from computing as a career. In the studies conducted by both Clarke and Teague, and by Margolis and Fisher, there were recurring themes where female students had indicated that they felt isolated (Clarke and Teague 1996; Margolis and Fisher 2002).

There were a small number of female participants in the computing A-level classes in comparison to the numbers of males. Females said they felt they could only approach other females for help as they were too embarrassed to ask the male students in their class because they felt they were asking 'stupid questions' (see interview extract 7), which is from a student not from the case studies.

> ALevelComputingF1: '*I don't mind the A-Level... my Dad helps me out so it's not too bad as I now understand it and also thought it might be quite cool to do. I went to my dad's company for work experience and I was in the I.T. department. It wasn't too bad. I wanted something easy and to just do stuff using Office or something, but dad made a mistake and put me in the actual I.T. department! I got to learn about making websites properly like through using PHP and SQL and I also learnt a little bit of Java. After learning about how to do those things, the A-Level didn't seem too bad. It's really logical*.'
>
> Interview Extract 7: Business Communication Systems course female participant

This was consistent with the studies conducted by Teague, and Sharp and Ward, who found that female students felt anxious about asking for help (Teague 1998; Sharp, Ward and Hankin 2006). The participants in this study said that they often spent lessons not achieving anything before plucking up the courage to ask a male student or the teacher in their class for help.

Lack of confidence is well documented to be a reason why female students are dissuaded from IT courses. Beyer, Rynes, Perrault, Haller and Hay. (2003), found that female students on computer science courses in America felt they had lower confidence levels than that of their male peers. The findings in this thesis reinforce this and found that programming was a reason for decreasing confidence levels of A-level female computing participants (see interview extract 9).

ALevelComputingF4: '*It's difficult because I don't understand what the teacher is on about. The module on networking is difficult and the business module is something that I find difficult. I am also not good at exams*.'

Interview Extract 8 GCSE ICT Full course female participant

A-level computing participants felt that they were not competent with the 'coding' aspect of the course. This was also evident in the questionnaire results, as shown in section 7.3.15. It was not surprising that, out of all the A-level computing modules participants had been taught, it was the coding modules and programming assignments which had caused participants the most grief (see interview extract 10), which is from a student not used in the case studies.

Researcher: '*So how did you decide not to take computing at degree level?*'
ALevelF5: '*Well 'cos, I dunno, I didn't really know much about what was in the in the computing prospectuses from the universities. So I asked the teacher for a meeting to see if I could discuss some of the prospectuses*.'
Researcher: '*That's a really good idea*.'
ALevelF5: '*That's what I thought! But I went to see her and she didn't really know much. She just said: 'oh my god, it just looks so difficult'*.'
Researcher: '*Couldn't you ask anyone else?*'
ALevelF5: '*I don't really know anyone else to ask. My teacher is the only person I know and I am too embarrassed to ask anyone else*.'
Researcher: '*Why are you embarrassed?*'
ALevelF5: '*Because when I went to see my teacher to make an appointment, a guy in my class was there he started laughing*.'

Interview Extract 9 GCSE ICT Full course female participant

Female A-level computing participants said that they did not feel the course was 'too bad' until they started the coding element of the course. They felt that this had diminished their confidence because of the lack of support they felt they received.

Interestingly female participants taking the degree course in computing were well aware that it would get difficult for them. Female participants in the first year felt down about their coursework but commented they knew where to get support should they need it.

However, by the second and third year, participants had accepted that it was part of the process and thrived on the challenge and the satisfaction of completing the work. To illustrate this point, case study extracts will be used from *Sheila Webber.*

Sheila Webber, Computer Science at the University of Southampton, Age 20

She said she was a bit daunted as she was the only girl in her group, until she was shown round the computer labs and realised that there were hardly any girls in the lab. This worried her. She spoke to her parents about this (her mum had come round to the idea of computing by then) and her dad said that there were girls in the lab, and there will be girls on the course. Her mum emphasised that if this is what she wanted to do then she will have to 'suck it up and deal with it' and make the most of it, i.e. join clubs and societies and other activities. She then decided to go for computer science. She does find the course difficult and has wanted to give up many times but she knows that her friends on the course feel the same way and they help each other. Her main set of friends on her course are a mixture of male and female students. She said that in her first year, she found it very difficult being in the minority but now she doesn't notice too much. She does think it can be an advantage because it means that all the lecturers know her name, but this can also be a disadvantage because they know when she's not in class! She said that social networks have been helpful because of status updates. You can see on Facebook that your friends (regardless of gender) are also struggling on the same piece of coursework as you. She said that if it wasn't for that, she would have found it hard to approach people for help. She also thought it was surprising that a majority of her cohort didn't come in with a programming qualification.

This was similar to the findings by Margolis and Fisher (2002), who found that the female students interviewed felt that their course was difficult but became manageable after a year. It was clear in this thesis, that the distinction between females studying for the A-level and the degree course was that the degree level students knew where to get support if they needed it. Even though the number of females on the degree courses was small, they had formed their own support network where they were able to call each other for help if needed (see interview extract 11), which is a student not within the case studies used.

Researcher: '*So when did you feel part of your course, like when did you think – yes, this is great I really like it*.'

DegreeComputingSolentF17: '*Honestly?*'

Researcher: '*Yep!*'

DegreeComputingSolentF17: '*After about a year and a half. I always felt that I shouldn't have been here ... that everyone knows a lot more than me. But they don't, everyone else is just too scared to show they are struggling as well. But I think it took me a while but now I am going for it!*'

Interview Extract 10 GCSE ICT Full course female participant

c. Learning about the 'new' aspects of computers

Participants on the GCSE Business Communication Systems course said that the modules they enjoyed were website design and computer maintenance. To illustrate this point, case study extracts will be used from *Marie Williams.*

Marie Williams, Business Communications Systems, Age 15

Marie Williams is 15 years old and is on the Business Communications Systems course. She enjoys learning about the practical side of computers and particularly enjoyed the computer maintenance module. She thought it was something that was different to what she had done before and learnt a lot from it. However, she would have preferred more lessons on it and she said she would love to actually make her own computer and felt that the course would help her do that.

These modules were popular because participants had not done them before. The element of 'newness' had the wow factor, as this was an expectation they had of the course before they took it and seemed to be important for all the participants (see interview extract 8).

GCSEF7: '*I thought we would learn new things*.'

Researcher: '*Like what?*'

GCSEF7: '*New things that aren't related to [Microsoft] Office! I use Office all the time at home, I know what to do what I want, if there's something I don't know I can Google it or look it up, I don't need to do a course that makes me do a course on every function of MS Word. What we spent a whole term doing, could have been done in four weeks*.'

Interview Extract 11 GCSE ICT Full course female participant

This is also reflected in a study by Lang, Fisher and Craig, where a Computer Club for Girls group was trialled in Australia and girls responded well to the new material they were able to study (Lang 2003).

d. Parents/Guardians provided a high level of influence on female participant's views to continue or not continue to study A-level and degree level computing

Parents/guardians were influencing factors as to whether participants decided to take computing or IT courses. They also helped fuel perceptions. Specifically, females mentioned that fathers gave advice about subject choices and career options. Participants talked about their fathers being an ongoing influence to them to take computing. To illustrate this point, case study extracts will be used from *Sheila Webber.*

Sheila Webber, Computer Science at the University of Southampton. Age 20

Sheila Webber is 20 years old and is currently studying computer science at the University of Southampton. Sheila decided to study computer science due to the positive encouragement of her father. She did A-level maths, German, physics and economics and was confused with what to do at university. Sheila's dad suggested computing because he had read that maths and computing are linked. Sheila and her dad both looked at the different courses and prospectuses for computer science. As neither had a background in computing, they found the prospectuses difficult to understand so they asked a friend to help them 'translate' the jargon. Sheila said she felt very daunted by the prospect of programming. Her dad told her not to worry and they will go to some open days to see what the prerequisites are. Whilst at an open day they learnt that programming was not a pre-requisite and emphasise that computing was about people as well as computers. They were able to speak to other students and learn more about the degree. During this decision making process, Sheila said her mother was horrified that she was considering computing. She wanted her to do psychology, which had more career options. But Sheila said she wasn't interested in psychology.

This is consistent with the findings of Adya and Kaiser, who conducted a literature review on career decisions in IT and found that fathers acted as early influencers with regard to girls for careers in IT (Adya and Kaiser 2005). The findings of this thesis have shown that

fathers have done this through playing computer games, introducing his daughter to new things on the computer, getting his daughter to help set up a computer and encouraging his daughter to think about computer careers. In some cases, it was fathers who had a computing/technical job who influenced his daughter to take degree level computing, as they often bought their work home (see interview extract 12).

> Researcher: '*So you mentioned your parents ... how did they influence your decision to study computing?*'
>
> DegreeComputingECSF19: '*I was going to choose maths but I had a discussion with my dad when we were out buying my prom dress (laughs) and he said he heard that computers have something to do with maths and it might be better with career prospects*.'
>
> Researcher: '*Wow... proms dress shopping! So what happened after he said that?*'
>
> DegreeComputingECSF19: '*Well we sat down at the computer and looked online to get a better understanding of what computing involves. But none of us understood what any of it was!*'
>
> Researcher: '*Oh so what happened?*'
>
> DegreeComputingECS19: '*Well dad did a bit more research and found Southampton University did a computing course 'cos it was in the league tables and it was pretty high. We found that the only entry requirements was maths so we kind of figured that if it's only maths then not many people would understand what computing was anyway. So we came to an open day and I talked to Eric about my concerns and he said not to worry ... obviously he was a bit more convincing! And I realised that it was ok and it didn't matter*.'
>
> Researcher: '*Awesome!! And here you are?*'
>
> DegreeComputingECSF19: '*Yep!*'
>
> Researcher: '*So if your dad hadn't helped you to research the course would you be here today?*'
>
> DegreeComputerECSFF19: '*No... Well I probably would have been here doing maths but definitely not computing.*'

Interview Extract 12 GCSE ICT Full course female participant

- Parents provided valuable support for participants studying computing at A-level and degree level, which is also evident in the literature. Tillberg and Cahoon found that,

within their focus groups, a majority of female participants cited their parents as influencing factors and vital for support (Tillberg and Cohoon 2005). The findings in this thesis specifically demonstrate that in particular, support is vital during A-level computing for female students because of their feelings of isolation.

- It was clear from the results of this study that, without the support of external influencers such as parents, participants were likely to give up their computing A-level course. In an article where recommendations are given to help increase the numbers of computing undergraduates, it is stated that parents '*seldom encourage*' their daughters to continue with computing (Cohoon 2002). He indicated that parents often felt sorry for their daughters coding late into the night or getting frustrated with their coursework. In other words, it could be assumed from the results of this study that parents had advised their daughter not to continue with computing because of the anguish it had caused her. (see interview extract 13).

Researcher: '*Wow, you really sound like although you find your course challenging, it seems like you are enjoying it! Are you going to carry it on at university?*'
ALevelComputingF12: '*No ... I am doing graphics instead.*'
Researcher: '*But why?*'
ALevelComputingF12: '*Because I find the A-Level so hard ... I don't think I want to take something that's going to make my life a misery for three years!*'
Researcher: '*But it might be easier as you'll get to grips with it?*'
ALevelComputingF12: '*I talked to my Mum about it and she said she hated me feeling so depressed and working till all hours to understand how to do things on the computing course. And that doing a degree will be like that. She's been to university so she knows how difficult it can be.*'

Interview Extract 13 GCSE ICT Full course female participant

It is difficult to state why there is a difference in parental support for A-level and Degree level female participants. In the first instance, it is because there are more men than women in computing and technology jobs, so there are more fathers than mothers to influence their daughters. It could also be that men are more interested in technology. It is difficult to say if the mothers are subconsciously reinforcing the gender gap during A-level which could again be based upon the prior perceptions and the prior experiences of both mothers and fathers.

9.2.2 How does the IT experience out of a formal education setting shape the way in which female students at different educational stages view the IT industry?

This thesis has identified various factors out of a formal educational setting, which have been shown to influence and dissuade female participants from studying computing and IT at A-level and degree level. It also identifies how experience out of a formal setting at different educational stages influences the way in which female students view the IT industry.

It has been demonstrated by Colley (2003), that there is a stark difference between boys' and girls' attitudes to computers and computer usage at home. However ,the study does not provide an indication as to whether computer use at home has an influence on career decisions and perceptions of the IT industry. The results of this study indicate that this is the case and more work needs to be done in this area to get a deeper understanding. Parental influence in an informal setting will be discussed. Both male and female participants use the computer at home in different and creative ways. However, they did not relate these to technological careers. This is reinforced by Sutherland, et al., who found that this was due to the gap between home and school computer use (Sutherland, Facer, Furlong and Furlong 2000).

e. Computing degree level female participants were more likely to study maths, rather than computing at A-level and it was parents/guardians who influenced them to study computing at university

Female participants studying degree level computing who had not done it as an A-level indicated that their parents/guardians had influenced their decision to do so. In the case study presented above, Sheila Webber did not study computing at sixth form. In both the interviews and questionnaires, it was found that parents had reassured them that their computing experience would not affect them at degree level and explained the link between mathematics and computing. However, this was only because parents had researched the course or had prior knowledge about computing, which is what convinced female participants that it may be worth pursuing. This is seen in section 8.2.5, which also demonstrates the influence of parents. These participants were interesting, as they had no prior programming experience to influence them either way.

f. There is a distinct difference between the ways in which male and female participants used the computer at home and this influenced attitudes on IT and computing courses

The way in which male and female participants used the computer at home had an influence on the attitudes of continuing with IT and computing courses. The findings in this thesis show this in the following ways.

- GCSE level female participants who used the computer at home, alone in an isolated way, tended to perceive the IT industry in a similar way, unless they were told the opposite by a parent or guardian. Although this study found there was not a clear quantitative indication of this, it was clear in the qualitative interviews. To illustrate this point, case study extracts will be used from *Charlie Andover.*

Charlie Andover, Business Communication Systems, Age 16

Charlie lives with her two older brothers and her dad. She says it's difficult to avoid gadgets and computer games in an all male house. She does enjoy playing computer games with her siblings and dad. However, she also values spending time on her own on her laptop. She has had her own laptop since she was 13 and has recently got an IPhone. She says that she loves using the computer to communicate with her friends and update her MySpace page. She said that her friends often come to her with computer problems because she seems to know all the answers! Charlie recently received a Mac for her birthday and loves using it for everything but especially graphic design. She said at A-levels, she would like to study maths, biology, art, sociology and physics. She said she would either like to study web technology or medical engineering or computing at university. She does state that her technology background has made her somewhat fearless of technology.

Levine and Donista-Schmidt found that positive computer use at home increases confidence (Levine and Donitsa-Schmidt 1998); 'positive use' refers to active engagement, rather than passive communication-based usage. Females tend to use computers passively, so are less likely to benefit from this effect (see interview extract 14), which was from a case study participant, Anna Smith.

Researcher: '*So where do you prefer using the computer?*'

GCSEF10: '*At home, in my room*.'

Researcher: '*Why is that?*'

GCSEF10: '*'Cos, then I can talk to my friends properly and I can update my Myspace page in peace!*'

Researcher: '*Why can you not do that at the after school computer club?*'

GCSEF10: '*Because I like to fiddle with colours and try new things out, I don't want people watching me while I do that*.'

Researcher: '*Why not?*'

GCSEF10: '*In case I make a mistake (pauses) I don't want people to think I am stupid*.'

Interview Extract 14 GCSE full course female participant

9.3 Perceptions

9.3.1 How do female students at different educational stages perceive the IT industry?

The ways in which the IT industry could be perceived at different educational stages have been identified: GCSE level, A-level and degree level and how this can influence career decision making. Thomas and Allen state that perceptions of IT careers do impact on whether young people decide to work in the IT industry (Thomas and Allen 2006). This thesis reinforces this, but also expands on this as findings indicate that views and attitudes to the IT industry changed as they gained more and more formal experience of computers.

g. Views and perceptions of the IT industry changed as female participants became older because they became more realistic and more positive than those who were younger

Views and perceptions of the IT industry changed and developed as female participants became older, and they became more realistic. The older participants had a broader experience of computers at school, whereas younger participants had to rely on skills-based experience from school. The findings in this thesis demonstrate these changes through the three different age groups.

- **GCSE level:** Female participants at GCSE levels did not believe they wanted to work in the IT industry because of their experiences and felt that it would be something that would bore them. This is in Tables 6-14 which show the numbers of participants who

could see themselves working in the IT industry in the future and is also demonstrated in a qualitative way (see interview extract 15), which is from Anna Smith.

GCSEICTF10: '*I don't want to sit in front of the computer all day. That's why I don't want to work with computers later on*.'
Researcher: '*Why do you think that?*'
GCSEICTF10: '*Because that's what we do at school*.'

Interview Extract 15 GCSE Full course female participant

However a higher number female participants studying the Business Communication Systems course felt that they could perceive themselves working in the IT industry but did not want to enter it because they felt that it did not suit their personality (see interview extract 16).

BCSICTF2: '*I think it's cool and it would be cool to work in it… but I don't think it's for me*.'

Interview Extract 16 GCSE Full course female participant

- **A-Level:** Female participants at A-level who studied computing and felt they didn't enjoy the course because they were lonely; felt that the IT industry was not for them because they perceived it to be a lonely and unsupportive place (see interview extract 17).

Researcher: '*So would you like to have a job in the IT industry?*'
ALevelComputingF10: '*No*.'
Researcher: '*Why?'*
ALevelComputingF12: '*The course is difficult, boring and I don't have many friends*.'
Researcher: '*Oh ok … so what do you think it would be like working in the IT industry?*'
ALevelComputingF12: '*I just think it would be the same, I wouldn't know what I was doing and I would just end up being the lonely dumb one sitting in the corner*.'

Interview Extract 17 A-level Computing Full course female participant

As participants gained more formal learning experience on the computer, they perceived the IT industry in a more favourable way. This is an important factor as it suggests

that with more experience and knowledge, we can change the way in which young people perceive the IT industry and more importantly the way that they perceive themselves in the IT industry.

> ALevelITF10: '*I reckon working in the IT industry won't be too bad. It seems OK. I like the course so I guess it's just like that really. Dunno*.'

As experience and knowledge increases, so does their aspiration to work in the IT industry. As participants became older, their experiences differed and their perceptions also changed.

- **Degree level:** Female participants studying degree level computing, who found their course satisfying, felt that they would like to work in the IT industry and were able to name organisations and possible job positions they would like to do but also understand the possible factors involved in certain areas of computing (see interview extract 19).

> Researcher: '*So what about after ECS ... What happens next?*'
> DegreeComputingECSF4: '*I think I want a job! I was thinking of doing a master's but I think a job would be better for me. I was going to apply for IBM but I don't know if I want to ... it's just that I'd be applying for a coding position, which I hope I have the ability to get because that is what I love. But I know that in a couple years time, I'll be pushed to one side to be a project manager or something like that. I don't enjoy that stuff ... I love coding ... I am a coding monkey!*'

Interview Extract 18 Degree level computing female participant

- Female participants taking degree level computing or IT perceived themselves to be well suited to different aspects of the IT industry, such as project management or analysts.

9.3.2 How do female students at different education stages perceive themselves in the IT industry?

This study has shown that the way in which young people perceive the IT industry is dependent upon their experiences and how they are influenced, e.g. by parents and teachers.

It is clear that the participants who perceived the IT industry to be a positive place, were more likely to consider choosing courses in computing or IT. The findings in this study reinforce this in the following ways.

Decision Making Stages

This study reinforces the views of Krumboltz and Mitchell, who state that young people first perceive the career before deciding to continue with courses. When young people make career decisions, there are various factors involved in these choices (Krumboltz 1979; Mitchell; and Krumboltz; 1996). Career theorist, Krumboltz states that:

'*Career decisions are the product of unaccountable learning experiences*.'

This thesis found that for female participants in particular to consider taking courses in computing or IT at degree level, it was important they had a positive experience of computers as well as a positive perception of the IT industry. It was after this stage that they considered taking a further course in IT or computing. Figure 9-2 shows the stages in diagrammatic form. The following sections in this chapter describe the factors that can reinforce the positive experiences and perceptions and those which do not.

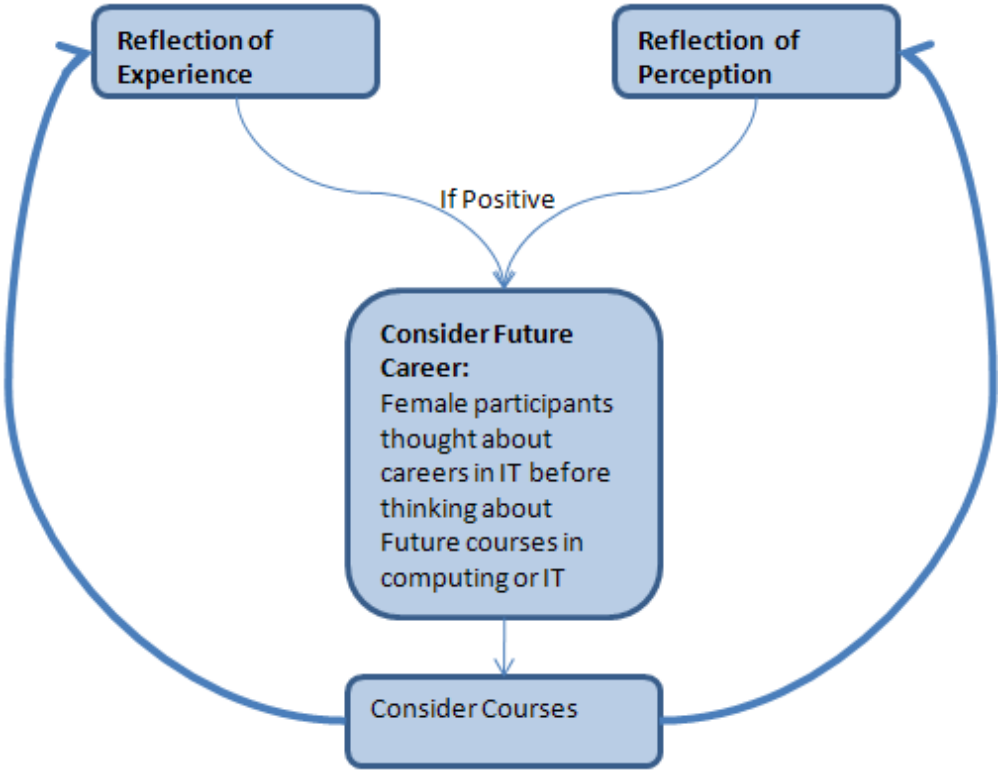


Figure 9-1 Career decision-making stages for female participants considering IT or Computing careers

- Within the literature it is clear that the perception of computing and IT careers are to do with the stereotype of the person who works in the IT industry. This is commonly

known as the ‘Geek’. The term ‘Geek Mythology’ comes from the book by Margolis & Fishers ‘Unlocking the Club House’. It describes computer science students (and those who work in the IT industry) who are obsessed with computers and spend all their time working with them and living up to the geek stereotype and the computer science culture. The GCSE participants mentioned characteristics from Margolis and Fishers ‘Geek Mythology.’ For example, they didn’t want to spend all day in front of a computer, but within the interviews they didn’t use the word *geek*. However, within the questionnaires it was clear that GCSE level participants were aware of the geek stereotype and felt that if they worked in the IT industry, then they would have to adhere to them. This resonated far more with the female participants who said that they felt they would be unfashionable or unhappy if they were in the IT industry.

- In comparison, A-level participants studying computing described the geek stereotype and mentioned the word *geek* in the majority of their interviews. The questionnaire results show that they believed that they would be unhappy, feel uncomfortable and unattractive if they were to work in the IT industry or study IT/Computing at university (see interview extract 19).

Researcher: ‘*Wow that’s great, so what type of university are you looking for?*’
ALevelComputingF1: ‘*Well somewhere away from home (!), but also somewhere that is friendly and not too intimidating. I also want an internship, so for something like a sandwich course or something. I don’t want to be in a department full of geeks with no lives. I haven’t got anything against them but I am assuming I am at some point going to have to work in groups with these people and I’d hate being stuck with someone who is obsessed with making something a nanosecond faster*.’

Interview Extract 19 GCSE Full course female participant

This corresponded with the questionnaire results, which mentioned that female participants had less positive perceptions of the IT industry than the GCSE participants. However, both male participants and female participants studying A-level IT were realistic about the IT industry. They commented that some aspects maybe challenging and involve a lot of work but they felt that was ‘the nature of the job.’ The questionnaire results reflected this with participants being far more positive, and a higher number of participants stating they would be happy, and a much higher number saying that they believed they would be able to have a family and have a lot of friends if they worked in the IT industry.

- Degree level computing female participants said that they were either ‘geeks and proud’ or indicated in interviews using phrases such as ‘I would die if anyone called me a geek.’ Both groups felt that they were using the computer in a ‘geeky’ way; however, they did not feel that it took over their lives.

  Researcher: ‘*So do you consider yourself a geek??*’
  DegreeComputingECSF1: ‘*I would die if anyone called me a geek. I like computers. I am not obsessed with them and I wear Jimmy Choo’s shoes. That does not make me a geek at all*.’

  Interview Extract 20 GCSE Full course female participant

The questionnaire responses found that the degree level female participants felt that the IT industry was a positive place to work. When female participants at degree level were asked about the impact perceptions had upon them, they said that they were very aware of the negative perceptions that society had of the IT industry. However, these participants said that the images did not bother them as they enjoyed their course. They took the course because they knew it was a good career to go into.

9.4 Conclusions and summary

This study has been able to provide an indication of the current factors at significant decision making points (GCSE, A-level and Degree level) which dissuade or encourage female students to pursue a degree in IT or computing. Existing studies in this area primarily focus on a specific age group, such as that by Mitchell (2003), which primarily focused on the GCSE age group, and extensive studies into the degree level group (Carter and Jenkins, 2001). To the researcher’s knowledge, fewer studies in the UK have been focused on A-level students. This study bridges the gap between all three, to understand how each age group experience and perceive the IT industry, and how this contributes to decision-making.

This research found that positive experiences of computers are needed to make girls more enthusiastic about careers in IT and, if girls have these positive experiences, they are more likely to perceive themselves working in the IT Industry. Researchers such as Margolis have shown that the IT industry and computing is perceived by society to be anti-social and blame it for dissuading females to go into IT (Mead and Metraux 1957; Fenkel 1990; Livingstone and Bovill 2000; Helmsley-Brown J and Fosket 2001; Colley and Comber 2003;

Margolis and Fisher 2003; Milner 2004; Mercier, Barron and O'Connor 2006). This study demonstrates that, although the IT industry is portrayed in a negative way to those making career decisions and supporters of decision makers, it is their experience of IT and others' opinions that are vital in assisting decision making. In other words, female participants who have had positive, active, experiences of computing are able to look beyond the computing stereotype; they were more likely to take a step forward to choosing computing as an option if they were supported and were given advice to do so. Every female participant who did computing at A-Level or at degree level mentioned a supportive person in their interview who had helped them decide that computing was right for them. Females taking computing had anxieties about choosing computing in comparison to those choosing IT courses. Figure 9-2 shows a flow chart of the factors that influence both male and female participants to study further courses in computing, regardless of their educational stage.

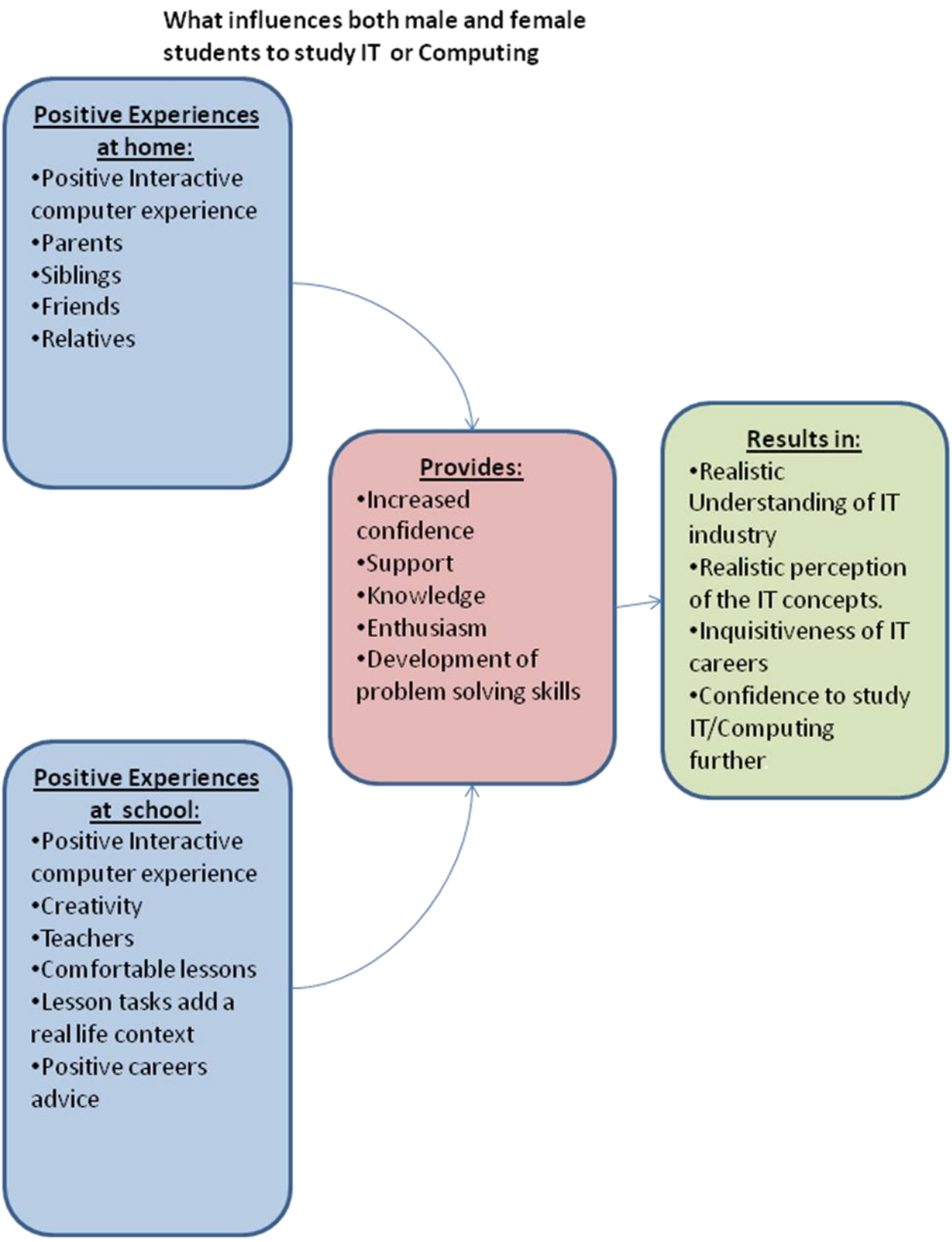


Figure 9-2 what influences male and female students to continue with studying IT or computing courses

The journey female participants take in order to study IT or computing at degree level was found to differ according to the subject they wish to take. Figure 9-3 is a summary of the positive factors that would have to occur for female participants to study specifically computing or IT at degree level. It begins by identifying the influencing factors (both formal and informal learning) at GCSE level and A-level, to eventually making a decision to study IT or computing at degree level.

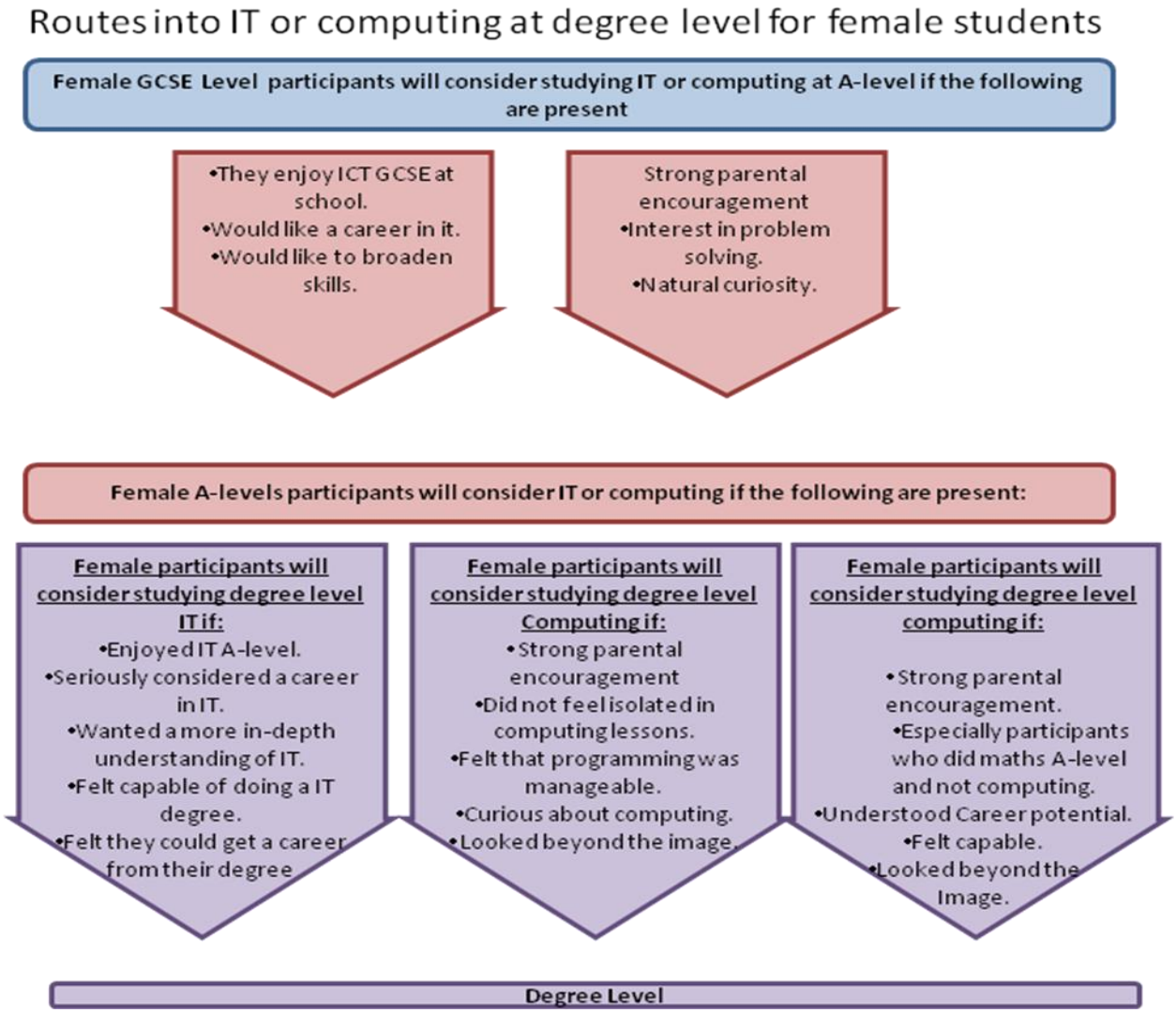


Figure 9-3 Routes into IT or computing at degree level for female students

9.5 Recommendations and future work

This thesis has identified various factors that can encourage or dissuade women at different educational stages to study IT or computing and work in the IT industry.

9.5.1 Recommendations

From the basis of these findings, possible recommendations for schools and universities to encourage women to continue with their IT education are now given.

a. Provide courses that are more relevant to the IT industry and the real world. The IT A-level and Business Communication Systems courses are popular for this reason. By providing a real life context, female students are able to see the relevance of what they are learning and how they can contribute to the IT industry.
b. Provide A-level computing students with more information about the IT industry and demonstrate how programming fits in with what goes on in real IT organisations. Again, this will allow female students to understand the relevance of what they are learning.
c. Provide A-level computing students with more support. This could be in the form of single sex classes, where they are not afraid to ask for help, or internal school women in computing groups.
d. Provide support for first year female undergraduate students who find the course challenging. This could be in the form of summer reading material before they start their degree or summer 'prep' classes.
e. Provide IT and computing teachers with a more in depth understanding of the IT industry and computing concepts.
f. Inform parents/guardians about the nature of IT and computing courses, and how they are relevant to the IT industry.

9.5.2 Future work

The factors that put women off computing and IT degrees have been identified as well as the positive factors that have been proven to encourage women into computing and IT degrees. This research can be taken forward in various ways.

- **Connection between the perceptions of parents/guardians and how they advise their daughters.**

A deeper understanding of how the computer experiences of parents can influence the way in which they advise their daughter on computing and IT degrees. In other words, investigate if there is a correlation between parents' knowledge, experience and perception of computers and how they portray IT and computing degrees.

- **Longitudinal research.**

There is a need for a longitudinal study to understand the issues addressed in this thesis in order to gain a holistic view of the student experience. This thesis has given a snapshot of the way that different age groups use computers, their computer literacy at each stage, and the difference in attitudes of both male and female students. This snapshot, however, does not demonstrate the way that computer literacy evolves over time for different people, how attitudes develop and the processes which inspire some individuals to have an active interest in computing ,whilst others do not feel the same.

A longitudinal out-of-school and in-school comparison would provide a more in-depth study into the specific reasons why and when females decide to opt out of computing. The research undertaken here explored how participants felt at the time they were interviewed, but also asked them to think back to what factors helped them make their decisions. Tracking back poses a danger, however, as participants may not remember accurately or may want to hold back information, as they fear being embarrassed by their previous views and opinions. A longitudinal study would overcome these issues and help identify key points of intervention.

9.6 Conclusions

The researcher began convinced that she 'could change the world' by dramatically increasing the numbers of women in computing. Although this is not the case, this thesis has given an insight into how women of different stages view the IT industry, how they experience computers, and what influences them to consider IT or computing courses.

To investigate these areas, 296 questionnaires were distributed and 230 interviews were conducted with both male and female students at different stages of their education. It was necessary to interview male students in order to understand what influential factors were unique to female students and what influential factors were similar to both genders.

There was a focus upon perceptions and experiences of women at different stages of their education in order to understand the different factors at different ages that could dissuade or encourage women onto IT or computing courses. There was a specific focus on the UK education system and IT and computing courses within it.

This research has demonstrated that male and female students have very different experiences of computing. These inform their perceptions of the IT industry, whilst role models, such as parents, influence career decisions. It was clear that if female students had positive and exploratory experiences with the computer and positive role models, they were more likely to consider computing as a career.

This can help us gain an insight into 'why'; in a society driven by technology, there is still a lack of women entering the IT industry. It is only through understanding the reasons behind why this is the case, that we will be able to increase the numbers of women in computing.

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Appendix 1 Key Skills Learning Objectives

Level	**Learning objectives**
Level 1	• Being able to handle numerical, textual and graphical information to carry out simple tasks. • Being able to use technology safely, taking care over computer equipment and backing-up data. • Sending and receiving email. • Who to speak to if something goes wrong with their computer. (QCA 2004)
Level 2	• Being able to carry out searches and obtain new information. • Present combined information e.g. text with images. • Enter formulas when using a spreadsheet. • Observe confidentiality, copyright laws and be aware of health and safety risks. • Be aware of how to reduce the risks of viruses. (QCA 2004)
Level 3 (typically taken before GCSEs)	• Being able to plan and organise work e.g. through the use of folders and subfolders. • Use different fonts and images. • Be aware of wider implications of using ICT: able to judge what helps to get tasks done faster and more efficiently.(QCA 2004)
Level 4 (typically taken at college)	• Applying ICT skills to academic work over a period of time and reflecting on this using a logbook. (QCA 2004)

Appendix 2 ICT GCSE Course descriptions of male/female breakdown (JCQ 2008)

Name of Course	Number of GCSEs	Description	Assessment[16]	% Male Candidates	% Female Candidates
GCSE ICT *Long Course*	1	The course is based on practical work, problem solving and involves developing 'real-life' ICT systems. Key pieces of evidence from, the following are needed included: word-processing, databases, spreadsheets, desktop publishing,	1. Four coursework projects 2. 2 Exams	55.6% (47567)	44.4% (38038)
GCSE ICT *Short Course*	Half		1.Two coursework projects 2.1 Exam	45.1% (36940)	54.8% (44350)

[16] Assessment is examining board dependent, especially for the GCSE Courses and Applied, where the weighting for coursework and exam is variable. Others are mainly portfolio.

		communications software, modelling/simulations, data logging and computer control[17].			
Applied ICT/ Double ICT	2	Unit 1: ICT tools and applications Unit 2: ICT in organisations Unit 3: ICT and society[18]	Typically Unit two examined. Others are portfolio.	58.1% (9329)	41.9% (6733)

(JCQ 2008)

[17] As outlined in Qualifications Curriculum Association (QCA)

[18] As outlined in Qualifications Curriculum Association (QCA)

Appendix 3 Additional ICT courses on the curriculum (JCQ 2008)

B-Tec IT Practitioners /Diploma Course *Level 1+2*[19]	4	There are 7 units for the Diploma Unit 1: Using ICT to Present Information Unit 2: Introduction to Computer Systems Unit 4: Website Development Unit 6: Networking Essentials Unit 7: Software Design and Development Unit 9: Database Software Unit 10 - Spreadsheet Software.		Assessed through portfolio.	Percentages unpublished
AiDA[20]	1	Award in Digital Applications (Unit 1)	**Units** 1. Using ICT	Assessed through	Percentages unpublished

[19] EDEXCEL and OCR Only

[20] EDEXCEL Only

			(Compulsory) 2. Multimedia 3. Graphics 4. ICT in Enterprise 5. Games Authoring	portfolio.		
CiDA[21]	2	Certificate in Digital Applications (Unit 1+ 1other)		Assessed through portfolio.	Percentages unpublished	
CiDA	3	Extended Certificate in Digital Applications (Unit 1+ 2other)		Assessed through portfolio.	Percentages unpublished	
DiDA[22]	4	Diploma in Digital Applications (Unit 1+ 2other)		Assessed through portfolio.		

[21] EDEXCEL Only

[22] EDEXCEL Only

Appendix 4 Additional ICT courses on the curriculum (JCQ 2008)

Name of Course	Number of A-levels	Description	Assessment[23]	% Male Candidates	% Female Candidates
Computing A/S level	Half	Typical Units in AS Computing:[24] 1. Computer systems, programming and networking concepts. 2. Principles of Hardware, Software and Applications 3. Practical systems development	Three exams.	88.9% (6955)	11.1% (866)
Computing A-level[25]	1	Typical Units in A-level Computing:[26] 4. Processing and programming	Two exams and one	90.5% (4588)	9.5% (480)

[23] Assessment is examining board dependent.

[24] AQA Examining board.

		techniques 5. Advanced system development 6. Practical project.	practical.		
ICT A/S level	Half	Units Unit 1: Information: Nature Role and Context Unit 2: Information: Management and Manipulation Unit 3: Coursework: The use of a generic application software for task solution.	Two exams and one practical.	62.4% (12029)	37.6% (7237)
ICT A-level	1	Unit 4: Information systems within organisations Unit 5: Information: Policy, strategy and systems Unit 6: Coursework: Use of information systems for problem solving.	Two exams and one practical.	61% (7607)	38% (4670)
ICT Applied Single	1	The Applied Course offers a wide range of modules (49). The guided learning hours for the three-unit Advanced Subsidiary GCE (Single Award) are 180. The guided learning hours for the six-unit Advanced Subsidiary GCE (Double Award) are 360. The guided learning hours for the six-unit Advanced GCE (Single Award) are 360. The guided learning hours for	Portfolio	59.3% (2052)	40.7% (5553)
ICT Applied Double	2		Portfolio	78.7% (2052)	21.3% (557)

[25] EDEXCEL doesn't offer this.

[26] AQA Examining board.

		the 12-unit Advanced GCE (Double Award) are 720.			
B-Tec IT Practitioners [27]	Two A-levels or the full award Applied ICT.	The BTEC National Certificate offers flexibility and a choice of emphasis through the specialist units. There is a choice of 52 different courses to take. Often these depends on what the school or college is able to offer but there is the potential to choose engaging courses.	Portfolio	Results not published	
Diploma[28]		• encourage learners to develop a broad understanding and knowledge about the Information Technology sector and to develop skills and attributes related to the sector • encourage learners to develop additional knowledge and skills to complement and broaden their learning about the Information Technology sector	Portfolio	Results not published	

[27] EDEXCEL Only

[28] ORC only

Appendix 5 Amendments made to questionnaire at pilot stage

Key Stage Three Questionnaire

Question Number	**Issue with question**	**How it was changed**	**What Questionnaire?**
Blurb on first page	The teacher said that she had to help a lot of students with the instructions.	This was made simpler and easier to understand. An example of how to fill out the questionnaire is also given on this page.	All Questionnaires
Question 3: 'Type of school: *Grammar School Community School Faith School Specialist School Academy City Technology College Independent.*'	Pupils didn't understand the answers of this question.	This question has been taken out as this information can be obtained from the school website.	All Questionnaires

Question 4: 'Does your school have specialist school status? *Arts college, Business and enterprise college, Engineering college, Humanities college, languages college, maths& computing college, music college, science college, sports college and technology college.*	Pupils did not know the answer to this question and teachers reported back saying that they had to give pupils the answers to this question.	This question has been taken out as this information can be obtained from the school website.	All Questionnaires
Question 5: 'What GCSE Options do you plan to take?	This question wasn't clearly laid out, for pupils to understand it. Pupils re-wrote mathematics, English and science even thought it was already written for them.	This question will be clearer. Making it obvious that only options are required.	Key stage 3 questionnaire.
Question 7: Where do you have access to a computer out of school with internet access?	Not clearly written. The teacher said that pupils had to re-read this question.	'Where do you have access to the internet out of school?'	All Questionnaires
Question 10 and 11: What activities do you do on the computer on a week day at home (Q10) weekend (Q11)?	Although pupils did answer this question, it was pointed out that the question needed to be more specific.	The questions changed to: 'During the weekend / typical day what activities do you do on the computer on a typical day'	All Questionnaires

Question 10 and 11	The teachers said that there was confusion of how to answer some of the questions	There will be an example of how to answer these types of questions that involve Likert scales.	All Questionnaires
Question 13: 'What is your favourite subject at school? ' Scale: '1- I really hate this subject 2 – I really don't like this subject 3 – Its ok 4 – I like this subject 5 – I think that this subject is excellent' Pupils are given a choice of subjects.	This question asked pupils to name their favourite subject, but yet they were given a scale.	'How do you feel about the following subjects at school'	All Questionnaires
Question 13	The scale that the respondents were given meant that the answers averaged 3!	In the next one, pupils will not be given the opportunity to write choose the 'its ok' and will be forced to select either a negative or positive answer.	All Questionnaires
Question 16 and 17: 'List up to three ways you enjoy (Q16) /don't enjoy (Q17) your ICT lessons'	Pupils didn't have enough space to write down their answers. So their answers were shortened, which meant the quality of their answers was compromised.	The space given to answer these questions was increased, in order to allow respondents to write what they really feel.	All Questionnaires

Question 20: ‘I would like a job doing: _____’	This has to be reworded as most of the responses said: ‘nothing’ or ‘something I enjoy’ or ‘dog training’	‘I would like a career in’	All Questionnaires
Question 24: ‘Define what you think ICT is?’	Pupils answered ‘Information communication technology ‘. The aim of this question was to get an understanding of what ICT meant to them.	‘What does information communication technology mean?	All Questionnaires
Question 28: If I was working with computers I would:’	This question asks the wrong question, it asks about working with computers.	‘If I was working in the Computing Industry I would’	All Questionnaires

GCSE Level Questionnaire

Question Number	**Issue with question**	**How it was changed**	**What Questionnaire?**
Question 5: ‘What GCSEs do you plan to take?’	Participants at this stage would have already made their GCSE stages	Taken out	GCSE Questionnaire
Question 12 and 41: ‘Who do you go to for advice?’	This question repeats.	Taken out repeating questions	GCSE Questionnaire

Question 17: 'Name 6 types of careers you could have if you worked with computers'	There is not enough space for respondents to answer this question.	Give more space. One line per question.	All Questionnaires
Question 21 and 22: 'What activities do you do on the computer during the weekday (Q21) /Weekend (Q22)?'	Common answer for other was 'blogging'.	'blogging' will be added onto the list of options.	All questionnaires.

A- Level Questionnaire

Question Number	**Issue with question**	**How it was changed**	**What Questionnaire?**
Question 3: 'Type of school? 'College, Sixth form Other'	Confusion in type of school, pupils changed this appropriately.	Options given: School with Sixth-form, Sixth form – college F E College	A-level questionnaire
Question 7: 'What are you doing now' 'Carrying on further study' 'Apprenticeship scheme'	All students ticked 'further study'	This question isn't really needed as the question after it asks what qualifications they are doing. So the question will be taken out.	All Questionnaires
Question 13: 'Who do you go to for advice'	This question repeats	Take out this question.	All Questionnaires

Undergraduate Questionnaire

Question Number	Issue with question	How it was changed	What Questionnaire?
Question 3: Type of high school you went to: *Grammar School Community School Faith School Specialist School Academy City Technology College Independent.*'.	Difficult for students to identify the school they went to.	Change school options.	All Questionnaires
Question 16: 'Did you have access to a computer when you were younger'	This question is too ambiguous, everyone said 'yes'.	Take this question out as questions 16 and 17 cover this.	All Questionnaires
Question 17 and 18	These questions are ambiguous as they need to be more specific and state if they ask and about past or present	How often did you use the computer at home during a working week?	All Questionnaires
Question 19 and 20	This is asking about the present tense	Put in second set of questions that ask about the past.	All Questionnaires

Changes made to pilot questionnaire 2

Question Number	Issue with question	How it was changed	What Questionnaire?
Question: 'How would you feel working with computers'	It doesn't ask what needs to be known.	'How would you feel if you had a career in the computer industry'.	All of them.

Appendix 7 Schools in Pilot Survey

School One	**School Two**[29]
Mixed Comprehensive (11-18 year olds)	Single sex girls school (11-16 [single sex], 16-18 (mixed sex)
Business and Enterprise College	Mathematics and Computing Status
Proportion of students on school meals: Above average	Proportion of students on school meals: High
Excellent ICT Equipment	Parents have expressed concern regarding ICT equipment.
Excellent ICT Teaching	ICT teaching unsatisfactory
Similar attainment for boys and girls.	A-C grades above national average
A-C grades in line with average	

[29] The school emphasised while I was there that provision of ICT teaching has changed since their last OFSTED report.

Appendix 8 Final Questionnaire: GCSE Level

A survey about your feelings on Information Communication Technology

Hiya!

My name is Reena Pau and I am doing some work at the University of Southampton on experiences and feelings about computers.

- The goal of the survey is to get an understanding about your experiences of information communication technology.
- Thank you very much for taking part in this survey. There are no right or wrong answers.

All responses will be confidential so please be as honest as you can.

Many thanks

Reena

1. **General Information About You**

   a. **How old are you? _____** years old

   b. **Gender**: Male [ ] or Female [ ]

   c. **What type of Information Communication Technology course are you taking: _____**

2. **Your experiences of ICT at school**

   a. Please tick one box for each of the subjects you do at school to show what you think of them

	1 – I really hate it	2 – I don't like it	3 – It's OK	4 – I like it	5 – I love it
Mathematics					
English					
Science					
Modern Languages					
ICT					
P.E					
Art					
History					
Geography					
Music					
Drama					
Other _____					
Other _____					

b. How do you find ICT at school? (*Tick the box that applies to you)*

Really Easy	Easy	OK	Quite Hard	Really Difficult
[ ]	[ ]	[ ]	[ ]	[ ]

c. Why did you find ICT this way?

d. List up to three activities that you enjoy in your ICT lesson:

1.
2.
3.

e. List up to three activities that you don't enjoy in your ICT lesson:

1.
2.
3.

f. Why did you choose ICT?

3. **<u>Your Experiences of Computers out of School</u>**

a. Where do you prefer to use the computer out of school hours ?(*Tick the box that applies to you)*

Home	
Library	
After School/Breakfast School Club	
Friend or Family member's house	
School computer club	

b. Who do you prefer to use the computer with out of school hours? (*Tick the box that applies to you)*

On your own	
With a parent	
With a brother/sister	
Other family member	
With a friend	
Other	

c. What activities do you enjoy doing on the computer? (*Tick the box that applies to you).*

	1: My Best Activity	2: I like this activity	3: Its ok	4: I don't really like it	5: I hate it	6: I've never done this
Play Computer Games						
Social Networking						
Email						
Graphic Design						
Blogging						
Stories						
Website						
Homework						
Programming						
Internet						
Fixing Computers						

4. **Plans for the future**

a. Who or what do you go to for careers advice? *(Please tick what applies to you)*

	Use	Never use
Parents		
Brother/Sister		
Other family		
Friends		
Career guides		
Career Advisors		
Prospectuses		
Teachers		
TV Programmes		
Magazines		
Other		

b. Do you plan to take IT or Computing at A-level?

If yes why:

If no why:

c. How would you feel if you were working with computers:

d. Be Happy	Yes [ ] No [ ]
e. Be Rich	Yes [ ] No [ ]
f. Have lots of friends	Yes [ ] No [ ]
g. Be fashionable	Yes [ ] No [ ]
h. Be Clever	Yes [ ] No [ ]
i. Have a family	Yes [ ] No [ ]
j. Be Glamorous	Yes [ ] No [ ]
k. Be creative	Yes [ ] No [ ]
l. Be a geek	Yes [ ] No [ ]

m. Be attractive	Yes [ ] No [ ]
n. Be Smart	Yes [ ] No [ ]

Thank you very much for your help ☺

Appendix 9 Final Questionnaire (A-level)

Hiya!!!

My name is Reena. I am doing some work at Southampton University on school pupils' views and experiences of Information Communication Technology (ICT).

1. Thank you very much for agreeing to fill out this survey.
2. The goal of the survey is to get an understanding about your feelings on Information Communication Technology (ICT).
3. There is no right or wrong answer. If you think you do not know the answer then please tick the 'I don't know box'.

All your answers will be confidential so please be as honest as you can.

Many thanks for your help

General Information about you

1. Age: _____ years old

2. Gender: Male [ ] Female [ ]

3. Are you studying for your:
(Please tick most appropriate box)

A/S Levels	
A-Levels	

4. What qualifications are you doing? (please be specific with regards to subject and qualification).

Your experiences at High School

5. Please tick one box for each of the subjects you do at school to show what you **thought** of each subject.

	1 I really hate it	**2 I really don't like it**	**3 Its OK**	**4 I like it**	**5 I think its excellent**
Mathematics					
English					
Science					
Modern Languages					
ICT					
P.E.					
Art					
History					
Geography					
Music					
Drama					
Other____					

1. How did you find ICT at school? (*Tick the box that applies to you)*

Really Easy [ ]	Easy [ ]	OK [ ]	Quite Hard [ ]	Really Difficult [ ]

2. Why did you find ICT this way?

6. List up to three activities that you enjoyed in your ICT lesson:

1.
2.
3.

7. List up to three activities you did <u>not</u> enjoy in your ICT/Computing lessons

1.
2.
3.

<u>Please answer these questions for the current IT or Computing course you are studying.</u>

3. How did you find ICT at school? (*Tick the box that applies to you)*

Really Easy	Easy	OK	Quite Hard	Really Difficult
[ ]	[ ]	[ ]	[ ]	[ ]

4. Why do you find your course this way?

8. List up to three activities that you enjoyed in your ICT lesson:

1.
2.
3.

9. List up to three activities you did <u>not</u> enjoy in your ICT/Computing lessons

1.
2.
3.

<u>Your experiences out of School</u>

10. Where do prefer to use the computer out of school hours? (*Tick applicable*)

Home	
Library	
After School / Breakfast School Club	
Friend/Family House	
School Computer Club	

11. Who do you prefer to use the computer with out of school hours? (*Tick applicable)*

On your own	
With a parent	
With a brother/sister	
Other family member	
With a friend	
Other	

12. What activities do you prefer to do on the computer out of school hours?

1 → This is my best activity

2 → I like this activity

3 → I think this is ok

4 → I don't really like doing this

5 → I never do this

	1	**2**	**3**	**4**	**5**
Play Computer Games					
Social Networking (e.g. MSN, Chat etc)					
E-Mail					
Graphic Design					
Blogging					
Writing Stories					
Creative Design					
Website Design					
Homework					
Programming					
Surfing the Internet					
Fixing computers					

Plans for the future

13. Who/What do you prefer to go to for advice about your career?

	Please tick one box
Parents	
Brother or Sister	
Other family members	
Friends	
Career Guides	
Career Advisors	
Prospectuses	
Teachers	
TV Programs	
Magazines	
Other (Please State)	

A/S Level participants only

14. Do you plan to continue with A-Level IT or Computing?

Yes	No	I don't know
[ ]	[ ]	[ ]

15. Please explain your answer

A- Level participants only

16. Do you plan to continue with IT or Computing at university?

Yes	No	I don't know
[ ]	[ ]	[ ]

17. Please explain your answer

Perceptions

18. I could imagine myself working with computers when I am older:

Yes	No	I don't know
[ ]	[ ]	[ ]

19. Please explain why:

How would you feel if you were working in the IT industry?

23.	If I was working in the IT industry I would:	
23 (a)	Be happy	Yes [ ] No [ ]
(b)	Be rich	Yes [ ] No [ ]
(c)	Have a lot of friends	Yes [ ] No [ ]
(d)	Be fashionable	Yes [ ] No [ ]
(e)	Be clever	Yes [ ] No [ ]
(f)	Have a family (get married and have children)	Yes [ ] No [ ]
(g)	Be glamorous	Yes [ ] No [ ]
(h)	Be creative	Yes [ ] No [ ]
(i)	Do problem solving Tasks	Yes [ ] No [ ]
(j)	Do programming Tasks	Yes [ ] No [ ]
(k)	Be boring	Yes [ ] No [ ]
(l)	Be a geek	Yes [ ] No [ ]
(m)	Be attractive	Yes [ ] No [ ]
(n)	Be smart	Yes [ ] No [ ]

Thank You Very Much

Appendix 10 Final Questionnaire (Degree level)

Hiya!!!

My name is Reena. I am doing some work at Southampton University on school pupils' views and experiences of Information Communication Technology (ICT).

1. Thank you very much for agreeing to fill out this survey.
2. The goal of the survey is to get an understanding about your feelings on Information Communication Technology (ICT).
3. There is no right or wrong answer. If you think you do not know the answer then please tick the 'I don't know box'.

All your answers will be confidential so please be as honest as you can.

Many thanks for your help

General Information about you

1. Age: _____ years old

2. Gender: Male [ ] Female [ ]

3. What Degree are you doing?

4. What Qualifications did you take at before university?

5. Did you take GCSE ICT?
   Yes [ ]
   No [ ]
   I don't remember [ ]

Your experiences at high School

6. Please tick one box for each of the subjects you do at school to show what you **thought** of each subject.

	1 I really hate it	2 I really don't like it	3 Its OK	4 I like it	5 I think it's excellent
Mathematics					
English					
Science					
Modern Languages					
ICT					
P.E.					
Art					
History					
Geography					
Music					
Drama					
Other____					

a. How did you find ICT at school? (*Tick the box that applies to you)*

Really Easy	Easy	OK	Quite Hard	Really Difficult
[ ]	[ ]	[ ]	[ ]	[ ]

7. Why did you find ICT this way?

Your college/sixth form experience

Please answer these questions for the IT or Computing course you are studied at sixth form.

5. How did you find ICT at school? (*Tick the box that applies to you)*

Really Easy	Easy	OK	Quite Hard	Really Difficult
[ ]	[ ]	[ ]	[ ]	[ ]

6. Why did you find your course this way?

8. List up to three activities that you enjoyed in your ICT lesson:

1.
2.
3.

9. List up to three activities you did not enjoy in your ICT/Computing lessons

1.
2.
3.

10. Why did you choose to study this course?

Please answer these questions for the current IT or Computing course you are studying.

1. How do you find your current degree course? (*Tick the box that applies to you)*

Really Easy	Easy	OK	Quite Hard	Really Difficult
[ ]	[ ]	[ ]	[ ]	[ ]

2. Why do you find your course this way?

11. List up to three activities that you enjoy on your course:

1.
2.
3.

12. List up to three activities you do not enjoy on your course

1.
2.
3.

Why did you choose this course?

Your experiences out of University

13. Where do prefer to use the computer out of school hours? (*Tick applicable*)

Home	
Library	
Friend/Family House	
Lab	

14. Who do you prefer to use the computer with out of school hours? (*Tick applicable)*

On your own	
With a parent	
With a brother/sister	
Other family member	
With a friend	
Other	

15. What activities do you prefer to do on the computer out of school hours?

1 → This is my best activity

2 → I like this activity

3 → I think this is ok

4 → I don't really like doing this

5 → I never do this

	1	**2**	**3**	**4**	**5**
Play Computer Games					
Social Networking (e.g. MSN, Chat etc)					
E-Mail					
Graphic Design					
Blogging					
Writing Stories					
Creative Design					
Website Design					
Homework					
Programming					
Surfing the Internet					
Fixing computers					

Plans for the future

16. Who/What do you prefer to go to for advice about your career?

	Please tick one box
Parents	
Brother or Sister	
Other family members	
Friends	
Career Guides	
Career Advisors	
Prospectuses	
Teachers	
TV Programs	
Magazines	
Other (Please State)	

Perceptions

17. I could imagine myself working with computers when I am older:

Yes	No	I don't know
[ ]	[ ]	[ ]

18. Please explain why:

How would you feel if you were working in the IT industry

23.	If I was working in the IT industry I would:	
23 (a)	Be happy	Yes [ ] No [ ]
(b)	Be rich	Yes [ ] No [ ]
(c)	Have a lot of friends	Yes [ ] No [ ]
(d)	Be fashionable	Yes [ ] No [ ]
(e)	Be clever	Yes [ ] No [ ]
(f)	Have a family (get married and have children)	Yes [ ] No [ ]
(g)	Be glamorous	Yes [ ] No [ ]
(h)	Be creative	Yes [ ] No [ ]
(i)	Do problem solving Tasks	Yes [ ] No [ ]
(j)	Do programming Tasks	Yes [ ] No [ ]
(k)	Be boring	Yes [ ] No [ ]
(l)	Be a geek	Yes [ ] No [ ]
(m)	Be attractive	Yes [ ] No [ ]
(n)	Be smart	Yes [ ] No [ ]

Thank You Very Much

Appendix 11 Interview Script

Interview Script.

Type of interview: Semi-structured interviews: whereby the researcher has a list of questions of fairly specific topics to be covered, often referred to as an interview guide, but the interviewee has a great deal of leeway of how to reply. Questions may not follow on exactly to schedule but generally all questions will be asked.

----------script----------

Me: 'Hiya, Thank you very much for taking part in this interview. You are interviewee number xxx. Please answer as truthfully as you can, there is no right or wrong answer and all responses will be confidential so answers will not be traced back to you. This interview should last no more than 30minutes. Thanks again.'

General questions

Age:

Gender:

Did you/are you taking ICT GCSE?

What A-levels do you remember taking?

Young people at school (11-14 year olds)

- What do you perceive a career in computing to be like?
    - Why do you think this?

Why this set of questions?

I would like to know if they believe a career in computing is positive or negative and find trends with their answers below, so for example if those that have said that they find computer careers exciting – how does this compare with their out of school activities?

- What activities do you do on the computer out of school?
    - Do you think you are learning from these activities?
    - What do you think you are learning?

Why this set of questions?

The reason for asking this question is to get an understanding of what informal activities are held out of school and whether young people think they are learning anything. Out of school activities are a good indication of what young people enjoy.

- What activities do you do on the computer at school?
    - What do you think you are learning from these activities?
    - Do you do any of these activities at home?

Why this set of questions?

The aim of this question isn't actually know what they are doing at school, its to get an understanding of their perception of the usefulness of these activities and their enjoyment of these activities.

- Do you take part in any computer clubs/groups?
    - What kind of computer clubs?
    - What do you do there?
    - What do you enjoy about them?
    - Do you do any of these activities at home?
- Has this changed your thinking about computers?

Why this set of questions?

An understanding of how they perceive initiatives influence their overall opinion of computers. If they take it then maybe they do enjoy computers in the clubs but no where else?

University Students

- Tell me what made you choose a computer science degree?

Why this set of questions?

I would like to get a general story of their choice.

- How do you remember your ICT lessons?
- Did they inspire you to choose computing?

Why this set of questions?

An understanding of how they felt about ICT lessons at school and how this compares with the other activities they did?

- What activities do you remember doing out of school on the computer?
  - Were you part of any computer club/group?
  - How did this activity motivate you to study computing at university?
- Did these activities inspire you to choose computing?

Why this set of questions?

To get an understanding of how and if they remembered computer clubs to be the motivating factor in them wanting to study computing a lot later on.

- All in all what was it that inspired them to choose computing at university?

Why this set of questions?

Get them to summarise now they've been probed into what they want to do.

Appendix 12 Activities which female participants preferred outside of school

Breakdown of participant figures

	My best activity	**I like this activity**	**It's ok**	**I don't really like it**	**I hate it**	**I've never done this**
Computer games	9	10	5	1	2	0
Social networking	23	3	1	0	0	0
Email	16	8	2	1	0	0
Graphic Design	8	8	5	1	0	5
Blogging	6	8	4	0	0	9
Writing Stories	0	3	7	5	3	9
Website Design	0	3	8	0	0	16
Programming	0	1	2	1	0	23
Surfing the web	21	3	3	0	0	0
Fixing Computers	0	0	1	1	0	25
Homework	0	0	0	16	11	0

Appendix 13 Activities which male participants preferred outside of school

Breakdown of participant figures

	My best activity	I like this activity	It's ok	I don't really like it	I hate it	I've never done this
Computer games	39	8	2	1	0	0
Social networking	32	10	2	6	0	0
Email	35	13	2	0	0	0
Graphic Design	8	16	4	0	0	22
Blogging	0	4	6	10	4	26
Writing Stories	0	0	2	32	12	4
Website Design	0	22	11	6		11
Programming	0	4	6	2	0	38
Surfing the web	39	5	6	0	0	0
Fixing Computers	1	5	17	3	2	22
Homework	0	0	0	25	25	0

Appendix 14 Correspondence with schools, teachers and participants.

Letter to Parents/Carers

Dear Parents/Carers,

My name is Reena Pau and I am a PhD student from the University of Southampton. I am investigating the reasons why young are put off computing and computing careers. I am currently undertaking interviews with young people from the ages of 14-16 years of age with the support of _____ school.

The reason for this letter is to ask your consent for your child to participate in these interviews. I have a full clear criminal record check and have a lot of experience working and interviewing young people.

The interviews will be recorded then transcribed by me, their will be no way of tracing the answers back to the pupils. The recordings will be destroyed once this study has been completed.

Interviews will last no more than 30 minutes and will take place either during PSHE, Lunch hour or their ICT lesson. Your child is able to leave the interview at any time and this will be explained to them at the beginning of the interview.

If you are happy for your child to take part in this study then I would be really grateful if you could sign the consent form below. Please do not hesitate to email me on: rp05r@ecs.soton.ac.uk should you have any queries.

Yours Sincerely
Reena Pau

Name of Child _____
Class _____
Your signature _____

Letter to Teacher

Dear Mr/Mrs/Ms_____

As per our phone conversation on the _____ I am writing to for formal permission to be able to interview some of the pupils in your class. Just to confirm this study has been approved by the ethics committee in the university and I have gone through a full criminal records check.

The interviews will be recorded then transcribed by me, however their will be no way of tracing the answers back to the pupils. The recordings will be destroyed once this study has been completed.

Interviews will last no more than 30 minutes and will take place either during PSHE, Lunch hour or their ICT lesson. Your pupils are able to leave the interview at any time and this will be explained to them at the beginning of the interview.

If you are happy for your school to take part in this study then I would be really grateful if you could sign the consent form below. Please do not hesitate to email me on: rp05r@ecs.soton.ac.uk should you have any queries.

Yours Sincerely
Reena Pau

Your name_____
School _____
Your Signature _____

Participant consent form

Thank you very much for taking part in this interview. Here are a couple points for you to read:

Structure of interview

- First questions will ask you about yourself
- We will then have a discussion about your use of computers

Please be as honest as you can as **interviews will not be traced back to you.** There is no right or wrong answer.

Interviews will last no more than 30 minutes.

You are free to stop the interview and leave at any time.

You will be recorded during the interview and no one will have access to these recordings apart from me.

Many thanks for participating. Do you have any questions?

Please sign and date this line _____

You are participant number_____

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