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The Under-representation of Women in IT: A Participatory Research Approach Assessment of 14-Year Olds' Perceptions of IT/ICT as a School Subject and Possible Future Career.

DPhil Sociology

University of Sussex

September 2014

Declaration page

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree. The source of the evidence presented here is a participatory action research approach which involved 164 teenagers from London Southeast Borough. The study, using age-appropriate activities included a questionnaire, a creativity map exercise (short focus groups) and interviews. The thesis in its entirety is my original work. Where the relevant work of others has been drawn upon within the thesis, this has been accredited to them.

Signature: ………………………….

Elizabeth E. Ibegbulam

Acknowledgements

First and foremost, my gratitude goes to my supervisor, Professor Ruth Woodfield, who has been there for me since 2006 during my days as an MSc student. Working with you over these years has been a privilege, an honour and profound learning experience I will cherish for the rest of my life. Without your support and encouragement, I could not have got this far. I am also indebted to my second supervisor, Dr Susie Scott, for her advice, valuable comments, positive suggestions and support for my thesis.

To my husband: you have been there for me and supported me, encouraged me never to give up my dreams and helped with the children especially with the school runs and numerous extracurricular activities. To my lovely children, Sterling, Samuel, Shirley, Sarah, and Stanley: you are my rock; knowing that you are always there for me, loving me unconditionally gives me great joy and pleasure to be your mother.

To my family and friends, I wish to thank you all for all the ideas, advice, and encouragement and for your role as my sounding board, support with cooking and cleaning and generally looking after my children.

Finally, special thanks go to my research participants, their parents and the teachers who gave their time to my research study; I could not have got this far without your contributions. I hope you feel that my completed thesis has represented your views well.

This thesis is dedicated to my late father in-law, Ozuru Igbo Nwa Chief S.N. Ibegbulam and mother in-law Nneoma P.N. Ibegbulam, both of whom encouraged me to continue with the PhD studies.

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Summary

In Year 9, when boys and girls are expected to make choices regarding what they want to become when they grow up, many take a crucial decision to drop or side-line IT as an academic subject, which in turn steers them away from a possible future IT career. This thesis examines the reasons why IT careers are not well-imagined or popular amongst teenagers at this critical time of their lives. Taking the widely acknowledged 'women in IT' problem as a starting point, it focuses specifically on gender differences that exist in relation to how teenagers form their ideas about IT as an academic subject, as a possible career and in everyday life.

79 boys and 85 girls participated in this study from a mixture of 12 state-maintained and nine independent secondary schools (single-sex and co-educational) in Southeast London Borough. This research was exploratory and used an age-appropriate, participatory and mixed-methods framework incorporating: a questionnaire, a creativity map exercise, group and individual interviews, mini-focus groups, and observations. During the interviews, students were also provided with information and opportunities regarding IT careers. I argue this has been of benefit to the students as well as the research, as it has prompted them to think about a career they previously had not even considered.

The findings of my study indicate boys were more likely than girls to say that they liked and enjoyed IT/ICT[1] as a subject and would consider IT as a career choice for the future. Evidence throughout the study does not suggest girls lack confidence with regard to their general engagement with and use of technology, compared to the boys. Rather, the findings suggest more needs to be done in the area of role models, mentors and careers advice to inform more girls (and boys) about IT careers. The thesis concludes with recommendations for further research, especially in light of the new computing curriculum, which commenced in September 2014.

[1] IT/ICT is used synonymously and interchangeably throughout this thesis. However there is a contextual distinction as defined fully in Chapter 2.2.1 (pp 26-29).

Glossary of Acronyms and Abbreviations

A/Levels – Advanced Levels

APU – Assessment Performance Unit

BCS – British Computer Society

Becta – British Educational Communications and Technology Agency

BTEC – Business & Technology Education Council

CC4G – Computer Club for Girls

CIOs – Chief Information Officers

DCSF – Department for Children, Schools and Families

DfE – Department for Education

DfEE – Department for Education and Employment

ESRI – Economic and Social Research Institute

GCSE – General Certificate of Secondary Education

HE – Higher Education

HESA – Higher Education Statistics Agency

ICT – Information Communication Technology

IT – Information Technology

ISC – Independent Schools Council

KS3 – Key Stage 3

KS4 – Key Stage 4

LEA – Local Educational Authority

NC – National Curriculum

NFER – National Foundation for Educational Research

NGfL – National Grid for Learning

NOF – New Opportunities Fund

OECD – Organisation for Economic Co-operation and Development

Ofsted – Office for Standards in Education

SET – Science, Engineering and Technology

STEM – Science, Technology, Engineering and Mathematics

SIC – Standard Industrial Classifications

SSDA – Sector Skills Development Agency

UCAS – Universities and College Admission Service

UK – United Kingdom

UKRC – UK Resources Centre for Women in SET

VQ – Vocational Qualification

WISE – Women into Science and Engineering

WNC – Women's National Commission

Chapter One: The underrepresentation of women working in IT and girls considering IT careers for the future

1.0 Introduction

Since the 1970s, both academics and industry experts have commented on the ongoing issue of skills shortages in the UK Information Technology (IT) industry and the industry's inability to attract, employ and retain women. According to e-skills UK, IT is central to the UK economy and a key source of competitiveness for all sectors. The UK IT and telecoms industry accounts for 8% (£75 billion) of the UK's total Gross Value Added (GVA),[2] and the people working in IT occupations account for just over 1.1 million of the UK's total workforce, which currently stands at 30.15 million.[3]

Whilst employment in IT professional occupations has consistently grown in the last decade and is forecast to grow even more (by 1.42%) over the next decade, the representation of women within IT has steadily declined. This stems in great part from the low female representation levels in IT-related subjects in both secondary and higher education (HE). Academic, industry and, to some extent, government, have worked hard to engage young girls with IT subjects and IT careers in the face of prevailing and persistent stereotypical perceptions that IT is a man's occupation.[4]

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[2] e-skills UK: Technology Insights 2012.

[3] Office for National Statistics (ONS): Labour Market Statistics, February 2014. Retrieved 23 February 2014 from http://www.ons.gov.uk/ons/dcp171778_350998.pdf

[4] See fig 1.0(1): IT occupations by gender in appendix A of the appendices

According to statistics provided by the e-skills UK 2012 report, women account for 48% of the UK labour force but make up just 15% of IT professionals.[5] The picture is particularly concerning because, in spite of the fluctuations over the past 10 years, the ratio of women to men working in IT is falling.[6]

Across all subjects in higher education (HE), women account for 56% of degree course applications and 55% of acceptances; this is in stark contrast to Computer Science and IT-related subjects, where they make up just 20% of applicants and 21% of acceptances.[7] Women also make up less than a quarter of Computer Science graduates in the UK. From 2004 to 2013, the gender gap between men and women widened by 10%, while the number of female applicants fell by 11% following five years of continuous growth (between 2006/7 – 2010/11). This resulted in a 38% decrease in the number of women leaving HE with a Computer Science degree.[8]

At GCSE level, the gender divide in terms of those taking an ICT GCSE has narrowed since 2004. However, it is important to recognise that the total number of ICT GCSEs taken declined over the same period from 98,833 in 2004 to 73,487 in 2013, a decline of 26% overall.[9] At A-level, the gender gap widens again: males account for 91% of those taking Computing as an A-level subject, and females just 9%. This gap has widened by 10% since 2004. Although the gender gap is not as great for ICT A-level with 62% of

[5] e-skills UK: Technology Insights 2012.

[6] See fig 1.0(2): Women as a percentage of all IT occupations in appendix A of the appendices

[7] e-skills UK analysis of UCAS Applications and Acceptance data 2013. See figs 1.0(3) & (4) for percentages of women applicants and acceptances in appendix A of the appendices

[8] See fig 1.0(5): Students studying and graduates of Computer science by gender (2003/04 – 2012/13) in appendix A of the appendices)

[9] The Engineering UK Report - 2014.

the candidates being male and 38% female,[10] in terms of total numbers taking Computing and ICT A-levels, it is a similar pattern of decline. Since 2004, there has been a 53% reduction in the overall numbers taking the Computing A-level and a 32% decline in those taking the ICT A-level, while figures recorded in 2013 show that just 6.5% (245) of females took the Computing A-level and 37.7% (3,959) took the ICT A-level.[11]

Although statistics in 2013 showed that girls are still outperforming boys at both GCSE and A-level,[12] the segregation of boys and girls into different academic areas has profound long-term effects on girls' career opportunities and trajectories and leads to disadvantage in the workplace.

In 2007, a survey of Chief Information Officers (CIOs) showed projected skills gaps in every area of IT by 2010, with the largest gap in business intelligence and business process improvement.[13] In 2011, e-skills UK projected skills gaps in the areas of IT security, business, technology specific, interpersonal, analytical and research skills. An article by Collins reviewing Baroness Lane Fox's debates (2014) projected still further skills gaps and highlighted the need to fill one million technology jobs by 2020. Thus, there is a business as well as an equalities case for tackling the low participation of women in IT; today's employers and organisations are stressing they are looking for not

[10] There is a distinction between computing A-level, which is more specialised and more closely related to Computer Science at HE level, and ICT A-level, which tends to be broader and more applications based.

[11] See figs 1.0(6) & (7) for percentages of girls and boys GCSE ICT entries and results, and the percentages of female STEM A-level courses in appendix A of the appendices

[12] Paton, G., Education Editor, The Telegraph – GCSE results 2013: Girls stretch to record lead over the boys. August 2013.

[13] Information based on the IT and Telecoms Insights 2008 report by e-skills UK based on Gartner research. In 2007, only 16% of tech workers were women. The report warns that new talent in the IT industry is diminishing at an alarming rate.

only the technical 'know how' skills, but also the 'softer skills', such as business acumen and relationship building. These are abilities that it is assumed women can more often bring to the workplace than men (although see Woodfield 2000 & 2002 for a challenge to this employer assumption). Gender imbalance in this sector, however, remains a significant and worsening issue; statistics recorded in 2010 show only 18% of all IT professionals in the UK were female, with 17% in 2011 and 15% in 2013.[14]

As will be evidenced throughout this thesis, it is arguable both boys and girls have poor information about the benefits of IT careers, and that girls especially are largely unaware of the opportunities IT careers can present. The products and consequences of IT are part of our daily lives, whether it is the operating systems on mobile phones, the computer networks that automate everyday financial transactions, or the reams of information sought and found on the Internet. Careers in IT offer numerous opportunities, including job satisfaction, career progression, financial remuneration and stability. Within the IT workforce, there are many jobs and roles one can embark upon, such as programming, software testing, systems analysis, hardware development, ethical hacking - part of Cyber Security (a favourite topic mentioned by one of the girls in my study) - project management, quality assurance and client-relationship management.

The versatile nature of IT as a tool used to enhance business performance, as well as the all-pervasive nature of computers, means IT professionals are found in almost every industry. There are a variety of jobs to suit different individuals, from developing games or designing teaching systems and advanced medical techniques and processes, to enhancing business strategies and communications as well as the management of

[14] e-skills UK Sector Skills Council Ltd.

people. IT is a fast-moving area; new opportunities are constantly emerging, with demands for newer and more portable computing initiatives, wireless and cloud computing, virtualisation and green initiatives. The advances in these technologies are taking the IT industry in unexpected directions. As mentioned earlier, as both personal and business uses of IT continue to grow, so IT personnel in all IT disciplines continue to be in demand, particularly those who are able to combine both technical and soft business skills.

Originally, my interest in this research was centred on the lack of female managers working in IT in the UK, with many having worked in the sector for years without having progressed into senior management. However, the literature review at the start of the study unveiled a much larger problem, specifically, a general lack of women working in IT or the underrepresentation of women in this sector. Existing research has suggested the causes of this underrepresentation are so numerous, complex and deep-seated in institutional gender inequalities that it is actually difficult to know how to achieve a gender balance in IT (Faulkner 2002, Trauth, Quesenberry and Morgan 2004, Cohoon and Aspray 2006, Griffiths and Moore 2006). Some studies specifically claim that boys and girls either get attached or attracted to or turn away from IT at a very early age due to its masculine image and their own different socialisation experiences. Such proponents argue that the ‘women in IT’ problem can be addressed only if we focus on children as well as on a range of institutional and societal obstacles preventing women’s progression at later stages (Millar and Jaggar 2001; Peters, Lane, Rees and Samuels, 2003; EOC 2004). Using the ‘women in IT’ problem as the backdrop issue and foundation, my research focus shifted to 14-year olds’ perceptions of IT in general (their personal uses and how they interact with IT), IT as a subject they are taught in school and IT as a possible future career.

An improved understanding of 14-year olds' perceptions of IT as a subject and as a possible future career is important; future careers are, to an extent, influenced by the choices made at this age. There is limited empirical work on this age group (14-year olds). Improved understanding could lead to an increase in the future of female (and male) participation rates in IT.

The main questions this research was designed to address were as follows:

1. How do 14-year old students (girls and boys) perceive IT as a subject?
   a. Do they like IT as a subject? Why/why not?
   b. Do they feel comfortable and confident using computers? Why/why not?
   c. What are their suggestions for improvement regarding what and how they are taught in IT as a subject?

2. How do 14-year old students (girls and boys) perceive IT as a career?
   a. What are their reasons for viewing IT careers positively or negatively?

3. Would 14-year olds consider working in the IT sector or as an IT consultant in another industry as a possible future career?
   a. What are the reasons for their decision?
   b. How and to what extent do 14-year olds perceive IT occupations as gendered, i.e., more appropriate for one gender than for another?

c. To what extent and how do 14-year olds perceive IT and the IT sector as male-dominated and male-oriented?

4. How and to what extent do gender differences exist with regard to 14-year olds':

   a. perceptions of IT as a career?

   b. willingness to consider IT as a possible future career choice?

5. How do 14-year olds (girls and boys) perceive IT in general?

   a. How comfortable and confident do they feel with their uses of and engagement with computers?

      i. Are there gender differences in terms of uses or engagement?

   b. How do they use and engage with IT (technology) inside and outside of school?

Using information provided by the teenagers (14-year olds) in this research, an attempt has been made to understand their perceptions and provide evidence-based recommendations that could contribute to our collective understanding of the 'women in IT' problem and how to resolve it.

1.1 Background: the ‘problem’ of women/girls in IT

As stated earlier, available statistics in the UK suggest a steady decline in the number of women entering the IT industry. The 2011 Intellect report, produced by the Department of Trade and Industry (DTI) in conjunction with the IT sector skills organisation e-skills UK, found two main reasons for the shortage of women in IT: first, a bad public image of IT and its ‘long hours’ culture and the perception of IT as a ‘geek’ industry, and second, a lack of understanding amongst women and girls about the opportunities available in IT.

In the report it is noted that 75% of the women surveyed believed there is a long-hours culture within the IT industry. Although it is noted the industry does not affect family life any more than other sectors do, also highlighted is the fact that, even amongst those women choosing an IT role, there has been a decrease in the number who view their working environment as sympathetic to their needs, and for this reason many leave the sector.

Moreover, the ‘nerdy’, ‘geeky’ image of the IT industry is still seen as a major concern for women, with 41% of the respondents believing young girls are put off pursuing a career in IT. A number of well-known initiatives, for example, Computer Club for Girls (CC4G), have been put in place to encourage girls into Science, Engineering and Technology (SET) careers, but the existing literature suggests their impact on these stereotypical views of IT work is minimal.

A large-scale study conducted by Training Camp surveyed 1,000 UK teenage schoolgirls. The results revealed that the girls showed a strong interest in technology, with 76% claiming to be ‘very interested’ in IT; nevertheless, the majority of them also said that they were not interested in a job in IT (Williams 2007). According to Lachlan Mackinnon, Head of the School of Computing and Creative Technologies at the University of Abertay Dundee, the lack of interest in IT is due to ‘boring’ IT classes focussing on Microsoft Word and Excel and which are turning teenagers off IT as a possible future career (Lomas 2008). With these issues in mind, a radical overhaul of the ICT curriculum for state-maintained schools was conducted by the Department for Education (DfE) in collaboration with the British Computer Society (BCS), IT businesses within the IT industry and e-skills UK, to present students with an up-to-date, relevant, and applicable ICT curriculum in line with 21st Century technology. This curriculum came into force in September 2014. There was concern that the curriculum in its previous form was having an extremely negative impact on young people’s attitudes towards IT.

Much of the existing literature claims that the lack of women in IT is due to the ‘IT culture’ that, from primary school onwards, marginalizes girls. It is claimed that girls are disadvantaged very early on as they already, for a variety of reasons, lack exposure to technological play (Jenks and Kahlon 2005, Biggs 2006). The Assessment Performance Unit (APU) investigated the activities of school-age children and found that the experience of boys playing with construction toys, such as Lego, was twice that of girls (Brown 1993). This is important to note when examining gender-related issues with technology as it has been shown that ‘basic experience of shapes and sizes of materials and structures based on practical ‘hands on’ science and technology is directly related to children's later abilities in technology' (Brown 1990, p.137). The APU also found that the different experiences of pupils outside school affect not only the skills they develop, but also their understanding of the situations where their skills can be used appropriately (Murphy 1993).

Furthermore, the APU study showed that children as young as six had formed strong opinions about the kind of activities boys may undertake and those that are suitable for girls. The gender stereotypes that have been ingrained in children before they come to school are shown to be further incorporated and reinforced within the classroom (Brown 1993, Murphy 1993, EOC 2004). A majority of children still feel there are 'boys' activities' and 'girls' activities' and 'children may feel like they are not entitled to an activity or classroom area if they perceive it as lying outside their gender domain' (Brown 1990, p.137). Hence, it is argued that this lack of entitlement holds girls back in their development of technological skills and interest.

Research also seems to suggest teenagers' decisions about their learning and what they expect to get out of life are usually formed at the age of 14, during the final stages of Year 9 (Blenkinsop, McCrone, Wade and Morris 2006). Although it is not uncommon for teenagers to be unsure regarding what career path they really want to pursue at this stage, it is clear that up until the end of Year 9 teenagers should be offered good impartial information, advice, and guidance[15] to ensure they do not make restricted choices at the age of 14 that set them on a career path they cannot change later. As one

[15] A point expressed strongly in the youth green paper, Youth Matters (2005), which, in the related consultation, specifically asks what kind of help and support is most important for young people and how we can ensure that information, advice and guidance provided to young people is comprehensive and impartial and challenges rather than perpetuates traditional stereotypes.

study has suggested, few teenagers - particularly at the age of 14 - are able to make the link between careers education and guidance activities and the actual personal decisions they make, thus suggesting there is a need for more clarity and proper advice from schools' career development guidance sessions to make such links more explicit (Blenkinsop et al. 2006).

1.2 The National Curriculum for 14-Year olds (Key Stage 3)

Key Stage 3 (KS3) in the English (and Welsh) educational system refers to the first three years of secondary school, that is, Years 7, 8 and 9 when students are between the ages of 11 and 14.[16] This period in a student's education is crucial to their future attainment, and evidence shows that if they do well at KS3, then they significantly increase their chances of doing well at GCSE and beyond (DfE 2010).

In KS3, it is a statutory requirement laid out by the Department for Education (DfE)[17] and the Local Educational Authority (LEA)[18] for teenagers attending state-maintained schools (grammar, voluntary aided, and comprehensives) to work through the KS3 National Curriculum (NC), which involves a number of compulsory subjects.[19] The NC, first introduced into all English (Welsh and Northern Irish) state-maintained schools following the Education Reform Act 1988, has undergone a number of changes, reviews

[16] In Northern Ireland, KS3 also refers to the first three years of secondary school, although this is years 8, 9 and 10. Scotland, although part of the UK, operates a totally different school system. See paragraph 1.2a in appendix A of the appendices for a summary of the Scottish education system.

[17] The Department for Education was previously known as the Department for Children, Schools and Families (DCfS) in 2007 during Gordon Brown's government. In 2010 the Conservative/Lib Dem Coalition Government took control and Michael Gove became the Secretary of State for Education. His department is the Department for Education (DfE).

[18] Local Education Authorities (LEAs) are the local councils in England and Wales responsible for education within their jurisdictions.

[19] See fig 1.2(1): KS3 compulsory NC subjects in appendix A of the appendices.

and updates over the years. The most recent changes of the NC came into effect on 1st September 2014 and included discontinuing ICT as a subject and replacing it with Computing.

Although there are statutory regulations that independent schools (which include private or public schools)[20] must observe, they are not bound by all the directives of the DfE and LEA. Thus, it is not compulsory for independent schools, free schools or academies to follow the NC. Instead, they can use the NC as a flexible framework, which they can adapt to suit the specific characteristics of the school and the needs of its students.[21]

During Year 9, the 14-year old students start thinking about the subjects they wish to choose to carry forward into Key Stage 4 (KS4). KS4 is the last two years in state-maintained secondary school education, incorporating GCSEs and/or the other end of secondary school year exams (Years 10 and 11) when the students are aged between 14 and 16. By the end of Year 9, students will have confirmed the set of subjects they wish to study, and their studies in many of these subjects will lead to nationally recognised qualifications, such as iGCSEs, GCSEs, and Vocational or National Diplomas (BTECs). Ideally students will need to choose subjects they enjoy and do well in (subject to the availability of their choices at the different schools), as well as the core curriculum

[20] Independent schools in the UK are known as private schools, and some of the much older and more exclusive private schools (i.e., members of the Headmasters' and Head mistresses' Conference (HMC)), that cater for the 13-18 year old range in England and Wales are known as public schools. E.g., Harrow, Eaton, Winchester, Charterhouse etc.

[21] For example, during an interview (16/06/2009) with the Head of Year 9 at Hawthorn School, an all-boys Independent Day School in a southeast London Borough, he advised IT be offered only in Lower 6 up to Year 8, from then on IT becomes an optional GCSE subject. Beyond Year 8, request for the subject becomes elective due to schools' perception of the coursework not being extensive enough to be graded as a full GCSE module.

subjects, but they also face pressure to get a balance of subjects that will give them more options when deciding on courses and jobs in the future.[22]

To assist with choosing the appropriate subjects to carry forward to KS4, it is a legal requirement for schools in the state sector to provide careers education and guidance. Trained staff or personnel knowledgeable in this area should deliver comprehensive and impartial advice regarding students' options with the help of external professional bodies, such as Connexions.[23] A similar process of career education and guidance is available in the independent sector: some of the independent schools use battery tests, such as the Morrisby Careers Psychometric Tests[24] and CareerStart,[25] in combination with these career educational programs. 14-year olds' subject choices are also influenced by a range of other factors, such as their own views and expectations and the views of their parents, teachers, peers, role models, other members of their family and the media.

The literature on 14-year olds' perceptions of their school subjects suggests that uptake of subjects varies according to whether the subject is viewed as 'masculine' or 'feminine' (Colley 1998). In studies with teenagers conducted by Weinreich-Haste

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[22] See fig 1.2(2): KS4 compulsory NC Core and Foundation subjects in appendix A of the appendices

[23] Connexions is a national government initiative that aims to provide integrated advice, guidance and access to personal development/career opportunities for 13-19 year olds (and up to 25 years old for young people with learning difficulties and/or disabilities) and to help them make a smooth transition to adulthood and working life. Connexions services were officially closed down by the Conservative/Liberal Democrat Coalition Government in 2010.

[24] The Morrisby tests form a series of individual tests that provides insight into ability patterns and what sort of work environment or career will best suit students.

[25] CareerStart is a unique programme of interactive seminars developed specifically for Years 10 and 11 and all sixth formers in schools. The purpose of these is to offer young people training in generic transferable business skills to complement and extend their academic and extra-curricular experience. The aim of CareerStart is to help prepare students, post-GCSE through the sixth form for life and relationships in higher education, the workplace and the world beyond. It is designed to complement the programmes offered in schools by careers and sixth form tutors.

(1979, 1981), Archer and Macrae (1991) and Osborne, Simon and Collins (2003), findings confirmed a number of science, engineering and technology-related subjects, especially IT, are stereotyped as male. Some areas have consistently been stereotyped as masculine while others have been stereotyped as feminine (Colley 1998, p.25). This, in turn, can affect the decisions 14-year olds make regarding their subject choices.

In the Weinreich-Haste (1979, 1981) studies, students were asked to rate subjects on several scales: masculine-feminine, difficult-easy, interesting-boring, useful-useless, complicated-simple, about people-about things and involves feelings-involves thought. The academic subjects, such as the sciences, IT, and mathematics, were perceived as masculine while the language subjects were perceived as feminine. These findings were similar to those in Archer and Macrae’s (1991) study. The relationship between the scales found in both studies throw some light on the perceptions of gender-stereotyped subjects of male and female students. For girls, masculine-feminine was associated with difficult-easy and complicated-simple, so masculine subjects were seen as difficult and complicated while feminine ones were seen as easy and simple. For boys, masculine-feminine was linked to interesting-boring and about things-about people, so masculine subjects were seen as interesting and about things while feminine subjects were seen as boring and about people (Colley 1998). The Archer and Macrae (1991) study also suggests the pattern of connections indicates that the masculine subjects may be seen as being of higher status than the feminine ones.

Research shows subject choice preferences for 14-year olds are influenced by desired career paths. A clear gender gap in career aspirations was recorded by Kelly (1989), demonstrating a distinction between occupations associated with technology ‘for boys’ and people-oriented occupations ‘for girls’. Among the top ten preferred jobs for boys were engineer, pilot and computer expert; while for girls this list included nurse, teacher, and hairdresser. There is a clear association here in the perceptions of ‘masculine’ and ‘feminine’ school subjects with the traditional division of labour between males and females and their occupational and familial roles:

> The association of feminine subjects with ‘about people’ and masculine subjects with ‘about things’ is linked to both female participation in occupations which require extensive contact with others and to their preferences for subject areas which concern or are about people rather than those which deal with inanimate entities or systems. (Colley 1998, p.24)

1.3 Structure of the thesis

The rest of the thesis unfolds as follows. Chapter Two provides a literature review, focusing on academic and industry sources analysing women in Science, Engineering and Technology (SET) as a whole as well as an introduction to the ‘women working in IT’ problem. A statistical picture based on the figures currently available is provided, along with a comparative analysis of the different educational sectors, that is, the private sector vs. the state sector, and single-sex vs. co-ed environments. A review of IT as a subject in secondary schools and an analysis of gender differentiated participation rates in IT are also provided.

Chapter Three provides a full discussion of how the research design was developed and how the research activities were conducted. Due to the nature of this research, which involved teenagers’ participation and the attempt to elicit data from an under-researched and difficult-to-reach population, a participatory action research approach (PAR) was used. This research approach starts from individual experience but uses creative and visual techniques, such as drawings and creativity maps, to build trust and spark discussion (IIED 2000). These creative techniques rely on young people's imagination and facilitate debates, reflection, and arguments, which help them to describe, interpret and analyse their experiences. The activities here included sharing knowledge and experience, recognising and encompassing different perspectives, working in teams on a practical task during the creativity map exercise, completing a questionnaire and conducting group interviews (semi-structured) and participant observation.

Chapter Four, the first of the data findings chapters, presents the 14-year olds' perception of IT as a subject while Chapter Five presents IT as a possible future career and Chapter Six considers the teenagers' engagement with and uses of technology inside and outside of school. Finally, Chapter Seven concludes the thesis, draws the findings of the research together and summarises the activities of the other chapters as well as providing some general closing comments and suggestions and recommendations for future study.

Chapter Two: Literature review

2.0 Introduction

This chapter provides an overview of the literature framing the area of interest for this thesis, that is, gender differences within 14-year old English teenagers' perceptions of IT as a subject, as a possible future career and of IT in general, i.e., technology as a major part of their lives inside and outside school. Chapter Two is split into four distinct but interlinked parts, starting with an introduction to secondary school education in England that discusses the different types of secondary schools in the state and independent sector. This is followed by a discussion of the single-sex vs. co-ed debates in relation to how school types affect students' academic performance and subsequent future career aspirations.

The next part focuses on IT policy in relation to ICT as a subject being taught in English secondary schools. A historical overview of IT as a subject is presented, with a detailed background of ICT as a subject taught in English schools. The chapter goes on to explain the different ways IT is taught in schools followed by a brief introduction to current teaching models for IT in schools.

The third part introduces IT as a career starting with the IT industry in its current form, progressing to a more general discussion with regard to the proportion of women currently working in IT, problems with the IT work environment and gender differences in participation in IT careers.

The final part brings together literature relating to the ‘gender and IT’ sphere in general. This includes a discussion of gender differences in perceptions of ICT as a school subject, in relation to subject choices, and in academic performance. A review of possible career choices and preferences in relation to biological and sociological essentialist views is presented, along with gender differences in participation of IT, engagement with, and uses of IT generally, both at home and in school. The chapter then concludes with a brief discussion of Computer Clubs for Girls (CC4G), one of the initiatives put in place to encourage girls’ interest in IT generally and in IT careers for the future.

2.1 Secondary school education in England

According to the 1996 Education Act, children in England are required by law to have a compulsory education until they are 16 years old;[26] this was amended to 17 in September 2013 and rose again to 18 in 2015. Section 7 of the 1996 Education Act states:

> The parent of every child of compulsory school age shall cause him to receive efficient full-time education suitable to his age, ability and aptitude, and to any special educational needs he may have, either by regular attendance at school or otherwise. (Education Act 1996)

Therefore, education is compulsory, but school is not; children are not required to attend school but can be educated at home or in an educational establishment, such as a school within the state or independent sector.[27] Depending on parental choice and the resources

[26] Education and Skills Act 2008, Office of Public Sector Information.

[27] Introduction to Education in England, Woodlands Junior School, Kent. http://resources.woodland-junior.kent.scho.uk/customs/questions/education.html

available, students aged between 11 and 16 years old can be enrolled in and educated at a state maintained secondary school, which may be either comprehensive, grammar, voluntary aided, academy, free school or at an independent secondary school, referred to as a public or private school.[28]

Secondary education within the state sector is free to all pupils, and the fees are funded from taxes, public funds (central government) and the LEA. Schools within the state sector are normally run by, or in conjunction with, the government, whereas independent secondary schools are privately run and owned by individuals, organisations or educational trusts. Independent schools are not administered by local or central government and retain the right to select their student body; they are funded either by raising their own funds through private sources, predominately in the form of tuition charges (school fees), or by gifts and long-term charitable endowments. For more information on private vs. state schools, please see paragraph 2.1a in appendix A of the appendices.

The main point of entry into the English educational system is a nursery place at the age of three,[29] followed by Reception, Years 1 and 2 (KS1) and then the Juniors – Years 3, 4, 5 and 6 (KS2). Secondary education starts in Year 7 (KS3, Years 7-9) and continues in Years 10-11 (KS4).[30] At this point, some teenagers start taking GCSEs, but the majority take their GCSEs in Year 11. A-levels start from Year 12, also known as Sixth

[28] Please see paragraph 2.1a in appendix A of the appendices for definitions of the different types of schools in the state maintained and independent educational sector.

[29] The independent sector offers nursery education for children as young as three months old in the form of day care places, but independent schools are able to admit children in the prep/pre-prep section of their schools from the age of two years old.

[30] These Key Stages mirror what is available in the independent sector; the only difference is that the year groups maybe called something else.

Form. After this stage, some students move on to university to study for a degree, while others choose different career paths, such as work, apprenticeships and travelling (during a gap year).

During KS1, 2 and 3, ICT is studied as a core subject and is compulsory (part of the National Curriculum). From KS4 onwards, ICT becomes optional, and the uptake of girls compared to boys is significantly lower. In a study conducted by Pau, Argles, White, and Lovegrove (2005), the main findings led to the following conclusion:

> Secondary children found IT boring; there was not much variation in what they learnt in junior school, to what they are being taught at secondary school. Furthermore, enjoyment of IT lessons decreases by the age of 14 for both genders. However, girls lose interest at a much faster rate than boys. Girls use enjoyment of lessons as a factor in career choices, whereas boys view lesson enjoyment and career as different entities. (Pau et al. 2005, p.1)

2.1.1 Single-sex vs. co-education

The conventional thinking 30 years ago was that co-education would break down gender stereotypes, but this has not necessarily been the case. Research in the 1970s, particularly that by Dale (1969, 1971, 1974), tended to emphasise the social benefits of co-education, and the possible disadvantage of lower achievement in girls was not given much consideration (Colley 1998). A debate has since ensued in which a clear picture of potential academic and social disadvantages of co-education for girls has emerged, although methodological points have been fiercely contested. Dale's research appeared to find that students from co-educational schools were less anxious than their peers in single-sex schools, that boys had lower 'neuroticism' scores in personality tests, and higher levels of academic achievement, particularly in mathematics. He concluded that co-education was beneficial for boys and probably had little effect on girls (Dale 1974).

A similar view was held by Faller (2013), who confirmed that some research studies have found co-education schooling is good for boys in that it reduces gender stereotyping, but that this is not the case for girls; research has found that it actually reinforces stereotyping and that girls can be intimidated by the dominant nature of boys in the school. This is coupled with the fact that in mixed environments, girls may be less likely to participate fully in sport and to choose traditionally ‘male’ subjects (such as IT).

According to Smithers and Robinson (2008),[31] there is ‘an emerging consensus both in this country and elsewhere that there are no striking advantages to either single-sex or co-education’ (p.5). Their report has been cited as supporting co-education simply because, in their view, firm evidence in favour of single-sex education is lacking. These researchers pinpointed a fundamental problem in this area of research: ‘the paradox of single-sex and co-education is that the beliefs are so strong and the evidence is so weak’ on both sides of the debate (p.3).

A recent review from the Head of Ofsted, Christine Gilbert (2006-2011), recommended different teaching styles to inspire boys to learn, noting that the motivation of boys and girls was markedly different from a very early age (Bateson 2008). A number of co-educational schools have recognised this and have started to teach boys and girls in separate classes. There has been much recent press coverage of such experiments.[32] In

[31] Research conducted by Smithers and Robinson of the University of Buckingham, commissioned by Headmasters and Headmistresses Conference (HMC) in 2008, whose member schools are predominately co-educational.

[32] A number of state co-educational schools in the UK – Dalziel High School, Motherwell, Scotland, Pringle School, Swadlincote, Derbyshire, Shenfield School, Essex, The Costworld School, Leicestershire and a number of schools from Mill Hill in London also got involved in the subject segregation experiment and found that the GCSE results of the boys and girls improved significantly.

2012, David Thompson, in his BBC documentary[33] 'Single-sex or co-educational schools for girls and boys?', reviewed government reporting that of the 3,300 state schools, 165 were all boys and 219 were all girls. Of these state schools, $^{17}/_{25}$ of the top A-level and GCSE results were from single-sex schools. The programme concluded that boys and girls can benefit from some separation from one another to reflect their different learning methods and how they relate to one another, and that a number of co-educational schools, both in the independent sector and the state sector, operated some form of single-sex classes in core subjects such as Maths, Science, Languages, and Technology so that students could obtain the maximum benefit from their learning.

It is interesting to note that several studies have supported the view that girls in single-sex schools are more likely to do well in traditionally male-dominated subjects, such as IT, Maths, and Science, and to engage wholeheartedly in sports (Spielhofer et al. 2002, Younger et al. 2005). Research by Cooper (2006), found that the influence of peers, parents, teachers, and the media is noted as being a major factor affecting girls' confidence and self-efficacy in and attitudes towards ICT. Studies by others have demonstrated the existence of stereotyping in relation to gender and ICT, which can become self-reinforcing: girls learn that computers are 'boys' toys', increasing their anxiety around ICT and leading to negative attitudes. Although this negativity is reduced with experience, it presents a significant barrier to the use of ICT and computers in a variety of settings (Ware and Stuck 1985, Chen 1986, Campbell 1988, Cooper 2006). Cooper (2006) found evidence that for girls, working with ICT together with boys can have a negative impact on their anxiety levels and performance. In the

[33] David Thompson (2012) School and Education Choice of Parents; http://www.bbc.co.uk/news/uk-politics-16855727

study, girls and boys were asked to use a problem-solving game in pairs; some were grouped in same-sex pairs and others in mixed pairs. Boys' performance increased in the mixed-sex pairs, while girls' performance decreased. Boys have been observed to claim superior knowledge, dominate discussion and teacher time, dominate the equipment and make girls feel unwelcome or inadequate in ICT lessons (Culley 1986, Beynon and Mackay 1993).

Such studies suggest girls ignore gender stereotypes and develop their competitive side more fully in single-sex schools. Their peers understand them, and they feel comfortable being themselves: 'girls are less self-conscious in single-sex schools; they are certainly more confident and more likely to speak up for themselves… because they are less worried about what others, particularly boys, think of them' (Jill Berry, President of the Girls' Schools Association 2009). Equally, several studies suggest that boys, for their part, feel free to explore subjects like languages and the arts without fear of ridicule (Able 2000, Younger and Warrington 2005, Morrison 2011). Sexual stereotypes fade into the background; with no girls to impress, boys can get on with being themselves.

In summary, the evidence for the argument that single-sex schooling provides a better environment for girls and boys to progress academically is inconclusive. However, there is an indication that girls' in single-sex environments are much more interested in stereotypically male dominated subjects than girls in co-ed environments. These ideas are explored further in the discussion of my research findings in Chapter Seven (pp 263 – 278).

2.2 Policy and historical overview of IT as a subject

IT, or ICT as it is also termed, is a NC subject taught in both the private and state maintained schools in England. However, it is slightly different from other subjects studied in school because as well as being a subject in its own right, it also exists as a tool used across the curriculum to enhance learning. The National Association of Advisors for Computers in Education (Naace)[34] defined ICT as:

> [a] complex although nevertheless well-defined subject in its own right, and whilst its delivery is often through practical work sometimes crossing boundaries with other subject disciplines, the body of knowledge which it contains must be recognised as an essential component of a modern education and does not properly form part of any other National Curriculum subject, nor should this body of knowledge be confused with the use of ICT skills or systems in learning or teaching the content of other subjects just as English retains its identity as a subject in addition to being the medium of instruction and learning across the curriculum. (Berry 2012, pp.1-2)

ICT has evolved since it was introduced into schools as part of the NC in 1989. Today, components of the subject involve teaching students how to use a range of hardware, such as desktop and portable computers, projection technology, calculators, data-logging and digital recording equipment. In addition, software packages and software applications, such as word processing, spreadsheets, presentation packages, desktop publishing applications, databases, generic software, multimedia resources and information systems, including intranets and the Internet, are also used (Hennessy, Ruthven and Brindley 2005).

In England, the school curriculum, apart from teaching how to use computer hardware and software, also includes the teaching of ICT theory. This is to enable students to

[34] Naace is the professional association for those who are concerned with advancing education through the appropriate use of ICT. Naace was established in 1984 and has become the key influential professional association for those working in ICT in education.

understand how IT can be used to solve school or work-related problems in the future. The Data Protection Act, the Computer Misuse Act and other legal and ethical issues related to ICT are also included in the curriculum. What the teaching of ICT did not include in English schools is computer programming. However, as part of the new NC that came into effect on 1st September 2014, ICT has been discontinued and replaced with Computing. In KS2, students will be expected to learn how to write code, understand what algorithms are and create and debug simple programs. In KS3, the students will be expected to code, design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems.

The nature of ICT as a subject concerns the development or procurement of information technology to fulfil useful roles in people's lives and in organisations. Thus, the subject is concerned with the application of ICT by people in various contexts, including the home, the wider society, work and business, in order to achieve useful goals or outcomes. ICT encompasses the wide variety of processes behind the building of IT artefacts (systems, infrastructure, software and so on) and an understanding of the organisational and social processes involved in their procurement, deployment, and effective use.

As stated earlier, however, ICT is different to all other NC subjects in that the speed at which the content is developed needs to match the rapid development in the ways IT is used in the world (Ager 2011, p.2). According to Naace's 2011 report,[35] the fundamental concepts and principles of the school subject of ICT can and should be

[35] The importance of ICT in the English School Curriculum – A Naace response to the National Curriculum Review 2011 – Chair of the Naace Board of Management.

specified and made statutory, and the guidance provided to schools needs to be updated annually; failure to do this in the past has led to programmes of study that have slipped behind and failed to stimulate pupils academically. It is also a factor in some current ICT qualifications being poor value in helping young people develop their careers (Ager 2011).

2.2.1 Background to IT as a subject

The difference between the terms ‘Information Communication Technology’ (ICT) and ‘Information Technology’ (IT) is often confusing. Pickford and Hassell (1999) defined ICT and IT as follows:

> ICT refers to the computing and communications that support teaching and learning, where the focus is on the curriculum subject being taught, not on the technology skills, and IT refers to the students’ knowledge and understanding of the technology and their ability to apply it, as stated in the IT National Curriculum. Here the focus is on technology skills. (p.3)

In England, ‘ICT’ has now largely replaced ‘IT’ in educational terminology and has become better established within schools (Abbott 2001). However, it has not yet been fully adopted by the business and manufacturing industries. Nonetheless, the terms ‘IT’ and ‘ICT’ are used synonymously. In 1997, a report commissioned by Tony Blair and David Blunkett under the chairmanship of Dennis Stephenson saw the first use of the term ‘ICT’ in English politics, emphasising the importance of the communications technologies, particularly the Internet (Imison and Taylor 2001). This change of terminology is significant because not only does it express the current educational interests in the use of the Internet, Intranets, and video conferencing, but also it has been used by the central government to repackage, and to take ownership of and raise the status of, technological initiatives in schools. The revised NC for 2000 states:

> Information Communication Technology prepares pupils to participate in a rapidly changing world in which work and other activities are increasingly transformed by access to varied and developing technology. Students use ICT tools to find, explore, analyse, exchange and present information responsibly, creatively and with discrimination. They learn how to employ ICT to enable rapid access to ideas and experiences from a wide range of people, communities and cultures. Increased capability in the use of ICT promotes initiative and independent learning, with students being able to make informed judgements about when and where to use ICT to best effect, and to consider its implications for home and work both now and in the future. (DfEE/QCA 1999, p.14)

The teaching of ICT as a curriculum subject in schools has always been problematic, mainly because the term ‘ICT’ is ambiguous (Russell 2001); it is a broad term that is often used interchangeably with many other terms, such as ‘information technology (IT)’, ‘Computer Science (CS)’ (Heywood 2006), ‘information systems (IS)’ (Benson and Standing 2005), and ‘computing and information technology’ (Lynch 2007). This confusion arises due to the overlapping nature of the fields within ICT (Heywood 2006). Lynch (2007, p.3) investigated IT and gender at secondary schools and found that the terminology used to describe ICT areas was ‘fraught with potential confusion’, while Benson and Standing (2005) suggested that a number of managers tend to view IT and IS as being identical. Prior to the global acceptance of the idea that ICT can change everything we do, there was ‘just another’ curriculum subject entitled ‘Computing Science’. There was no initiative to include it in other curriculum subjects or to introduce it to teachers of these other subjects. It focused mainly on computing science specialists teaching students who had elected to study the subject at either KS4 or A-level. The current situation is very different, and ICT has taken over as the subject that should be spanning all secondary school years in a variety of forms (Russell 2001).

The structure of the NC dates back to 1988, at which time ICT was placed within the area of technology. The revisions of the late 1990s gave ICT a significantly improved status as an independent subject, and while the Programme of Study provides a basis for the creation of a scheme of work utilising the latest tools, as mentioned above, the exemplar study units for primary schools are now seriously out-dated. However, the relatively recent update for secondary schools offers a model that allows, with some revision and a re-visiting of the Level Descriptors, for the subject to be made fit-for-purpose across all phases (Naace 2011). Independent schools (including academies) do not have to follow the NC and are free to use ICT in learning and teaching as they see fit. However, the Independent Schools Council (ISC) has an active ICT group that promotes an annual ICT conference. While the implementation of ICT is as varied as schools themselves, the best have adopted innovative approaches that match those in the rest of the country as exemplified in the reports of the 2009 ICT Conference (available online at http://tinyurl.com/4cjnpdk). Some groups of independent schools, such as GEMS,[36] have adopted the broad principles of the NC for ICT (Naace 2011).

The use of ICT within most of the established curriculum subjects is on the increase. It is now a subject involving training, and a huge amount of funding has been injected into schools through the New Opportunities Fund (NOF), the National Grid for Learning (NGfL) and various other initiatives set up through the British Educational Communications and Technology Agency (Becta). Funding has been available in various forms over the years and has been targeted towards encouraging teachers to include ICT in the delivery of their chosen subject. ICT is not just about computers; it covers the use of, to name a few, fax machines, tape recorders and cameras. It also covers any products that will store, retrieve, manipulate, transmit or receive information

[36] GEMS Education (Global Education Management Systems) is a global education company founded in 1959 that owns and operates dozens of international schools, in countries that include United Kingdom, United States of America, Jordan, Egypt, Saudi Arabia, China, India, and the United Arab Emirates.

electronically in a digital form. Consequently, a good way to think about ICT is to consider all the uses of digital technology already in existence to help individuals, businesses and organisations use information. ICT is also concerned with the way these different uses can be combined. It is an increasingly powerful means of enhancing our abilities to learn, to communicate, and to think creatively and logically. Using ICT as a tool for learning means that students must ‘get their hands dirty’ with technology. Therefore, teaching students how ICT can be used is not enough; it is vital they are given opportunities to experiment (Imison and Taylor 2001).

2.2.2 Models of IT delivery

The teaching of ICT as a school subject has become a controversial issue, with a reportedly high proportion of students not liking the subject due to what they see as flaws in the way it is taught. Despite many government initiatives and the sustained efforts of many education professionals over two decades, there remain concerns about the teaching and learning of IT in English state secondary schools (Crawford 2000). Many see ICT as lacking any intellectual challenge or opportunities for the creative expression of fresh material, and consider it overly bureaucratic in its assessment methodologies (Ofsted 2009). Other problematic issues identified in Crawford (2000) are uncertainty regarding which curriculum models lead to effective teaching and learning, confusion over which styles of teaching and learning are the most appropriate (Crawford 1999), lack of continuity and progression in the curriculum, and low standards of attainment (Goldstein 1997). Finally, most IT teachers lack qualifications in the subject, and the quality of teaching is poorer than in most other secondary school subjects (Goldstein 1997).

ICT in schools can be taught or delivered in a variety of ways depending on the policies of a particular school. This can be as a discrete subject or an integrated subject or by using what is popularly known as the hybrid approach (Crawford 1997).

2.2.2.1 IT taught as a 'discrete' subject

IT may be taught as a discrete specialist or standalone subject, whereby students have a separate, dedicated ICT lesson. Depending on the school, this normally takes the form of a one-hour block in KS3 and is generally taught by ICT specialist teachers. The focus of the lesson is usually IT and does not always relate to other curriculum subjects.

According to Crawford (2000), the problem with discrete lessons is that few schools have sufficient IT resources, and the time for ICT must be found in an already crowded timetable. As a result, either all pupils have a relatively insubstantial curriculum, or only some pupils are offered a more substantial course, perhaps leading to external assessment in the General Certificate of Secondary Education (GCSE) in their final year of compulsory schooling (Crawford 2000). Another problem identified is the fact that a school following the discrete mode of teaching alone would not be meeting the statutory obligations as stated by the DfE, which are to teach ICT as a compulsory and integrated subject (DfEE/QCA 1998).

Nevertheless, the teaching of IT as a discrete subject can be beneficial to students, as specialist lessons provide many pupils with a significant, even exclusive, part of their ICT experience in school (Hammond 2004). Also, the students do sometimes need to be taught some IT skills in isolation before they can usefully apply them within other subjects, coupled with the fact that it is actually quite difficult to deliver or achieve full coverage of the ICT curriculum without teaching it as a discrete subject (Imison and Taylor 2001).

2.2.2.2 IT taught as an 'integrated' subject

IT can be taught across the school curriculum as an integrated subject. This requires detailed curriculum mapping to ensure that the programmes of study specified in the English NC for ICT are covered; in practice, this is rarely satisfactory (Goldstein 1997).

The integrated mode of teaching, a method of study preferred by the government, is where ICT is taught as part of, and integrated into, other subjects. These include Mathematics, English, Geography, Science, and Modern Foreign Languages (MFL). The DfEE (1998) suggested that there is much to be made of the integrated approach and that the integration within the subjects should be the way forward:

> Many English teachers have used computers for creating electronic newspapers that students produce with desktop publishing software. Good English work is sometimes produced, and the pressure of working to a tight production timetable throws into sharp relief the advantages of text and image handling by computer. Often, however, expectations of layout and visual attractiveness of such class publications are not high. Opportunities are rarely taken for involving teachers from art and design departments in jointly supervising and assessing such work. The application of IT to designing and making a product, such as a newspaper offers opportunities for teachers with different subject backgrounds to be seen to work together in order to raise expectations and standards overall. (DfEE 1998, p.24)

The main problem, as identified by Crawford (1998, 2000), is that teaching ICT as an integrated subject can be problematic and disadvantageous to the students in that it is taught mainly by non-IT specialists. In addition to this, assessment and reporting tends to be difficult to co-ordinate (Crawford 1998, 2000). A similar finding regarding the teaching of ICT as identified in Ofsted (1999) raised concerns about teachers' subject knowledge, pedagogical knowledge and pupil progression. ICT was arguably the 'least well taught' subject in English secondary schools. Standards were reported to be improving, but concerns remained due to wide variations in the provision and the quality of teaching (Ofsted 2001).

2.2.2.3 IT taught using a 'hybrid' approach

IT can be taught in schools using what is called a 'hybrid' approach to teaching ICT, as suggested by Crawford (1997). The hybrid approach involves the integrated use of IT within other subjects, topped up by the discrete use of a timetabled ICT slot. IT is taught as a discrete subject in the first year of secondary school (Year 7) and subsequently across the curriculum in the other years – from Year 8 onwards (NCET[37] 1995, Selwood and Jenkins 1995, Crawford 1997). Imison and Taylor (2001) suggested that a hybrid model presents a number of problems. First, few secondary schools are sufficiently well resourced or staffed with IT specialists to prevent separate ICT lessons and integrated IT work from detracting from each other. In addition, both ICT resources and the IT teacher's time become preoccupied with 'ICT lessons', and little access and support is available for integrated work. This is exacerbated when the school offers IT-related GCSE or post-16 options. Such courses allow a few students who are interested in IT to further their knowledge and skills to high levels, but this is usually at the expense of the rest of the pupils. Furthermore, there is a danger that ICT becomes the preserve of the

[37] National Council for Educational Technology (NCET, now Becta), 1995.

IT ‘department’, and other staff may believe that they cannot or need not be involved (Imison and Taylor 2001, p.86). The hybrid approach, therefore, can be seen as self-defeating; attempting to teach IT as a discrete subject and also to integrate it into the curriculum means neither can be done effectively (Imison and Taylor 2001).

2.2.3 Current teaching models for IT in schools

As stated earlier, the issue of which is the best mode for teaching IT in English secondary schools is one mired in controversy as the various modes available all have their benefits and limitations. Therefore, it is, to a certain extent, down to the individual schools or local bodies that control the schools to decide which mode is suitable for their students.

Following the response to the Royal Society’s call for evidence on computing in schools, Naace (2011), after close and informative dialogue with its members, made the following recommendations for all schools:

a. ICT should remain as a discrete subject within a revised NC with a compulsory programme of study.

b. ICT should remain as a core teaching and learning tool within all other subjects of the curriculum in order to ensure that learners experience real-world application of IT in specific subject contexts.

c. The programmes of study for all statutory subjects of the revised NC should make reference to the role of ICT in supporting teaching and learning in those subjects.

d. There should be a revised and compulsory Programme of Study for ICT, developed from those currently existing and this should encompass:
    i. Those aspects of IT best taught in discrete ICT lessons and with a focus on the core knowledge and understanding related to the subject;
    ii. Aspects of ICT that should be further developed and exemplified throughout the other subjects of the curriculum whether statutory or not;

e. The guidelines for teaching of non-statutory subjects should make reference to the role of ICT in supporting teaching and learning in those subjects.

f. Subject associations should be commissioned to develop new exemplar materials that support the use of ICT in enhancing learning, teaching and standards in all school subjects; and

g. KS4 IT qualifications should be reviewed to ensure that they are fit for purpose and provide a valid, sound basis for both future study of ICT and Computing at Level 3 and above and/or provide pathways into employment based training (Naace 2011, p.20).

Of the 21 schools that participated in my study, teaching ICT as a discrete subject, as recommended by Naace (2011), was the most popular choice. 14 schools preferred the discrete mode of study, compared to five schools that favoured the hybrid approach and two schools that opted for the integrated model of study (see appendix A for the different schools and their study preferences).

2.3 The current state of IT as a career

It is important for my study to understand the current state of the IT industry. This is relevant as it highlights the need for more people to be involved in technology careers, and the need for more gender balance within IT. According to e-Skills UK (2012), the IT sector required 110,000 new entrants by the end of 2015 drawn from education, unemployment and job switchers to fulfil its potential and more than 129,000 new entrants will need to be trained yearly to sustain the forecast growth of the UK IT and telecoms industry until 2020. As employment in the IT industry is set to grow at a rate of 2.19% per annum - five times faster than the UK average - it is imperative more people are recruited into the sector over the next few years to avoid worsening skill shortages. To date, a number of solutions have been suggested, focusing on increased training, better IT education at school and the promotion of IT in the media, but more still needs to be done to bring people into the profession to meet this forecast demand.

Additionally the proportion of women working in IT is a significant issue, with women making up fewer than 20% of the IT professional workforce (e-Skills UK 2014). Organisations such as the Association for Computing Machinery (ACM), British Computer Society (BCS) Women; a women-only specialist group of the BCS, Women in Science and Engineering (WISE), Women in Technology (WIT), Ada Initiative - Anita Borg Institute for Women and Technology, Girl Geek Dinners and so on, are dedicated to promoting better understanding and participation of women in IT careers and have as one of their goals the increased participation of women in the overall field of ICT. They are currently, and have historically, engaged in various campaigns to stimulate the interest of more women and girls in IT in general and in IT careers.

The lack of girls taking IT-related qualifications at school directly impacts upon the proportion of women that are employed today as IT specialists. It is noteworthy that although girls taking IT related qualifications in Secondary Education are low in number, they consistently outperform the boys. It is arguable, therefore, that if girls were more inclined to participate in IT careers then the pool of talent available to IT employers for the future might improve noticeably (e-Skills 2014).

2.3.1 Issues relating to the proportion of women in IT careers

The lack of girls and women taking IT-related qualifications directly affects the proportion of women that are employed as IT professionals (e-skills 2008; Botcherby and Buckner 2012). Furthermore, a number of issues have been highlighted as the key causes for the lack of women in the UK IT industry today. These include: the lack of knowledge about the breadth of roles in the IT sector, IT being perceived as uncreative, the lack of role models and mentors who are women and how family commitments are affected by working patterns or mobility (part-time working and flexi shifts).

Although all these issues are debateable and vary from country to country, the same factors have been identified by a number of feminist writers, and the implication is that they have global applicability in some respects (Woodfield 2000, EOC 2002, Faulkner

2002, Cohoon and Aspray 2006, e-Skills UK 2008). Experiences of women in IT in the UK are varied. Some women who had previously left the IT sector are trying to return as they feel it is still a rewarding career path, others have left and vow never to return perhaps due to personal experiences or current circumstances, and others attempting to progress into higher status IT-related jobs still feel there is something worth staying for (Women in Technology (WIT) 2009). A study conducted by the Women in North West IT (WINWIT) project investigating the state of gender and the UK IT labour market revealed women report a level of job satisfaction but also painted a picture of overt as well as indirect discrimination, with women often distancing themselves from their gender in an effort to blend in, and where there is both hidden and blatant pay discrimination. Indeed, the study revealed such an astounding level of fear and loathing towards women, it is remarkable that any women at all persevere with an IT career (Adam et al. 2005).

E-skills UK (2010) also stated that other factors discouraging women from embarking on careers in IT include the negative misperceptions about the nature of IT jobs formed during or before early teenage years. Many students, especially girls, are unaware of what an IT career involves and perceive the industry as male-dominated, geeky and complex (e-Skills 2010, Intellect Report 2011). Discussions with girls in general regarding IT careers show this is representative of their current attitudes towards IT careers. Students are not able to select or even consider IT careers for the future because, although they enjoy their chosen and various uses of technology, there is still evidence they contrast these practices with stereotypical images of men using computers. The connectedness and digital mobility that girls take up for pleasure in their everyday lives are not carried through into their perceptions of IT workplaces as potentially leading to ‘cool’ and connected working lives (Gannon 2008). There is a lack of understanding of what a career in computing involves and what an IT professional does (Chan, Stafford, Klawe and Chen 2000, Newmarch et al. 2000, Harris and Wilkinson 2004).

There is evidence that one of the reasons there are fewer women than men in the IT industry is due to gender discrimination. This stems from the stereotypes associated with both sexes: the roots of gender discrimination are built into a plethora of work practices, cultural norms and images that appear unbiased, such as definitions of competence, commitment, and leadership in the sector (Melymuka 2000). These stereotypes can bias people into assuming women can be less suitable than men for IT roles. It is argued that most people do not explicitly notice such phenomena, let alone question the influences shaping their decisions and actions, but nevertheless, they create a subtle pattern of disadvantage that restricts women’s and men’s choices and behaviours (Niederman 2004).

2.3.2 Work environment/gender differentials in the UK IT industry

The lack of women in IT has been the focus of various initiatives in the UK over the last 30 years. These initiatives predominately draw on liberal feminist approaches to the ‘problem of women in computing’ (Moore, Griffiths and Richardson 2006, p.4). From the liberal feminist viewpoint, technology and the technical arena are essentially neutral, and women are socialised away from involvement with technology because they have adopted stereotypes of women’s roles in work and society (Grint and Gill 1995). These stereotypes regarding women and IT affect their attitudes and expectations and, to a large extent, their career choices. This is a point confirmed by Ahuja (2002), who argued that women experience barriers in IT based upon career choices, career persistence and career advancement. She also pointed out that social expectations form a social barrier that creates attitudes that in turn, negatively influence the choice of IT as a career for women (Ahuja 2002). As such, only a change in societal attitudes or gender roles will encourage more women to venture into male-dominated roles, and IT has traditionally been a male-dominated industry. The liberal feminist approach to the 'problem of women in computing', typified by WISE and SET discourses highlights the need to improve the image of, and access to, IT and the need to encourage more women onto computing courses, as well as the need for better equal opportunities and improved management of diversity legislation (Henwood 1996). The 'women in IT problem' first emerged as a reported phenomenon in the late 1970s and early 1980s as it became clear that computing was not the gender-neutral working environment some had hoped and predicted it could be (Panteli and Stack 1999, Woodfield 2000).

Women constituted a small minority of ICT technicians when technology spread into common usage in the 1990s, and they were identified as being in need of support with general ICT literacy. As a result, a number of initiatives backed by the government were designed, set up and put in place to tackle ICT literacy issues (Phipps 2008). These include UK online centres, wired up communities, further education colleges, dedicated women's centres, learn direct, European Computer Driving Licence (ECDL) and Innovative women's ICT training projects, among others (Devins, Darlow and Smith 2002, Selwyn and Gorard 2003, UKRC 2006, Phipps 2008).

Despite all the campaigns and measures suggested and put in place, women are still leaving the ICT workforce in large numbers (Platman and Taylor 2004; Webster 2006; Burns, Griffith, Moore and Richardson 2007). There have been many criticisms of the measures advocated by the liberal feminist approach to address the gender imbalance in IT settings (Cockburn 1986). These include its tendency towards technological determinism, given that it leaves 'technology' largely untroubled and views technology as 'neutral' (Faulkner 2000). The 'individualism' of the liberal feminist approach to the 'problem of women and technology' has also been highlighted, situating the 'problem' as it does with the 'failure' of women to realise the (liberating) potential of technologies (such as the Internet), their 'failure' to engage properly with these technologies in home and workplace settings, and their 'lack' of awareness of the myriad career options made available through technological engagement. One of the main criticisms regarding this approach is that it leaves the culture of IT untouched and implies that if only women could understand the IT sphere better, and change their 'mis'-perceptions, their underrepresentation would be corrected. A significant amount of work has thus been done to detail what is 'wrong' for women within the IT culture and to strengthen the claim their perceptions are not wrong but based on an accurate appreciation of the problems with IT's occupational culture; there are aspects of the IT sector that are masculine and not just male-dominated (EOC 2004, Gatrell 2004, Henwood 1996).

There is more to the 'women and computing problem' than simply adapting the representation of the sector so that more women are attracted to it and, in particular, attracted into high-paid and more prestigious posts, although this is important. As mentioned earlier, with the contextualisation of the 'women and computing problem' comes the highlighting of the unsuitability of the IT workplace for many women: the culture of long hours and presenteeism (Simpson 1998) that exists within IT, the negative perceptions of part-time workers in the IT sector (DTI 2004) and of part-time work more generally (Epstein, Seron, Oglensky and Saute 1999), the instability of the IT market and the deeply ingrained 'masculine culture' of IT. It is alleged that these factors need to change before women can comfortably find a place within the IT industry. Rather than women being forced to adapt to the current IT culture, it is suggested that the IT industry needs to broaden its appeal to a more diverse pool of talent (Platman and Taylor 2004, Women and Equality Unit 2004).

The literature reviewed above seems to suggest that improvements need to be made to education to raise awareness about IT careers and counteract negative perceptions. As well as offering guidance to companies in the IT industry to help them shift ingrained, male-dominated cultures, the creation of positive narratives and championing of role models to combat negative stereotypes is required. The strengthening of female networks and mentoring opportunities has an important part to play, and access to funding links need to be available to encourage more women and girls into new IT start-ups.

Finally, more research on women and technology is required to encourage more girls into technology careers for the future. According to Wajcman (2007) technology is socially shaped by men to the exclusion of women: it has a masculine image not because it is dominated by men, but because it incorporates symbols, metaphors and values that have masculine connotations. There is ample scope for more empirical research on the gender relations of IT, especially nuanced research that captures the increasingly complex intertwining of gender and technology and reflects the diversity of feminist voices (Wajcman 2007: 296).

2.4 Gender differences in perceptions of IT as a school subject

When teenagers, especially girls, have the option to choose subjects, they may decide to discontinue ICT studies due to perceiving it as an ‘unpopular’, ‘uninteresting’ ‘uninspiring’ and ‘boring’ subject. Therefore, understanding the differences in perceptions between the girls and boys who participated in my study could help to challenge any negative perceptions, re-focus dismissive attitudes and explore ways of encouraging girls, in particular, to continue with ICT studies after completion at the compulsory key stages. This in turn could help to keep open the possibility of them considering IT along with other careers of interest.

Teenagers are opting out of IT related courses and subjects at KS3, perhaps because they find the ways IT courses are taught to be discouraging. This filters through to lower participation rates of girls at A-level and degree level. In 2008, the proportion of women choosing IT as a first degree was 15% and the proportion participating at A-level was 10% (e-Skills UK 2008).

2.4.1 Gender differences in subject choices

Lindah (2003) has indicated that when teenagers are expected to and have the right to exercise ‘choice’ (this happens normally towards the end of Year 9 in state maintained schools), they become uninterested in ICT, and the majority of teenagers, especially girls aged 10-14, choose to opt out of ICT for varied and/or complex reasons including media representations of ICT as a subject and career, peer influences, parental influences and the current National Curriculum (SSDA 2004, Anderson, Lankshear, Timms and Courtney 2006, Gras-Velazquez, Joyce and Debry 2009). Another study found that females who thought of computers as machines rather than animate objects were more likely to drop out at the start of an introductory computing course (Nelson, Wiese and Cooper 1991).

Furthermore, research studies by Anderson et al. (2006) discussed other factors that are particularly widely cited regarding the decision of female students not to take up professional ICT career-oriented subjects at secondary and tertiary levels. These included female students associating ICT subjects with a poor image, as being either a 'nerd' domain or as a focal point for undesirable elements of 'male culture'. Perceptions of IT as being 'male-gendered' (Margolis and Fisher 2003) and of male bias in software were also seen as turning female learners away from ICT subjects (Gurer and Camp 2002, Millar and Jagger 2001).

Female students often feel inferior to and/or dominated or intimidated by male students in learning settings (Cisco Systems 2002, Gurer & Camp 2002) which, to an extent, suggests that this could be a function of girls viewing themselves as being low in confidence and awareness with respect to ICT (Association of American University Women (AAUW) 2000, Beckwith, Burnett, Wiedenbeck, Cook, Sorte and Hastings 2005). Additionally, the relative lack of role models and mentors for females among teachers and peers is felt keenly in the later years of school and in higher education, especially as female students tend to perceive ICT negatively and can have poor knowledge about the subject (Newmarch, Taylor-Steele and Cumpston 2000; Anderson et al. 2006).

A study by Graz-Velazquez et al. (2009) presented a similar picture to that found in Anderson et al. (2006). This study confirmed that teenage girls often drop out of ICT studies after secondary school education partly due to the lack of support from role models, persistent stereotyped views that the sector is better suited to men, a lack of understanding about what IT jobs entail, and in some cases, depending on how easy or difficult they find the subject. However, a positive key finding of this study is that girls generally enjoy ICT studies and are competent users of computers and computer operating systems (Gras-Velazquez et al. 2009). Newmarch et al. (2000) suggested that the way ICT is 'taught in schools is a major barrier', and numerous female students find ICT subjects at school uninspiring, especially when they are delivered as 'how to learn software which will be obsolete' within a few years (p.6). For most girls, 'pressing buttons successfully' is not enough: they need to become proficient and effective ICT users with skills to enable them to work with updated or new products without fear (Newmarch et al. 2000, p.3). Dorman (1998) also suggested we should be aiming to 'teach girls how to creatively function within a new technology world' (p.3).

The literature reviewed in this section sheds light on why there is a mismatch between both girls' and boys' participation in ICT studies and their interest in ICT careers. This may stem from the fact that students are able to make the decision to drop out of ICT studies very early during their school life (KS3). Indeed, Gras-Velazquez et al. (2009) suggest that those who do choose to continue generally enjoy IT and are competent users. This is important for my study because it helps to define the issues and suggests methods and ideas on how to address the gender imbalance in ICT.

Enjoyment of ICT as a subject, especially amongst girls, does not automatically equate to an interest in future ICT studies and IT careers. As mentioned above, this may be due to the stereotypical image of IT careers, which suggests the IT industry as being more suitable to boys rather than girls. This informs my study as I look for ways to encourage, though not persuade, girls to consider IT studies and careers for the future.

2.4.2 Gender differences in academic performance

The school national curriculum is taught equally to both boys and girls, but research conducted on behalf of the National Foundation for Educational Research (NFER) found that boys were slightly more likely than girls to find SET-related subjects easy and to enjoy them and that a greater proportion of boys than girls thought SET subjects would be important for their future career and adult life (Blenkinsop, McCrone, Wade & Morris 2006). A study conducted by the Organisation for Economic Co-operation and Development (OECD 2009) also confirmed the findings of Blenkinsop et al. (2006). According to the OECD's findings, not only did 15-year old boys in England find SET-related subjects easy and enjoyable, but they were also a quarter of a school year ahead of girls their age: the boys scored, on average, 10 points higher in the science tests than the girls.

However, there are important underlying gender patterns of competencies in science that should not be ignored, bearing in mind that statistical information and the literature review of the KS1, 2, 3 and 4 results in England show that girls perform better and achieve better grades overall (Burgess, McConnell, Propper & Wilson 2004; UKRC 2009). Boys outperformed girls in ‘explaining phenomena scientifically’ while girls outperformed boys in ‘identifying scientific issues’ (Shepherd 2009, p.2). In the areas of scientific knowledge, boys tended to outperform girls in ‘physical systems’ and ‘Earth and space systems’, whilst in the area of ‘living systems’ girls outperformed boys. Therefore, science assessments must be balanced in their treatment of the different competencies because a test containing an overwhelming percentage of items from the ‘identifying scientific issues’ competency would generate the belief that girls have an advantage in science, whereas a test dominated by items from the ‘explaining phenomena scientifically’ competency would do the opposite (OECD 2009, p.22). These findings, according to leading academics, are still disappointing as they risk reinforcing an outdated stereotype that girls are not suited to SET subjects (OECD 2009).

Statistics from UKRC (now WISE) show fewer girls applying for vocational qualifications (VQ) in IT-related subjects. However, contrary to the lower participation rates of girls in ICT studies, the pass rates are still better for girls than for boys: 83.5% of girls compared to 78.4% of boys passed IT (VQ) and 66.7% of girls and 22.2% of boys passed other subjects at General Qualification Level 1. Girls also did better academically at GCSE-level ICT courses – 48.3% of girls compared to 40.5% of boys achieved A*-C grades. The gap between boys and girls in terms of those taking ICT GCSEs in the UK has narrowed by 6.5 percentage points since 2008; 56% were boys and 44% girls. To date, despite the reduction in the numbers of students overall taking ICT GCSE-related courses (70% since 2005), the proportion of girls taking these courses has increased slightly by 3.5% points since 2004 and girls now constitute 50%

of all students taking ICT GCSE. The proportion of girls who sat an IT-related GCSE in 2013 was 44%, a decrease of 3 percentage points compared to 2012.

Nonetheless, despite the number of A-level IT-related courses continuing to decline in recent years, falling by 43% over the 2003-2011 period (e-Skills UK 2012), the proportion of girls taking ICT A-levels has remained relatively stable in recent years. In 2011, a total of 39% of girls compared to 61% of boys sat ICT-related A-levels, a reduction of 8%. Despite their underrepresentation, girls still outperformed boys in IT-related subjects both at GCSE and A-level, which in turn suggests that girls do enjoy and find IT-related subjects interesting, especially when they perform well in them.

2.4.2.1 Women and IT in higher education

For the past few years, women have consistently outperformed men at university in terms of the proportions of women participating and the achievement of ‘good’ degrees (Equality Challenge Unit (ECU) 2012).[38] Women remain underrepresented in some disciplines, however, and particularly those related to IT and Computing. In 2010-11, there were more female (55%) than male full-time undergraduates (45%) enrolled at university (Universities and Colleges Admission Service (UCAS) 2010/11). However, only 13% of UK applicants to IT-related higher education courses were female (e-Skills 2012). A recent study of higher education highlights the fact that the increase in university fees implemented in September 2012 has led to a decrease in student numbers; the persistent imbalance between supply and demand for university places means that well-qualified individuals miss out on a place (Hinton-Smith 2012, p.6).

[38] A ‘good’ degree is one achieving either of the top two classifications – a ‘First’ or a ‘2:1’.

Education and training, whether formally or informally acquired, provides workers with the capital knowledge, skills and abilities that bring benefits to them in terms of labour market outcomes, as well as to workplaces and society more generally in terms of productivity and social outcomes (Adams and Demaiter 2008, p.353). Therefore, if women were more inclined to participate in IT careers, then the pool of skills available to IT employers might improve noticeably. Computing jobs are comparatively well paid and represent a growing number of opportunities in the workforce (e-Skills 2012); therefore, recruiting individuals of both genders makes good business sense. It has been suggested that diversity in the workforce can serve to provide a richer mix of skills and ideas and the quality of design solutions could actually be enriched by the diversity of the individuals in the IT professions (Lazowska 2002). Whilst the government in the UK has sought to expand female graduate numbers as a means of promoting economic and social mobility, the possibility that increased supply is not matched by demand has been the subject of considerable attention (Chillas 2010, p.156).

2.4.3 Girls and IT – gender and career choice

Despite the fact that girls have continued to outperform boys at both GCSE and A-levels, in STEM subjects they also choose science and technology occupations less readily. This ‘choice’ has been suggested to be biologically determined (Holdstock 1998, Kimura 2001, Gottfredson 2006). However, there is broad agreement in the sociological literature that the ‘choice’ reflects socialisation patterns - the role of parents, educators, careers advisors, friends, peers and society (Crompton and Harris 1998, Henwood 1998, McGrath, Cohoon and Aspray 2006, Woodfield 2007). The view here is that girls are more influenced by role models in their environment, and that the lack of ICT-oriented role models is possibly a dissuading factor for the girls. Their current role models do not see ICT studies or careers as female-friendly and this attitude impacts them negatively (Adya et al. 2006, Gottfredson 1981, 2006). There are barriers to female entry in the workplace that create discrepancies and lead to employer demand based on preferences for a particular type of worker that more readily fit the template of technology occupations. For example, there are currently more males in IT, and assumptions that men are more likely to choose their career over paternal responsibilities. (Crompton and Harris 1998, Henwood 1998, McGrath, Cohoon and Aspray 2006, Woodfield 2007).

Children's perceptions of scientists have been shown to be gendered and to default to a male prototype (Buldu 2006). Historically, some educational institutions, school texts, and curriculum materials have had illustrations which portray scientists as men while women are relegated to domestic and reproductive roles (Cohen and Cohen 1980, Buldu 2006). It has been claimed that such images persist within the IT arena: men are presented as high achievers who are active, skilled and adventurous, whereas women are presented as being passive and submissive:

> Media images more frequently depict computer programmers and developers as male, and women as users. In advertisements of technology products, women are often presented as passive and inexpert users to show how simple some device is to use, suggesting that the computer is [so] easy to use, even women can use it. (Jenson and Brushwood Rose 2003 p.172)

Gottfredson's theory of occupational aspirations places individuals firmly at the centre of the point at which a job role is actively selected, but also relates significantly to the social and psychological forces that have created the individual up until that point

(Gottfredson 1981, Fassinger 1985, Osipow 1990, Woodfield 2007). Gottfredson used the terms ‘circumscription’ to describe career exploration as a process of eliminating and retaining occupational choices and ‘compromise’, which ultimately deals with the implementation rather than the development of aspirations in career choice. She argued that one of the strongest characteristics defining an occupation is its sex-type and an awareness of this develops early in a child’s life; by the age of four or five years, children are aware of key gendered differences of adult roles (Gottfredson 1981). By adulthood, the sex-type of an occupation is generally associated with its actual sex-typing, with 0.85 accuracy, demonstrating how powerfully linked ‘perceptions’ and ‘choices’ are (Woodfield 2007). If a child’s perception of an occupational area – in science, technology or medicine, for example - is ‘masculine’, then they are more inclined to hold stereotypical images of it and its ideal workers. Children develop ideas about the roles of men and women even before they start school, and these are often reinforced by different influences including parents, teachers, the type of school they attend (single-sex or co-ed) and the media. As a result, subject and career choices may be shaped from an early age (EOC 2001), suggesting that the choice to study technical subjects such as Maths, Physics and Technology at secondary and tertiary level is reinforced by these influences and perceptions of gender dominance. For instance, a 2012 study showed that nearly half of all co-educational state maintained schools in England did not have a single girl going on to study Physics A-level (Institute of Physics, 2012). This is a long-standing pattern in both the academic and employment spheres, and is arguably rooted in gender-influenced subject choices at school (Elwood and Gipps 1999). It is suggested that children come to school with learning styles already developed and with an understanding of what is and is not appropriate for them. What they judge to be appropriate, they tackle with confidence, and what they consider alien, they tend to avoid (Murphy 1993). It is further argued that school itself cements these orientations (Woodfield 2007) and that occupational stereotypes are strongly linked to career choices later on (Gottfredson 1981, EOC 2001, Woodfield 2007).

According to Holland (1973) as cited in Anderson (1998, p.142), occupational or career choices are influenced by a set of interacting ‘person-environment variables’, that is, people seek out occupations that match or are congruent with their personality type. Holland defined six categories of personality and occupation: artistic (describing self-expressive and creative people), investigative (describing scientifically-oriented people who enjoy thinking through problems), realistic (describing practical, rugged people who enjoy working outdoors or with their hands), conventional (describing people who prefer highly ordered verbal or numerical activities), social (describing humanistic people concerned with the welfare of others), and enterprising (describing people who enjoy selling, dominating, and leading). As a result, a large proportion of women would neatly fit into the ‘social’ category and seek out careers in social work, teaching, or secretarial work, and a large proportion of working-class men would be equally at home in the ‘realistic’ category, seeking work as skilled or unskilled labourers due to their differing personalities and environmental relationships. However, the strength of the theory lies in identifying specific, measurable traits that allow occupational counsellors to acknowledge the here-and-now demonstration of interest, which helps to improve the occupational choice process (Holland 1973).

2.4.3.1 Biological essentialist arguments about choices and preferences

Biological differences have been cited as one reason why girls are less likely to choose science and technology occupations (Holdstock 1998, Kimura 2001, Gottfredson 2006). Brizendine (2006), an advocate of this approach, suggests that the make-up of the female brain affects girls' subject choices and career aspirations; as such, girls perform tasks, absorb and process information differently to boys and in a manner less suited to SET disciplines. "The Female Brain" (Brizendine 2006), observes that 'male and female brain operating systems are mostly compatible and adept but they perform and accomplish the same goals and tasks using different circuits' (Brizendine 2006, p.7). This has implications for learning styles and the ways in which girls can most effectively be taught, and research conducted for the Department for Education and Skills confirms the differences in learning styles between boys and girls (DCSF 2003).

Brizendine (2006) suggests that the 'female brain' finds it easier to acquire linguistic, auditory and fine motor skills and to exhibit attention to detail; it is more decentralized and more integrated and typically uses a greater variety of parts or locations for a single task than does the male brain. The different developmental stages of the male and female brains are triggered by hormones and coincide with the onset of puberty; hence, the female brain matures two to three years earlier than that of the male. It is also during these teen years that the brain is developing, reorganising, and adapting the neuronal circuits that drive the way a girl thinks, feels, acts, and so on. The brain is unfolding ancient instructions on how to be a woman: this influences girls' views of what is acceptable in terms of careers and subjects (Brizendine 2006).

Research by Brizendine (2006) found that as boys and girls learn differently, single-sex environments allow children to explore the various stereotypical subjects without fear of being ridiculed in front of their peers. Teachers in such environments can kindle a girl's interest in subjects that are not traditionally female and encourage them to dream 'outside the box' and want a career in technology as opposed to a nurturing career. Similarly, teachers in an all-boys environment can teach effectively in ways that reach boys and appeal to their leaning style:

> Intrinsic underlying differences between boys and girls mean that their learning needs differ to such an extent that they can only be met effectively when taught separately. Different levels of physical, psychological and emotional maturity mean that boys and girls are ready for different types of learning at different stages. (Dr Despontin, Headmistress of Haberdashers' School for Girls, Monmouth)[39]

However, contrary to Brizendine (2006), Fabes (2011) suggested that the theory 'boys and girls learn differently' is not supported by brain research since neuroscientists have found few sex differences in children's brains beyond the larger volume of boys' brains and the earlier completion of girls' brain growth, neither of which is known to relate to learning. Differences among the sexes can increase in sex-segregated environments, making positive interactions between boys and girls constrained (Fabes 2011). As another study found, 'positive and cooperative interaction with members of other groups is an effective method for improving intergroup relationships' (Halpern et al. 2011, p.2). A recent review by Eliot (2011) revealed fundamental flaws in the arguments put forward by proponents of single-sex schools to justify the need to teach boys and girls separately. Eliot showed that neuroscience has identified few reliable

[39] Dr Despontin's contribution to the article on the 'What the experts say – A summary of the key findings on the benefits of girls' schools'. Retrieved from http://www.mydaughter.co.uk/girls-schools/ 20/10/2011.

differences between boys' and girls' brains relevant to learning or education. She stated that single-sex school advocates often claim differences between boys' and girls' brains based on studies carried out in adult men and women, but that such effects have rarely been found in children. Therefore the assumption, that because gender differences in the brain have some biological basis they are necessarily fixed or 'hardwired', is incorrect. She concluded:

> Beyond the issue of scientific misrepresentation, the very logic of segregating children based on inherent anatomical or physiological traits runs counter to the purpose and principles of education. Instead of separating children in the name of 'hardwired' abilities and learning styles, schools should be doing the opposite: instilling in children the faith in their own malleability and promoting their self-efficacy as learners, regardless of gender, race, or other demographic characteristics. (Eliot 2011)

Furthermore, according to Vincent-Lancrin's review of gendered cognitive differences as cited by Woodfield's report (HEA 2011), 'neuro-scientific research is yet to find differences in the cognitive capacities of girls' and boys' (2008, p.287, see also DCSF 2009). As well as the unreliability of cognitive test scores per se, their capacity to produce existing gendered attainment patterns has also been disputed (Strand, Deary & Smith 2006). The fast-paced reversal of fortunes for men and women in relation to HE challenges explanations that are over-reliant on relatively fixed, underlying, differences and it is difficult to explain the discipline-specific variations in current gendered attainment patterns with reference to stable discrepancies in ability levels. Some disciplines at this level, accounting and finance and business, for instance, manifest no clear relationship between gender and attainment (Paver and Gammie, 2005). Furthermore stable, underlying, differences would seem unable to explain why some disciplines have changed from being male to female-dominated very quickly, such as veterinary science. Indeed, the pace of some recent HE changes, and the international, institutional and disciplinary variations in the gender gap in HE point to what Richardson has referred to as ‘an intrinsically social phenomenon’ (2004, p.324), with social change-drivers, that consequently can be addressed generally and within any specific HE context.

In spite of the opinions and on-going debates from the biological essentialists, it is arguable that the relationship between gender and career choice is not straightforward. Even if we accept that gender differences between boys and girls are biological, then we are left having to explain the obvious disparities in the take-up of STEM (and other) subjects at school and as career choices. Alternatively, if there really are no biological differences affecting subject choices then the evidence would suggest social and other factors are influencing girls’ choices.

2.4.3.2 Girls and IT – social factors affecting career choice

An important body of research suggests that the childhood socialisation of girls by their environment and families (especially parents) unknowingly yet purposefully enforces the stereotypical behaviour that they are future ‘nurturers’. Even before girls gain an understanding of themselves, or learn about their own individual personalities, social norms already assign what is viewed as acceptable for their gender type. Girls observe their parents’ attitudes towards them through such experiences as being given dolls to play with and pink clothing to wear, while at school they are encouraged to seek ‘nurturing’ careers and are socialised by their peers to avoid STEM subjects. Therefore, it is arguable that if the girls’ socialisation process could involve being exposed to a wider variety of environments and not just observing and participating in what is familiar and known to their parents, peers and role models, then this might encourage them to develop an interest in STEM and other subjects, as well as consider alternative career choices for their future.

Bandura's social learning theory (1977) suggests that people learn through observing others' behaviour and attitudes and the outcomes of those behaviours. Most human behaviour is learned observationally through modelling: from observing others, one forms an idea of how new behaviours are performed, and on later occasions, this coded information serves as a guide for action (Bandura 1997). In relation to children's subject or career choices and their perceptions, Bandura's social learning theory is similar to Gottfredson's approach, which claims that children learn from or by example.[40] It explains how gender similarities and differences occur – sex differences in gender identity and roles result from a learning process that involves modelling, imitation, and reinforcement: for example, boys watch other boys to learn acceptable behaviour, and similarly, girls watch other girls (Bandura 1977). Children learn gender role expectations from an early age and strive to understand social rules that are acceptable.

It has often been argued in psychological and sociological literature that these roles stem from social processes which operate during the development of children to mould them into behaving in ways that are sex-appropriate (Bandura 1997), a process that, in turn, leads them into occupations which are seen as appropriate for their sex, (see also Gottfredson (2006)). Social learning theory, helps to explain why many women select 'feminine' job roles (such as nursing - nurturing, sensitivity) and men select 'male'

[40] Models can influence social, helpful behaviour and they can also affect antisocial, aggressive behaviour when someone gets the benefits of aggressive behaviour, he/she will be more aggressive.

roles (such as computer programming - assertiveness, aggressive) – because this is what they see/gather from the people from whom they copy/learn, and personal attributes reinforce the gender stereotypes associated with these roles (Bussey and Bandura 1984).

Research on teenagers' career aspirations and ambitions (Schoon & Parsons 2002) has suggested that parental educational aspirations, family social status or background, and family income play an important role in shaping their career ambitions, choices and educational performance. This may mean that teenagers from both high and low income families are likely to model their future careers based on the expectations of their family members as role models. This in turn suggests that, if their family do not view IT as prestigious enough or appropriate for their gender or background, teenagers are likely not to pursue such careers.

2.4.4 Gender differences in boys' and girls' participation in IT

Research since the 1980s and 1990s suggests that boys typically use computers more often than girls, both at school and at home, that they dominate technology and commandeer the most up-to-date computer, have higher participation rates in specialist computing classes and computer clubs, and have greater experience of particular activities including programming (Chen 1986, Crawford, Groundwater-Smith and Millan 1990, McKinnon and Nolan 1990, Crombie and Armstrong 1999). Not only is recent research regarding boys' and girls' participation and use of IT still reporting similar findings to those of earlier studies, but research also shows that noticeable gender differences persist particularly in relation to boys' and girls' attitudes towards ICT (Clegg and Trayhurn 2000, Colley and Comber 2003) and between IT use in the home and in school (Kerawalla and Crook 2002, Facer, Furlong, Furlong and Sutherland 2003, Holloway and Valentine 2003). For instance, Colley and Comber (2003) noted that ICT is now much more widely used in the school curriculum and that there is evidence of a reduced gender gap regarding students' use of word processing, graphics, programming, and mathematics applications. Colley and Comber also found no overall gender differences in frequency of use of recently developed technology, such as e-mail, Internet, and CD ROMs. Others similarly found boys' and girls' access and use computers regularly for entertainment, particularly the Internet, although they may use the Internet differently (Volman and van Eck 2001, Gardyn 2003, Papastergiou and Solomonidou 2005).

The research reviewed in this section seems to suggest that girls are open to using and enjoying technology regularly, even though they may do so differently from boys. Therefore, if the gendered image of technology as an academic subject is partly to blame for girls opting out of it, then segregating the girls from the boys could, to an extent, reduce the social pressure on girls not to participate in advanced IT studies, and therefore in turn garner more interest in technological careers.

2.4.4.1 Boys' and girls' participation in IT within schools

The levels of participation in ICT between boys and girls varies, even though the literature suggests there is little difference in ICT activities undertaken by boys and girls at school because most use, especially during lessons, will be directed by the teacher (Selwyn and Bullon 2000; Hayward, Alty, Pearson, and Martin 2003). The differences that do exist between boys' and girls' use of ICT at school may be largely due to boys spending more time at school playing computer games outside lesson time rather than to differences in use during lessons (Wilson 2002, Colley and Comber 2003, Becta 2008). A similar finding in a 2009 study also confirmed there is no substantial difference in ICT knowledge, use, and aptitudes between the boys and the girls in school, that ICT is actually a favourite subject of most British female students, and that some of the girls even plan to study ICT at university (Gras-Velazquez et al. 2009). Therefore, the differences may largely be due to boys playing computer games outside lesson time and/or the 'motivational factor' (Hayward et al. 2003).

One explanation for the difference in the motivational effect of ICT between boys and girls is that the design of educational software and content, as a certain amount of educational software, including pre-school software, has been found to contain a significantly greater number of male characters than female, promoting at a young age the idea that ICT is associated with boys (Aubrey and Dahl 2008). Cooper (2006) argued that the focus on using ICT to raise boys' achievement has meant that the design of educational software has been geared towards the game-like qualities of point scoring and competition that appeal to boys. Cooper cites Littleton et al.'s (1998) research, which showed that girls suffer from lower motivation, higher anxiety, and a decrease in performance when using software of this kind. When girls are given software that is more gender-neutral, such deficits disappear, suggesting that there is nothing intrinsically de-motivating about ICT.

In the study conducted for the DfES, boys were motivated by higher levels of access to ICT, especially ICT activities, which were competitive in nature and short in duration. Girls, on the other hand, needed more support than boys in their use of ICT. Whereas the girls preferred to have an explanation before starting ICT activities, the boys would rather try things out for themselves (Volman, Van Eck, Heemskerk and Kuiper 2005). Hayward et al.'s (2003) study found that, while the majority of boys and girls said that they enjoyed using computers, boys were more likely than the girls to say they found them more motivating than traditional methods of learning. A few of the girls said they found computers less motivating, but the majority said they made no difference. This study found the trend became less noticeable with age. In the survey conducted by Kitchen, Finch and Sinclair (2007), both primary and secondary teachers were more likely to 'strongly agree' ICT had a positive impact on boys' motivation, and that at secondary level, the difference between boys and girls was slightly greater. There was a similar finding in the study conducted by Underwood et al. (2007), where it was found that secondary level girls were less responsive to ICT use than were boys.

Other research studies have suggested girls show less interest in and enthusiasm for ICT the older they get (Saunders 2005; Volman et al. 2005; Christensen, Knezek and Overall 2005). Passey (2004) suggested that an explanation as to why some younger girls may have less interest in ICT might be that teachers in Passey's (2004) research felt that enthusiasm for ICT at school was driven by home access rather than gender – at very early ages, some pupils use ICT toys at home, and the use of these could relate to motivation towards using ICT in school. A lack of such toys for girls could be a limiting factor in the motivation girls have at early ages for ICT.

Research into the link between education and gender seems to provide evidence that ICT can raise the achievement level of boys and help to close the attainment gap between boys and girls. It has been found that interactive learning opportunities involving learning by doing with immediate feedback have been successful (Younger et al. 2005). The use of ICT, especially computer games in schools, also seems to have a positive impact on engagement, and in particular, on school drop outs, who are more likely to be boys (Kirriemuir 2004). Unfortunately, there is considerably less evidence on the impact of ICT on girls' attainment. What evidence there is seems to suggest that, while ICT does have a positive effect on girls' attainment, and while the difference in impact between the genders is not great, ICT seems to have a greater positive effect on boys than it does on girls (Kitchen et al. 2007; Becta 2008). Girls report less positive attitudes and self-efficacy towards ICT than boys (Volman et al. 2005, OECD 2005, Lynch 2007). Boys and girls report different preferences towards ICT-related tasks and applications. For example, girls are more positive towards communicative-oriented tools, like creative writing and teamwork applications, while boys are more explorative in their use of ICT. There also seems to be a slight tendency towards boys displaying a preference for individual learning with ICT, whereas girls are more likely to prefer collaborative learning (Volman et al. 2005).

2.4.4.2 Boys' and girls' participation in IT in the home

The level of boys' and girls' participation in IT outside of the school environment, which means primarily in the home, for either leisure or learning purposes tends to vary between the genders. Eurydice (2005) suggested boys have more experience of using ICT out of school, use it more freely and consider themselves more capable at advanced ICT activities, such as downloading and programming. Boys are also more likely to be experienced in the use of video games for entertainment purposes from a very early age (Colley 2003, Kent & Facer 2004). Girls, however, use technology more often than the boys for social networking and creative purposes, such as setting up their own website or creating an online photo album (Ofcom 2008).

Mobile phones are another area of technology where girls are also significantly ahead of boys in terms of both their use and ownership. According to Ofcom (2008), amongst children aged 12-15, girls show a significantly higher level of mobile phone use than boys. The girls use their mobile phones for a broader range of purposes, such as texting, instant messaging, accessing the internet, shopping, photos, and music, compared to the majority of boys who use their phones for few activities other than basic phone calls.

These patterns of girls' engagement with technology seem to suggest that in order to encourage them to consider further ICT studies and careers in technology, it might be helpful to teach more collaborative and creative applications that can be applied to social networking use via handheld devices, such as tablets, iPads and mobile phones.

2.4.5 General computer access and usage

Generally, levels of access to technology and computers have improved, although recent literature still highlights persistent gender inequalities with regards to accessibility and use (Clegg and Trayhurn 2000; Colley and Comber 2003). Regarding students' attitudes to computers, females are commonly identified as having less positive attitudes towards computers than males (Kramer and Lehman 1990; Jackson et al. 2001; Mitra, LaFrance and McCullough 2001). As mentioned earlier, girls in classroom settings are portrayed as less confident, more tentative and more anxious computer users and as having lower levels of self-efficacy, particularly in relation to programming and Computer Science

(Chen 1986, Crawford et al. 1990, Colley and Comber 2003). In the 2005 DfES study of home use of ICT, it was found girls were significantly more likely to have either no access to a computer or to have access to only one computer or laptop at home, whereas boys were more likely to have access to two or more computers or laptops (Valentine et al. 2005). Similar findings in other studies also suggested boys tend to be more enthusiastic about ICT than girls and that they purchase their own ICT hardware and software for leisure use (Holloway and Valentine 2003). However, there were not many differences identified in home access to the Internet; in the UK Children Go Online study, 74% of boys and 73% of girls had Internet access at home (Livingstone and Bober 2005). As ICT in the home covers a wide range of technologies including games, consoles, mobile phones and electronic dance mats, it is important to note that the pattern of differences between boys' and girls' access to these various technologies is not uniform.

2.4.5.1 Internet use

The available literature provides conflicting evidence regarding the use of the Internet outside of school. As mentioned earlier, considering that the Internet offers a wide range of activities, from fact finding and downloading music to website creation and blogging, the gender differences are not clearly marked. Tapscott (1997) argued he could not see any differences between how girls and boys use the Internet when he studied what he termed the 'Net generation' or 'N-Gen' (N-Gen are people born after 1977). In the study, Tapscott predicted that because N-Genners have grown up in the digital age, when they reach maturity, there will be equality between the sexes on the Internet;

indeed, statistics from the Carlsson and Facht (2002) study showed girls and women are as frequent Internet users as boys and men.

In the more recent research study UK Children Go Online, Livingstone and Bober (2005) found that boys use the internet slightly more frequently than do girls, and do so for longer - approximately an hour a day compared to half an hour for girls - whilst the Ofcom Media Literacy Audit (2006) study found girls spend slightly more time using the Internet than boys. Similarly, in the UK Children Go Online study, Livingstone and Bober (2005) also found that girls reported lower levels of online skills and self-efficacy. However, according to Ofcom (2006), 97% of 12-15 year old girls said they were confident about using the Internet compared to 94% of boys.

Arguably, the literature seems to suggest that differences in the boys' and girls' use of the Internet may be down to what they are doing online rather than a lack of confidence on the side of the teenage girls.

2.4.5.2 IT use for homework and school work

Some research indicates differences between boys' and girls' use of IT out of school with regard to schoolwork. Valentine et al. (2005) found that - although boys have greater access to hardware and spend more time using computers outside of school for leisure purposes - compared to boys (15%), girls (50%) were more likely to use the computer for school work, especially for subjects they enjoy, such as English, History and Science (Valentine et al. 2005). The only subject boys were more likely than girls to use a home computer for schoolwork was ICT. This suggests ICT use is more influenced by attitudes towards the subject than attitudes towards technology itself. In addition, girls are more likely than boys to say that they use the Internet for schoolwork (Ofcom 2008).

2.4.5.3 General recreational use of IT

As stated above, there are noticeable differences between boys' and girls' use of IT for leisure purposes. Valentine et al. (2005) found that boys are more intensive users of IT at home for leisure, and this gendered pattern of IT use is established as early as Year 2 (7 years old). Kent and Facer (2004) found that 46% of boys compared with 35% of girls reported using the computer for fun every day, and that more boys (82%) than girls (58%) reported liking 'digital activities' outside of school (Kent and Facer 2004). These differences, however, should not mask the fact that girls do spend a significant amount of time using IT for leisure purposes, particularly for online social networking; writing; developing artwork; cropping and editing photos; creating music; and producing invitations, booklets and diaries (Valentine et al. 2005, Ofcom 2008, Goldfein 2011, Crouch 2012).

Playing games, one of the main recreational uses of IT, is another interesting area identified as accounting for many of the differences in girls' and boys' use of IT out of school (Kent and Facer 2004). Valentine et al. (2005) found boys (70%) use game consoles at least once a week compared to girls (32%). Girls are also less likely to be intense game players and more often play games when bored rather than as a first choice activity (Kirriemuir and MacFarlane 2004). The British Broadcasting Corporation (BBC) commissioned a report (BBC 2005) about the UK game-playing population, which found that while the gender split amongst gamers was not large (45% female to 55% male), those who play games more frequently were more likely to be male (27% compared to 21% female). Ofcom (2008) also found that boys reported higher use of games consoles than did girls and were far more likely to cite games as the media activity they would miss most if it were taken away (21% of 12-15 year-old boys compared to 3% of girls). Also identified were major differences in the kind of games boys and girls like to play; for instance, boys tend to prefer sports, action adventure, and violent action games, while girls prefer educational games, puzzles, and fantasy adventure (Valentine et al. 2005, Redmond 2005).

Social networking, another popular recreational use of IT, has become an integral part of teenage life. Social networking starts young, with just over three-quarters (76%) of 13 to 14 year-olds having visited such sites and three out of four (75%) teenagers currently having a profile on a social networking site. Social networking penetration is higher among girls and older children; 94% of girls aged between 12 and 15 years belong to at least one social networking site compared to 85% of boys aged between 12 and 15 years (Nicholls 2012, Stoller 2010, Crouch 2012).

Facebook is the most popular site among British teenagers, with one study finding two-thirds (68%) identify it as their main social networking site, compared to 6% who said the same about Twitter and 1% who named MySpace, GooglePlus, or another social networking platform (Rideout 2012). In 2012, 80% of 12 to 15 year-olds used Facebook and 70% of teenagers in this age group claimed to log in most days of the week (Nicholls 2012).

Research conducted by Nicholls (2012) also found that 69% of 12 to 15 year-olds now share links on a social networking site (up from 63% last year), and the majority (64%) usually click on the links their ‘friends’ share. A significant minority of this age group also engage with consumer marketing via social media, with 41% agreeing with the statement ‘I keep up with a brand, product or company via a social networking site (for example, by becoming a ‘follower’ or ‘liking’ it on Facebook)’, and this is slightly more popular among girls (44%). Teenagers are becoming more conscious of their online footprint, more aware of the potential dangers thereof, and more knowledgeable about how to manage their online identity and presence (Rideout 2012). This trend is more prominent among 12 to 15-year old girls (85%) compared to boys of the same age (73%), and they have put in place restrictions to limit who is able to view their profile page (Nicholls 2012).

Facebook is proving to be an important platform for 12 to 15-year olds, to document their leisure time as well as to fill it. Half of all Facebook users upload photos at least once a week (59% of girls). On average, girls have about 226 friends compared to 184 for boys and girls are responsible for most of the ‘poking’ on Facebook (Goldfein 2011, Crouch 2012).

This research suggests teenagers, especially girls, are avid users of various social networking sites, which they are increasingly using for ‘micro-blogging’, playing games, posting pictures, and various other services. Most teenagers have at least one or more social networking accounts and girls are more likely than boys to log in daily and use social networking. This has implications for my study as it is arguable that their increased knowledge and use of IT means that there is a greater reason for teenage girls (and boys) to consider careers in technology.

2.4.5.4 Gender and computer programming

Turkle (1984) theorised that boys and girls approach computer programming differently. Girls, she suggested, tend to be ‘soft’ masters while boys are almost exclusively ‘hard’ masters. Hard mastery involves the imposition of will over computers through the implementation of a premeditated plan. Soft mastery, however, is more intuitive and interactive. It involves ‘tinkering’ and is the approach of the artist who works with materials. In this instance, she described girls as task-oriented users who focus on the utilitarian functions of computers and on the end product compared to males, whom she described as power users who are machine-oriented and for whom the computer is a toy to be manipulated for its own sake. Boys were reported to be individualistic and competitive in their computing orientation and girls more socially inclined.

The inconsistent and sometimes contradictory findings of the studies cited above suggest that gender should be seen in combination with a number of factors, such as socio-economic status, ethnicity, identity, pedagogy and classroom management, which can influence how boys and girls use technology and the impact that use has on them. Ultimately, it is no more true to say technology is engaging and appealing to all boys than it is to say that technology is unappealing to all girls (Littleton, Wood and Chera 2006), though the research reviewed so far shows girls are generally not motivated by the use of technology for its own sake. The stereotypical notion of computers being the domain of males still exists, as does the tendency for the content and design of software to favour boys' interests and preferences. This leads to girls' lack of confidence and perceived lack of ability, hence the lower numbers of girls interested in IT as a career or engaging in more advanced use of ICT especially in the areas of gaming and programming.

2.4.6 Computer clubs for girls (CC4G)

Computer club for girls, popularly known as CC4G, was introduced in 2005 as one of the government initiatives to encourage and increase girls' participation in IT. Its objectives were to improve their confidence, skills, and attitudes towards IT, and to foster an interest in possible IT careers. The aim of the club was to use a single-sex learning environment to encourage 10-14 year-old girls to become more interested in computers. CC4G was available in a number of schools, (especially all-girls schools), which was beneficial as it presented girls with the opportunity to use ICT without the fear they would have to compete with boys (Valentine et al. 2005).

The club, originally funded by the Department for Children, Schools and Families, for state maintained schools in England, has also been introduced into a number of independent girls schools, which, according to CC4G's own evaluation, has enjoyed considerable success. Around 66% of members reported they were more likely to consider a technology-related career, and 96% of club facilitators interviewed believed girls' ICT skills had improved as a result of their involvement in CC4G, while 90% believed participation would have a positive impact on girls' achievements across the KS3 curriculum (Becta 2008). Unfortunately, a recent assessment and evaluation study

(Fuller, Turbin, and Johnston 2013) on the success of CC4G seems to suggest that the initiative raises questions about the conceptualisation of the ‘problem of girls and IT’ and the solutions to be adopted.

Norms about what aspects of IT suit males and females clearly persist, as do gendered ways of talking about and valuing different types of IT jobs (e.g. hard and soft metaphors), and CC4G seems to fall short of the challenge associated with more radical strategies for tackling the gender imbalance, that seek to expose the gendered social constructions and discourses that underpin debates about the gender gap (Fuller et al. 2013).

Around 3,000 schools currently run CC4G, with a membership of more than 100,000 girls. The aim is for 150,000 girls in 3,600 schools to eventually benefit from the clubs. The software used for CC4G is designed to appeal to girls, with subject matter for projects chosen to encourage them to develop their skills. Through collaborating on projects, they also develop interpersonal skills, such as leadership and team work.

The consensus from industry research is that CC4G has not quite achieved all its aims, as a majority of the girls who attend the club at the various schools have not found it as engaging, challenging, interesting and helpful as was hoped, perhaps due to its subject content.

2.5 Conclusion

This chapter has introduced key themes and literatures relating to my research focus on 14-year olds' perceptions and choices of IT as an academic subject, a possible career and in relation to their general technology use. As has been established, IT is such an integral part of our lives that it is now required to be embedded across the school curriculum. Evidence has been presented in this chapter to underscore the importance of IT in schools. The various modes of delivery of this subject mentioned above have their limitations and advantages; schools have to review and decide which model will be the best to incorporate into their IT curriculum to allow the delivery of engaging and inspiring lessons. An assessment of the NC for KS3 and KS4 has been attempted as well as a review of 14-year olds' subject choices, how these choices are made and teenagers' initial perceptions of IT.

The chapter also discussed the current state of IT as a career in the UK, reviewing women currently working in SET occupations and the issues relating to the proportion of women currently in the IT industry. The problems, such as the low numbers and proportion of women coming through HE and the various skills they possess as well as the work environments and gender differentials, have been reviewed. This chapter has also focused on teenagers' perceptions of IT as a subject and as a career, gender differences, academic performance, career choice, as well as IT participation, use and engagement with technology amongst boys and girls both as school and at home. It concludes with a brief overview of CC4G, an initiative put in place to encourage more girls into IT careers.

Although an over-focus on the image of IT as a career and its culture has been criticised, it is arguable that there is still some benefit to be gained from exploring teenagers' subject choices, and their perceptions of IT and of what working in IT entails, in order to discover whether gendered perceptions at this key stage (KS3) of their educational and career development can be identified. The aim is not to demonstrate that participants' subject choices and perceptions are 'wrong', but to explore what these perceptions consist of at 14 years of age when these choices are made, and, comparatively, to explore whether gender and school variance (single-sex versus co-educational) can be meaningfully linked to teenagers' early occupational intentions in relation to IT work.

Choices and perceptions play a key role in all learning. Some essentialist theorists have argued 'choice' is biologically determined while sociological research has provided persuasive evidence that various social factors are more influential. Choice cannot be considered simply as one event occurring at a particular point in time, but should be viewed as a series of events which includes an individual's history/experience up until the point at which the subject/career choice is made (Anderson 1998). According to Super (1953), each person (male and female) has a different set of values, drives and motivations that are influenced by childhood experiences and serve as an initial set of goals that have a bearing on the process of choice. Perceptions, on the other hand, occur when a person gives meaning to an external stimulus or sensation in this instance, the perceptions of men and women attributes and roles, which have an influence both within and across groups in the form of attitudes and beliefs about what men and women are good at and at the level of the individual and his or her identification with stereotypical beliefs (Colley 1998). Notwithstanding the evidence of structural constraints in the occupational IT sector that make it more amenable to men than women, ‘perceptions’ and ‘choices’ at age 14, whether they are right or wrong, will play a significant role in driving women and girls away from choosing an IT-related occupation, as well as driving men and boys towards it (Bartol and Aspray 2006).

Using research data collected at 21 schools in a southeast London Borough education authority, this thesis seeks to explore teenagers’ recent perceptions and identify what role they play in forming academic and career choices, and whether identifiable gender differences at this stage are contributing to the general ‘women in IT’ problem. The ultimate aims of my study include the attempt to encourage (though not persuade) more girls to consider rather than reject IT as a school subject and career choice at the earliest opportunity.

Chapter Three: Research methods

3.0 Introduction

The research methodology includes both a discussion and an exploration of why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data has been collected and how the collected data has been analysed (Kothari 2009).

This chapter is split into two main sections. The first part gives a brief but general introduction to conducting research with young people and to research design, and then proceeds to detail the access negotiations undertaken before the research began. There is a brief discussion about the research participants with an emphasis on the expectations and implications of their recruitment for this research. The section then goes on to reflexively explore the research methods used as part of this process. Finally, research ethics are discussed in detail. Part two begins with a detailed narrative description of how this research was conducted, followed by a reflection on the fieldwork activities in general and a concluding summary of the entire chapter.

3.1 Research methods and design

Research methods are the particular strategies used to collect the evidence necessary for building and testing theories (Frey et al. 1991). For research to be organised and reliable, different methodologies are adopted and adapted to the particular context within which the research is undertaken. The methods used in the collection and analysis of data can be qualitative, which usually indicates an emphasis on words, or it can be quantitative, which indicates an emphasis on numbers (Bryman 2012). Philosophical assumptions, strategies of enquiry, and specific research methods define the variations between the two (Creswell 2003). Hanson (2008), however, argued that these sociological approaches have converged and can be integrated with each other in order to strengthen the research design (Patton 1990). This mixed methods approach (Creswell 2003) may include sequential procedures whereby a qualitative method is used for exploratory research, followed by a broader quantitative study to produce reliable statistical data that are more representative of the population. Alternatively, concurrent or consecutive procedures can combine qualitative and quantitative data collection in order to allow a comprehensive analysis of the research question, and the capacity to explore the findings emerging across the different data sets produced by the mixed-methods approach.

During the initial stages of this research, while I was considering how to proceed, a focus group was held with eight of my associates and work colleagues, all women, working in different capacities within the IT industry. The topic (The ‘underrepresentation of women working in IT’) was offered for discussion, and the group gave a number of reasons for the ‘lack of women’ in the IT departments of various companies. Understandably, most of the contributions and suggestions made during this session emerged from the fact that participants’ focus was mainly the IT industry itself, although the perceptions of teenagers and children were mentioned as a barrier. In conjunction with a literature review, a decision was taken to focus upon giving a voice to the teenagers.

Exploring this line of thought for this research affirmed my decision to use a mixture of qualitative and quantitative methods, which included participatory action research, questionnaires, creativity maps (focus groups, participant observation), group and individual interviews, and elements of comparative research. These methods were used in the research during the creativity sessions and fieldwork to explore the perceptions of 14-year olds' with regard to: IT as a subject, IT as a possible future career, and their general experiences of using IT.

Participatory action research is an approach for learning about and engaging with communities, as well as a creative learning process that involves a team of local people from local groups, services, and organisations working together to share, reflect on and analyse their experiences (Chambers 1983, 2008). It combines an ever-growing toolkit of participatory action research and visual methods with interviewing techniques and is intended to facilitate a process of collective analysis and learning. The approach can be used in identifying needs and in planning, monitoring, or evaluating projects and programmes. PAR places equal value on the knowledge and experience of local people and on their ability to come up with solutions to problems that affect them. As a powerful consultation tool, it offers the opportunity to go beyond mere discussion and promotes the active participation of communities in the issues and interventions that shape their lives (Thomas 2004).

3.2 Choosing a research method

An initial review of literature on the issues of conducting research with young people cited participatory methods as ‘child-friendly’ and ‘child-centred’, based on children’s own competencies so as to enable them to have a say in how they are represented to others (Gallacher et al. 2005). In addition, because of the embedded methods and tools, such as questionnaires, the visual tools - creativity map exercise, participant observation, group/individual interviews, and their flexibility of application, which is at the core of participatory research, I was convinced that this would be the best method for this research. Thus, the research design was centred on participatory action research methods, which, for the purpose of my study, can be defined as research in which the participants interact with the researcher to enhance the growth and development of the participant as part of the desired outcome (Bell, Cheney, Hoots, Kohrman, Schubert, Stidham & Traynor 2004).

3.2.1 Conducting research with young people

Children and young people are increasingly regarded as a group for whom having greater power and knowledge, and consequentially, a ‘voice’, is vitally important (Clark 2004, p.4). Political changes have attempted to bring children and young people to the fore, and the United Nations Convention on the Rights of the Child (1989) states children are entitled to have their voice heard regarding situations and contexts that affect them. In this research, it is important that the voices of 14-year old teenagers are heard as the study focuses primarily upon them and their perceptions of IT.

Effective research with teenagers depends on engaging them in age-related and culturally appropriate activities, which involves using a range of age-sensitive techniques, such as questionnaires, visual techniques (creativity maps), observations, interviews (group and individual), and so on. As part of this research, a creativity session[41] was conducted with the 14-year old teenagers, during which they completed the questionnaire, then with the use of the creativity map started a discussion amongst themselves and also wrote down their perceptions. Following this, interviews were undertaken with the participants. Rather than just collect their data, I discussed their concerns and questions regarding IT careers. As cited in Gottfredson (1981), people aspire to occupations that are familiar to them; therefore, part of the 'participatory' element in this research (the interview) involved the 'action' research element whereby participants were exposed to details of an IT career (to produce that familiarity).

PAR methods have been used in research projects such as the Health and Cancer Prevention Knowledge Project (Oakley et al. 2005) and Assessing Media Influences on Middle School Aged Children's Perceptions of Women in Science Using the Draw-A-Scientist Test (DAST) (Steinke et al. 2007). These projects involved a substantial input from young people and the project outcome made a significant contribution to the understanding and perceptions of minors within the project area in question. In projects where situations are complex with no clear line of inquiry to follow, PAR can also contribute to advancing theory and knowledge along with achieving practical results (Bell et al. 2004).

[41] This will be discussed in detail as part of section 3.7

As commented in Lloyd-Smith and Tarr (2000, p.61), it is essential within education to listen and consult with children as 'the reality experienced by children and young people in educational settings cannot be fully comprehended by inference and assumption'. A participatory research approach is very popular in projects that focus on children and young people's perspectives. Participatory methods are designed to be child-friendly and child-centred, based on children's own competencies so as to enable them to have a say in how they are represented to others. It is claimed that they can be emancipatory and democratic, respecting children's agency as individuals in their own right, and have an advantage over more traditional methods in accessing the authentic perspectives of the children being researched instead of the perspectives of the researcher (Gallacher and Gallagher 2005). Although most of the literature acknowledges the valuable contribution children and young people generally can make to research (Hood, Kelley, and Mayall 1996; Mahon et al. 1996; Morrow and Richards 1996), research such as Alderson (1995), Ward (1997) and Kirby (2001a) indicated that young people and children can be much more active participants in the research process when appropriate methods are deployed. Academics in the education field are now also becoming aware of the benefits of involving pupils/students in research (Nixon et al. 1996) and acknowledge the importance of pupils' views playing a valuable part in promoting changes in both teaching and learning (Gross 1997).

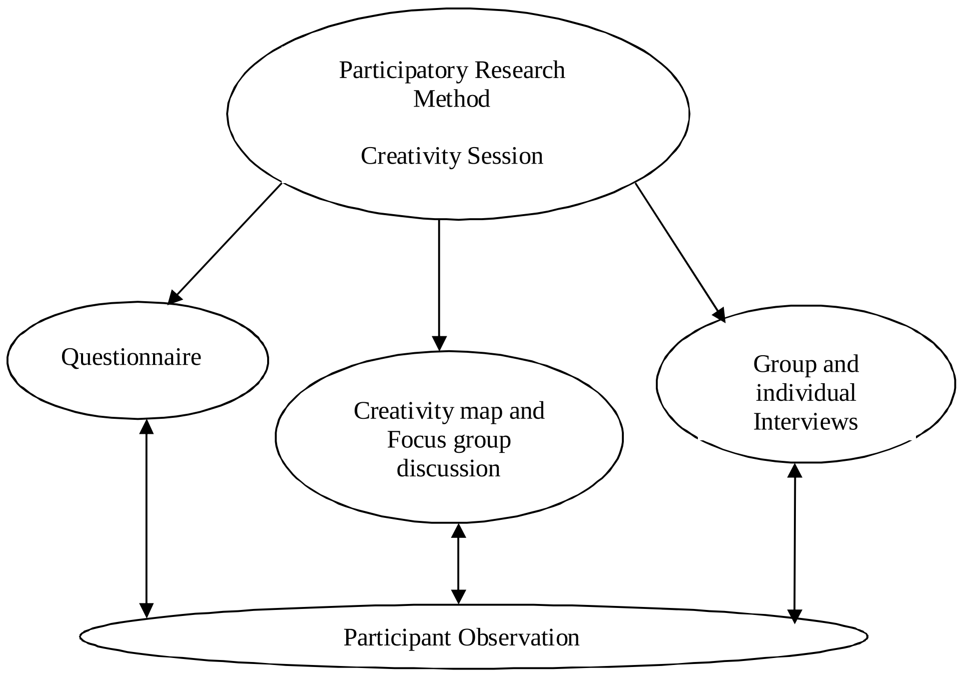
The value of participatory research methods is that they can be used at any stage of a project or programme cycle as a means of ensuring full stakeholder participation, especially from the targeted beneficiaries and service users (Chambers 1983). Participatory research seeks to 'de-elitise and de-mystify research, thereby making it an intellectual tool' that ordinary people (such as children/teenagers) can use to improve a situation (Tilakaratna 1990, p.1). Although participatory research methods have been criticised for lacking the methodological rigour and technical validity that is considered the gold standard of academic research by some, it is suggested that the weakness is a necessary trade off of a collaborative and adaptive research design. Supporters suggest that sacrificing some level of methodological and technical rigour is well worth the additional face validity and practical significance that is gained through adopting a participatory research approach. Additionally, many academic supporters would assert that there are ways to conduct participatory research that are sound by academic standards if one were to adopt a 'typical' qualitative research design that accounts for qualitative quality criteria, such as accountability, credibility, transferability and reliability. Furthermore, evaluating one's work against the 'seven 'I's' proposed by McNiff and Whitehead (2009)[42] will help ensure that a participatory research project adheres to qualitative research quality criteria. As part of my study, the combination of qualitative and quantitative tools selected during the research design phase helped to provide the necessary checks and balances to ensure that the research quality criteria were met.

With an exploratory focus in mind, the design for this research encompassed both qualitative and quantitative approaches. The procedure employed to conduct the research made clear the basic strategies adopted to develop evidence that is accurate and interpretable and deals with the selection of participants and the preparations for data collection. My study was designed in various stages, and although each stage can be considered in isolation, it is important to emphasize that each step is closely related to

[42] The role of the different 'I's in order to achieve research quality is as follows, in order of increasing analytical complexity: your actor-agent 'I', explanatory 'I', researcher 'I', scholarly 'I', critically reflexive 'I', dialectically critical 'I', and your meta-reflexive 'I'.

the others; the components, although mentioned only briefly below, will be discussed in detail later on in the chapter (see fig 3.2.1 below for the research components).

Fig 3.2.1: Research model



3.2.2 Participatory research with the schools in my study

Participatory research methods encourage the use of visual techniques, and these were used in this research (creativity map) in conjunction with the questionnaire, focus group/discussion, and the group/individual interviews.[43] I held formal and informal meetings with the research participant schools to discuss issues surrounding 14-year olds' subject choices and perceptions, as well as a creativity session with the teenagers as part of the research process. During the meetings and creativity sessions, the main priority was to ensure knowledge and experience with the research participants was

[43] These will be discussed in detail at the following sections: 3.2.3, 3.2.4, 3.2.5 and 3.2.6.

shared and different perspectives were recognised and included, as well as getting the participants to work in teams on practical tasks where required. Attempts were made to ensure that the use of visualisation (drawings) and analytical tools did not isolate or exclude any of the research participants (such as the visually impaired): the creativity map was printed on A3 paper in colour, and an open-ended creative learning process was adopted. The teenagers sat in small, manageable groups and were able to discuss and collaborate with each other (focus group style). Nothing was imposed on the research participants; they were advised at the start of the session of their right to withdraw from any of the activities should they feel uncomfortable or feel their rights were being compromised. However, none of the participants withdrew; they were cooperative and very helpful during the sessions and were also eager to have their voices and views heard. 'Factual misperceptions' were balanced by counter-evidence and discussions with the teenagers during the entire session.[44] Overall, the research process was collaborative. This was achieved by applying the principles of participatory research diligently.

Participatory methods use flexibility to allow different groups within a community to articulate complex and non-quantifiable cause-and-effect processes and to have a potential and a role that goes beyond simply augmenting and complementing 'conventional' research (Holland and Blackburn 1998). According to Kirby (1999), involving young people as researchers is a good way of collecting good quality research data and is entirely appropriate and proper if, for example, an academic researcher wishes to carry out in-depth research about the lives of young people, as in this current research, where in-depth understanding is required about the teenagers' perceptions

[44] This will be discussed in detail in the Research Ethics section – 3.6.

regarding IT. The PAR approach also provided a forum for this research to gain a better understanding of the rationale behind the choices these teenagers make and their perceptions. However, it also allowed me to provide information back to the participants after I had successfully collected data from them on their perceptions. At this end-stage of the research I did provide information to 'correct' mis-perceptions that they had sometimes held. In this way the research had an action research element common to many PAR studies, as the flow of information from me to the participants changed the research terrain at that point. Consequently, participants' perceptions of IT careers might be recorded differently in the questionnaire and creativity map exercise than it was in the interviews following my intervention. Table 3.2.2 below shows the chronology of the data-collection points and details where I provided information to the participants that could alter their perceptions.

Table 3.2.2: Participatory research: creativity session tasks in order of occurrence:

Task	**Activity**	**Intervention***
1. Questionnaire	Students: I provided the students with basic instructions on how to complete the questionnaire. The students were filling in the details on the questionnaire provided. While the students were completing the questionnaire, I was walking round and responding to any questions asked regarding completing the questionnaire	No
2. Creativity Map/ Focus group exercise	Students: I advised the students to write down, as a group, their perceptions and anything they feel regarding IT as a subject and as a career. Participant Observation – I walked round during the session just observing what the students were producing and listening into their conversations. **The IT map was created with relevant images of IT (provided by me) to stimulate reflection and discussion	No**
3. Group/Individual Interviews	Using my interview guide, I asked the students questions individually, and as a group. The students responded to my questions as well as asking some of their own. In the process of responding to their questions, I provided information regarding IT careers.	Yes

* Research Intervention – where knowledge/information was passed from researcher to student on IT careers.

My aim in undertaking this element of action research in my study was to provide the participants with an opportunity to have up-to-date, clear and positive information about such careers. Examples of the kinds of information given at this stage included: telling the participants what kind of roles in non-IT organisations are classified as IT professional roles, average salaries of IT professionals and expected working hours. I will assess whether this had a positive impact on their perceptions later in the thesis.

3.2.3 Designing the questionnaire

A questionnaire is defined as a document containing questions and other types of items designed to elicit information appropriate for analysis (Babbie 1990 p.377). A questionnaire can also be viewed as a well-established tool within social science research for acquiring information on participants' social characteristics, present and past behaviours, their standards of behaviour or attitudes and their beliefs and reasons for action with respect to the topic under investigation (Bulmer 2004). Questionnaires are used to gather the opinions of a larger group of people than could be reached by interview or focus group alone (Lemanski and Overton 2011). The construction of a questionnaire is an important part of research as well as other information collection activities because the analyses, outcomes, general conclusions, recommendations, recommended policy and areas identified for future research can depend on how well a questionnaire is constructed (Acharya 2010).

There are various types of questionnaires, such as structured (Sarantakos 2005), unstructured (McGuirk and O'Neill 2005) and semi-structured (Bird 2009). As part of my study, I designed a semi-structured questionnaire with a combination of both open and closed questions. This included ‘perception’ questions, to which participants had to respond only ‘yes’ or ‘no’, or just had to tick their preferred answers. I also used a Likert-type scale for the ‘perception’ questions, ranging from ‘strongly agree’ to ‘strongly disagree’.[45] At the start of the Creativity session, the questionnaires were handed to the teenagers with a note describing the research and what was required of them to complete the questionnaire. Also, a verbal introduction was given to make sure that the teenagers were comfortable with the requirements; as advised in Oppenheim (1992), the teenagers were all assured that anything written by them on the questionnaire would remain confidential and anonymous. They were made aware of their right to refuse to answer any questions with which they were not comfortable. For those students who needed extra help or clarification with information on the questionnaire, I was able to attend to all participants as and when required, rather than allowing the teachers to assist in this part of the exercise; this meant the teachers did not have an opportunity to read the students’ comments or influence their responses. The collection of the questionnaires after completion was solely my responsibility so as to eliminate teachers’ temptation to review the questionnaires. Thus, the teachers had no opportunity to ask or see the individual students’ completed questionnaires.

As stated earlier, the questionnaire was semi-structured with a mixture of pre-structured and unstructured questions starting with more personal, specific and pre-coded questions then moving on to more generic or open questions (Sarantakos 2005, McGuirk and O’Neill 2005). The benefits of this style of questioning were that none of the teenagers were disadvantaged, especially in this case, where some of them were not very well informed of their perceptions of IT and were yet to develop a structured

[45] See Fig 3.2.3 in appendix A of the appendices for a sample of the questionnaire used for this research.

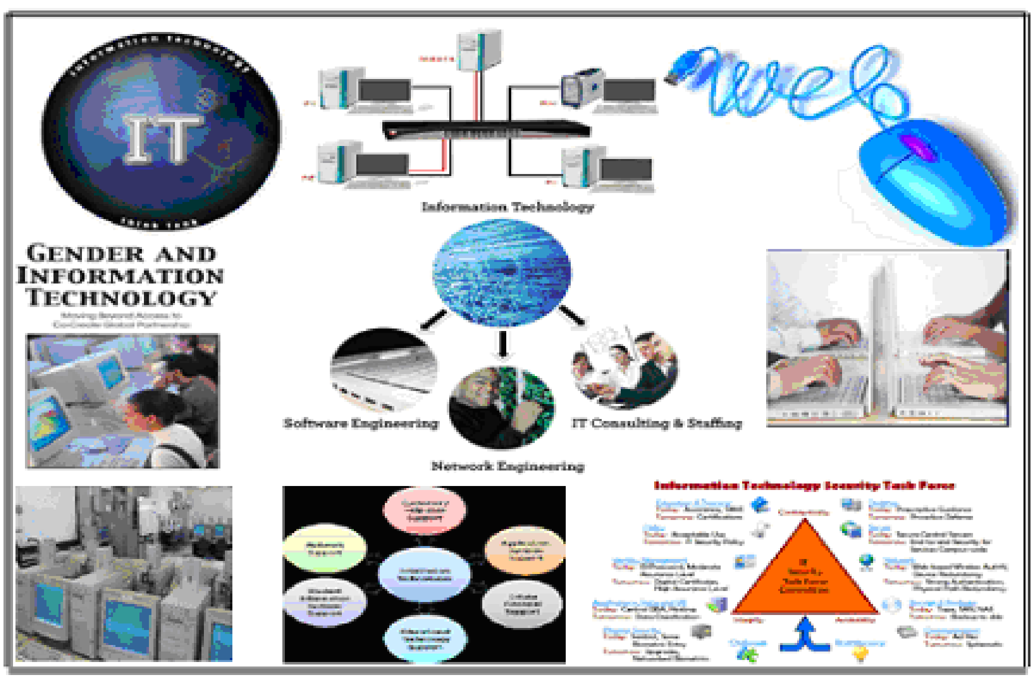
opinion. Also, as most of the teenagers were unfamiliar or unknown to me, I could not gauge their attitudes, their ability to communicate or their motivations, so the use of this style of questioning meant the questionnaire catered suitably for all abilities. I was able to gain more in-depth insights into the teenagers' attitudes, thoughts, perceptions and actions (Kendall 2008, Bulmer 2004). The questionnaire helped to provide evidence of patterns amongst the teenage participants and, in turn, I was able to use the information provided by them to probe further into their perceptions as the questionnaires were completed before the interviews were conducted. In effect, data analysis started almost immediately, with the teenagers providing clarification of things they had written or said. The use of the questionnaire also helped identify further lines of enquiry during the creativity session.

The use of questionnaires avoids interviewer bias, guidance and cues that can affect the validity and reliability of the data collection (Sarantakos 2005; Bryman 2008, 2012). Questionnaires do have their limitations in the sense that they do not provide opportunities for motivating respondents to answer the questions and can be seen as over-reliant on instruments and thus disconnected from everyday life. In addition, the measurement processes create a spurious or artificial sense of accuracy (Bryman 2008, 2012), and the results generated can be threatened by many factors, such as faulty questionnaire design, sampling and non-response errors, biased questionnaire design and wording, respondent unreliability, ignorance, misunderstanding, reticence, bias, errors in coding and processing and the faulty interpretation of results (Oppenheim 1992). However, I am convinced that the use of a questionnaire for my research was invaluable because questionnaires can produce generalizable results as a result of the large sample sizes involved (Oppenheim 1992) and the answers could be used to triangulate the qualitative data and vice versa.

3.2.4 Designing the creativity map

One of the issues identified from the literature I reviewed and from conversations held with my own children, who at the time were in KS3 and KS4, was the lack of awareness of IT careers in general and the prospects that IT careers offered. With this in mind, I decided to design a creativity map that showcased different images of IT and its components, including the words ‘gender and information technology’ (as seen in Fig 3.2.4(1) below) to direct the research participants towards viewing IT as inclusive and acceptable to both boys and girls. The activity was for the teenagers to write what they thought of the images and to provide a visual portrayal of their ideas, especially in terms of what IT meant to them.

<u>Fig 3.2.4(1): Creativity map</u>



As, part of the creativity map activity, which was started immediately after the completion of the questionnaire, the participant students were in discussion groups - similar to focus groups. Depending on the total number of students per creativity session, the teenagers were in focus groups of six or eight per table. For this activity, the students, already seated in groups, had pens, markers and paper to put down their perceptions from their brainstorming session (short focus group). There were several of these focus groups within the computer room (in a group of 16 participants, two focus groups were operating at the same time). The students nominated a leader to write down the information they came up with and the rest of the group volunteered their ideas and perceptions.[46]

3.2.4.1 Focus groups

Focus groups are a form of group interview (brain storming session) that capitalises on the communication between research participants in order to generate data (Kitzinger 1994). There are many other definitions of a focus group in the literature, but features like organised discussion (Kitzinger 1994), collective activity (Powell and Single 1996), social events (Goss and Leinbach 1996) and interaction (Kitzinger 1995) identify the contribution that focus groups make to social research. Focus groups explicitly use group interaction as part of the method; instead of the researcher asking each person to respond to a question (as in a group interview), the research participants are encouraged to interact by talking to each other, asking questions, exchanging anecdotes and commenting on each other’s experiences and points of view (Kitzinger 1994, Marczak

[46] See Figs 3.2.4(2) through to Fig 3.2.4(15) in appendix A of the appendices for examples of information produced from the focus groups (brain storming) with the aid of the creativity map.

and Sewell 2005, Morgan 1997). The size of focus groups tends to vary: groups can be made up of between three to 15 people, and although the recommended number of people per group is usually six to 10 (MacIntosh 1993), some researchers have used as many as 15 people (Goss and Leinbach 1996) or as few as four (Kitzinger 1995). Some researchers have used only one meeting with each of several focus groups (Burgess 1996) while others have met the same group several times.

The use of these short focus group (to explore the creativity map, see fig 3.2.4(1) above) in the context of my study was highly valuable as it was used to help draw upon the participants' attitudes, beliefs, experiences and reactions in a way which would not have been feasible using other methods: 'Attitudes, feelings and beliefs may be partially independent of a group or its social setting, but are more likely to be revealed via the social gathering and the interaction which being in a focus group entails' (Gibbs 1997, p.2). Kitzinger (1994, 1995) argued that interaction is the crucial feature of focus groups because the interaction between participants highlights their view of the world, the language they use when discussing an issue, and their values and beliefs about a situation. Interaction also enables participants to ask questions of each other, as well as to re-evaluate and reconsider their own understandings of their specific experiences.

Focus groups elicit information in a way that allows researchers to find out why an issue is salient as well as what is salient about it (Morgan 1988). As a result, the gap between what people say and what they do can be better understood (Lankshear 1993). If participants reveal multiple understandings and meanings, multiple explanations of their behaviour and attitudes will be more readily articulated. The use of a focus group embedded within the creativity sessions complemented the other research tools used as it provided a dialogue and brought together and made sense of the interviews as well as the other activities during the session. Some of the areas explored by the teenagers had not even been considered by me, especially in the areas where the teenagers perceived that the content of what they were learning in IT was not appropriate for developing an interest in a future IT career.

There were limitations to the use of a focus group in this research, such as not having complete control over the session (Gibbs 1997). Since there were two focus groups going on at the same time during the main session, there was less control over the data produced (Morgan 1988) and over the interaction between participants in relation to the questions they asked each other and how they expressed their doubts and opinions (Gibbs 1997). It was possible that while moving between the different groups, I may have missed information that I could have probed for in more detail, especially in the larger groups where there were five sessions held at the same time, and where recording did not capture all the information as it was muffled. However, the benefits still outweighed the limitations, as I was able to watch the sessions that were video recorded at a later date and then code carefully in detail.

3.2.5 Designing the group/individual interviews

Interviews can be viewed as a directed conversation for a specific purpose using a question-and-answer format, or as a meeting between two or more people face-to-face to accomplish a known purpose by discussion (Beatty 2002). There are different types of interviews, such as structured, standardized, unstructured, semi-structured and so on, but for my study and during the creativity session, the preferred type of interview adopted to avoid bias and distortion was the semi-structured interview.

A semi-structured interview is a managed verbal exchange (Ritchie and Lewis 2003, Gillham 2000) and, as such, its effectiveness depends heavily on the communication skills of the interviewer (Clough and Nutbrown 2007). These include the ability to structure questions clearly (Cohen, Manion and Morrison 2007); listen attentively (Clough et al. 2007); pause, probe or prompt appropriately (Ritchie and Lewis 2003, p.141); and encourage the interviewee to talk freely, i.e., ‘make it easy for interviewees to respond’ (Clough et al. 2007, p.134). Interpersonal skills (Opie 2004), such as the ability to establish a rapport, perhaps with humour and humility, are also important, as is the relational aspect and trust, which is needed between participants.

The semi-structured style of interviewing helped in the sense that I had only three main questions on the interview schedule,[47] but I was able to vary the sequence of the questions depending on the conversation with the teenager at hand. Semi-structured types of questions are frequently rather more general in their frame of reference than those typically found in a structured interview schedule, and another important dimension to the interviewing style was the flexibility to ask further questions in response to what were considered significant replies (Bryman 2012).

Interviewing is a key process in participatory research as it is used to collect information, then to reflect upon and analyse it. The ‘face-to-face’ element involved in

[47] See Fig 3.2.5 for the schedule which lists the three main questions asked during the interview; follow-on questions were asked based on the responses from the individual teenage participants.

interviewing is appropriate where depth of meaning is important and the research is primarily focused on gaining insight and understanding (Gillham 2000, Ritchie et al. 2003). It could also be argued that choosing to interview face-to-face acknowledges the potential significance of context.

Interviewing was of great benefit to this research as it put me in a better position to use the results as a knowledge base for understanding the students, and in documenting the results for wider dissemination (Tilakaratna 1990). Interviews generate different types of information and are particularly useful for eliciting quite specific, individually held information. Thus, interviews can be used to ascertain unique views not presented elsewhere and to gather general and commonly shared information. Especially in this case of teenagers' perceptions of IT and IT careers, careful planning was undertaken with the help of useful tips from the literature reviewed in Kvale (1996) regarding the ten criteria for a successful interviewer.

As part of the 90-minutes creativity session, 45 minutes were dedicated to interviewing the group. The students were already split into groups of six, eight or 10 per table; they were interviewed as a group and individually, they were not taken away from the computer room or to a secluded corner to be interviewed individually but were interviewed at their tables. I started the interview with a general discussion of what IT careers are all about, before proceeding to ask the questions on the schedule to which students responded by raising their hands to attract my attention. I also asked questions by focusing on students individually. The students wore name tags so I could use their names during this part of the session. Based on their responses, a number of follow-on questions were asked. Some of the students also asked questions to get a better understanding of the prospects of IT-related careers, and I responded to their questions with as much accuracy and care as I could. These group sessions involved a continuous process of responding to the various questions the students were asking.

Although semi-structured interviewing was beneficial to my research, it is also important to recognise and address some of the weaknesses that this method might have. Denscombe (2007) discussed research demonstrating how people respond differently depending on how they perceive the interviewer, that is, the interviewer effect. The sex, age and ethnic origins of the interviewer have a bearing on the amount of information people are willing to divulge and their honesty about what they reveal (Denscombe 2007, p.184); this extent of the problem is dependent on the nature of the topics being discussed. Gomm (2004) described demand characteristics, which is when interviewees' responses are influenced by what they think the situation requires. This is one reason why it is important to make the purpose and topics clear at the beginning of an interview and to seek to put the interviewee/s at ease. For instance, in some of the sessions, especially those where the students were known to me (the Wazobia Youth Club children), the teenagers were very vocal and expressed their views and discussed their perceptions freely without any inhibitions, whereas in some of the other sessions, the students needed prompts before they would say anything at all. I was addressed differently in the various sessions; some called me 'Miss', 'Mrs Ibegbulam' or 'Elizabeth'. It is possible that some of the students were not active contributors because they were too shy to participate in the discussion, or did not feel part of the session because of the way they were selected, or had no interest in or knowledge of the topic being discussed.

Patton (2002) discusses a number of issues experienced regarding semi-structured interviews: for instance, topics may inadvertently be missed or comparability be reduced because sequencing and wording will probably be different in each interview, but what is potentially lost is gained by allowing interviews to develop their own coherence, which in itself can be analysed. For instance, I asked a student if they would consider IT as a possible career for the future. They responded negatively, but went on to discuss the lack of availability of career advisors both in the schools and outside the school environment. As mentioned previously, semi-structured interviewing depends significantly on the skill of the interviewer; interviewees may say what they think the interviewer wants to hear or the opposite of what they think they want to hear. Therefore, subsequent checks and probes should be put in place to prompt responses and check the validity of them where there are doubts.

In my study, I used the questionnaire to triangulate information provided by the students during their interviews. Reviewing the students' contributions identified some instances of contradictions with what they were saying. What the students wrote down during the creativity (map)/focus part was sometimes different to what they put on the questionnaire – both in the closed-ended questions and the open-ended questions - and to what they said in the interview itself. A key task of the researcher is to pull from the various data sources so that the whole evidence, when analysed and written up, is convincing, credible, and reliable (Patton 2002).

All the interviews conducted during the creativity sessions were recorded, apart from in three of the schools (Oak, Ash and Maple Schools), which objected to the recording of their sessions.[48] In those schools where the session was not recorded, I had to document the teenagers' responses through handwritten notes. My expectation during the creativity map exercise was to interview the teachers involved during the sessions, but the teachers did not give their consent to an official interview. This was quite unfortunate as it would have been an ideal opportunity to obtain a better understanding of the educational policies implemented by the individual schools and the teacher input with regard to career choices, especially that of IT for the 14-year olds. I felt that the teachers were knowledgeable and aware of the problems the teenagers faced when making the right decisions for their subject choices and possible careers. An interview would also have been a good opportunity to obtain the teachers' views on what was happening in the schools with regards to the ICT curriculum and the teachers' role regarding the teenagers' attitudes in relation to IT. Some of the teachers did make off-the-record comments regarding their consistent failure to recruit enough student interest to run IT subjects/modules beyond Year 9. These have been included in the overall analysis of the data set.

3.2.6 Participant observation

Participant observation is 'a field strategy that simultaneously combines document analysis, interviewing of respondents and informants, direct participation and observation and introspection' (Denzin, 1989 pp.157-158). The essence of participant observation is the immersion into the settings, cultural practices and daily activities of the people who are the focus of the study. Through participant observation,

[48] There was no particular reason cited as to why they objected to the recording. On the day of the creativity session, the teachers were asked to confirm if they were happy for the session to be recorded, but they advised that they were not happy, but were more than happy for the students to complete the questionnaire and contribute fully to the research by answering questions and writing down their thoughts on paper.

relationships are formed with people (in this instance, the teenagers) who, in turn, teach the researcher to see the world through their eyes. This translation of everyday experience and knowledge acquisition in the field into the rigorous conduct of participation is rare and of benefit to research inquiries (DeWalt and DeWalt 2011).

Participant observation techniques were used in this research during the creativity sessions with the teenagers. As the term ‘participant’ suggests, I was part of the session, participating in the same activities as the teenagers being observed rather than just being an observer. In my capacity as ‘participant observer’, I was on hand and so was able to take down field notes, answer questions as and when required, conduct interviews based on the open-ended questions prepared for the session, and gather other documents that were produced by the teenagers (drawings and notes), as well as observe the proceedings of the day. There were seven creativity sessions in total (one per school and one with a mixed group from the Wazobia Youth Club). The teenage research participants worked individually while completing the questionnaire, which was the first task of the day. They then worked in groups during the creativity map task, which was the second activity. The students had an opportunity to swap groups during the session and work collaboratively with other sets of teenagers. The creativity sessions for the schools were held in the computer suite, while the one held with the Wazobia Youth Club was in a purpose-built meeting room. During the sessions, the teenagers visually and verbally expressed their perceptions of IT as a subject and as a possible career, but also were involved in describing IT through healthy debate, speaking, and role-playing, and by drawing designs and pictures. See figures 3.2.4(2) through to 3.2.4(15) in appendix A of the appendices for examples of information generated by the students.

Participant observation is beneficial as it gives insight into context, relationships and behaviour. Also, it can provide information previously unknown to the researcher: ‘As I sat and listened, I learned the answers to questions I would not have had the sense to ask if I had been getting my information solely on an interview basis’ (Whyte 1981 p.300). Participant observation also offers a number of advantages to researchers; in their guide for field workers, DeWalt and DeWalt (2011) advised that participant observation enhances the quality of the data obtained during fieldwork, as well as the quality of the interpretation of the data, whether those data were collected through participant observation or by other methods. Participant observation is thus a data collection and analytical tool, and it encourages the formulation of new research questions and hypotheses grounded in on-the-scene observation (DeWalt and DeWalt 2011). During the creativity session, I was privy to a number of ‘at-the-side’ informal conversations at the various tables. In one particular case, the teenagers were discussing how IT is not introduced to them as a career, which is why no one really considers it as a possible career choice, and how they had never thought of IT ‘in that way’ (as a job). Here, participant observation as a powerful tool to interpret the data helped me to understand and document what the students specifically meant when they said ‘in that way’. This will be discussed in Chapter Five (IT as a career).

Participant observation does have its limitations in the sense that it can be very subjective as it relies heavily on the subjective interpretation of the researcher, whose experiences cannot necessarily be replicated. Also, as pointed out by Hammersley and Atkinson (1983), there is the danger of the researcher ‘going native’, which means being too involved, or having ‘too close’ a rapport with the person or persons being observed to the extent that objectivity is lost. Although in the course of the creativity map exercise and interviews, I did become close to some of the students (I was able to relate well to them as I have children of similar ages), and some of them were personally known to me, to counteract this and eliminate any ambiguity or bias, I attempted to carefully document only what was heard and seen, rather than relying on assumptions.

The documentation of field notes can also be very problematic as the notes can contain a lot of confidential information, which may not be appropriate for wider circulation; this is especially so in this instance, where some of the information derived from teenagers who stayed back to help clear up after the creativity sessions and made further comments. These were not recorded but were documented in the field notes. Similarly, conversations with, and observations of, teachers around the sessions were informative and were fed into the overall considerations of the findings.

Participant observation is less suited to research situations where the researcher is an outsider and not so familiar with the area (Hammersley and Atkinson, 2004), but the advantage for my research is that I straddled the insider/outsider divide. Southeast London Borough was a familiar territory to me: I currently reside in the area and have a personal interest in and relationship with some of the schools because my children have attended them or I know teachers from them, and I am involved with the Youth club.

Bryman (2012) reflected on the personal beliefs, interests and feelings (values) of a researcher and argued that research that simply reflects the personal biases of its practitioners should not be considered valid and scientific because it is bound up with the subjectivities of its practitioners; however, he subsequently went on to say that such a view is held with less and less frequency among social scientists nowadays because it is not feasible to keep totally in check the values that a researcher holds (Bryman 2012). Durkheim (1858-1917) wrote that one of the corollaries of his injunction to treat social facts as things was that all ‘preconceptions must be eradicated’ (Durkheim 1938, p.31, cited in Bryman 2012). Since values are a form of preconception, his exhortation was at least implicitly concerned with suppressing them when conducting research. His overall position is unlikely to be regarded as fully credible today because it is now widely acknowledged that the researchers’ values can materialise at any point during the course of the research. The researcher may develop an affection or sympathy for the people being studied that was not necessarily present at the outset of the investigation, and this is more prevalent in participant observation where the researcher can develop a close affinity with the people whom they study to the extent that they find it difficult to disentangle their stance from their subjects’ perspective (Becker 1967). However, it is important to constantly reflect on the risks associated with developing overly subjective readings of situations and data.

As in Bryman (2012), my personal values and judgements may have possibly intruded into the research process at some point in the design, especially as I have children in secondary school who actually do enjoy IT as a subject. Even though it is widely reported as a ‘dull’ and ‘boring’ subject, and many teenagers are relatively ignorant of the possible IT careers, my children are fully aware of them. I work in an IT environment as a consultant and have an understanding of the issues surrounding women and IT. My view is that the stereotypical environment does exist in the sector, but also that this does not mean women cannot thrive in IT-related careers and progress in their chosen paths. However, during the research, my aim was to mitigate any possible bias my work and family experiences might give me via the use of various research tools and methods, and by maintaining a reflexive perspective on the relationship between the data and my own thoughts and experiences. It is hoped that the checks and balances put in place during the design, the quantitative tools used in the research, the selection of schools, and the recruitment of the participants were sufficient to counteract and reduce the effects of unintentional personal bias.

3.2.7 The pilot study

The pilot study was the first research creativity session conducted with the Wazobia Youth Club group.[49] This group was used to test all of the activities created for this research, especially regarding the timing of the activities. I wanted to ensure that the session was targeted appropriately for my participants; ensuring, for instance, they would have time to complete the questionnaire in a future session, that it was reasonably easy to respond to and sufficiently engaging so that the teenagers did not get bored. Following on from the test run session, future planned sessions were tweaked slightly as a result of lessons learnt from the pilot. The pilot session confirmed that the questionnaire and other research activities were pitched correctly for my target audience (teenagers), so I was able to observe how those teenagers addressed issues that are of importance to them and how they reacted to IT in general.[50]

[49] Wazobia, which means ‘come’ in Yoruba, Hausa and Ibo - the three main local Nigeria languages, is a children’s/youth club for children born to Nigerians in diaspora. The club meetings are held once a month, and the children learn about their Nigerian heritage, Nigerian values and the Nigerian culture.

[50] The pilot session was included as part of the main research due to limited numbers of research participants.

3.2.8 The comparative aspect of the research

Comparative research is a tool that aims to make comparisons, namely to identify, analyse and explain similarities and differences between research units and across different countries or cultures (Ragin 1987). The aim of comparative research is to understand a situation better when compared to two or more meaningfully contrasting cases or situations (Bryman 2012). For the purposes of this research, the comparative tool was adapted to explain fully the similarities and differences between gender, specifically boys' and girls' perceptions of IT in general, as a subject that they are taught at school and as a possible future career option. To some degree, I have placed a comparative emphasis on the school type (single-sex versus co-ed) to understand if IT fares any better or produces a different or similar outcome in relation to interest and uptake in the future; and to identify if there is a case for arguing that single-sex education/classes may be the way forward to promote IT as a subject and future career, which is viewed in the literature as 'stereotypical' and as more acceptable to boys than girls.

Throughout this research process, various cases were reviewed and compared to highlight the similarities and differences between genders in relation to participation rates for IT. The findings section will provide a detailed analysis of both school environments (by gender), information gathered from the teenagers during the creativity map/short focus groups task, as well as data collected from the interviews and the completed questionnaires.

3.3 Negotiating access

Gaining initial entry to research sites has been widely identified in the qualitative research literature as a potentially difficult, but informative part of the research process; overcoming challenges in this aspect remains one of the main tasks of fieldwork (Hitchcock and Hughes 1995, Hammersley and Atkinson 2007, Bryman 2012).

The literature reviewed regarding the issue of access highlighted a number of concerns. Feldman, Bell and Berger (2003) viewed access in light of building relationships and sustaining them, where building a rapport with people behind doors and learning from them is essential. Viewing access from this relational perspective makes it more of a continuous and dynamic process where every individual relationship in the field deserves unique attention when starting or ending the research, although Hammersley and Atkinson (2007, p.41) thought access mainly to be a ‘thoroughly practical matter’ where intra- and inter-personal skills need to be developed. They considered theoretical understanding and the ability to identify access hurdles and discover ways of overcoming them to be the most important issues. Hammersley and Atkinson (2007) further argued that the access negotiating process constitutes a significant part of the research, rather than being merely a step on the ladder, because knowledge of the context of research settings is essential for data interpretation.

It is important to consider the skills that will enable researchers to gain access to the organisations and/or to the respondents’ true views. In this regard, some studies tend to focus on those skills that enhance the possibilities of opening doors, and there is a body of literature on the pragmatic side of the process of negotiating access, which considers some aspects of researchers' experiences in different contexts (Armstrong 1987, Darlington and Scott 2002).

Finally, it is important to be aware of the researcher's position as either an insider or outsider and the power relations that might be in place, especially in relation to action research (Coffey 2002, Feldman et al. 2003, Denscombe 2007). The question of what contributes to building a trustful relationship in such an environment is a difficult one, but it is crucial that researchers reflect upon it (Feldman et al. 2003).

Gaining access requires a developed reflexivity that needs to be built on an understanding of the macro-political context in which access is negotiated. Troman (1996) argued that the macro-level changes contribute to shaping participants' and gatekeepers' responses to access requests. In such environments, Walford (2001) believed, researchers need to excel in the art of selling themselves and their research through more effective micro-level interactions during the access negotiations process.

Taking into account the concerns identified regarding gaining access, careful planning was undertaken during the initial stages of developing the research design for this project. I sent a Letter of Intent to Conduct Research[51] to nine carefully selected secondary schools in the Southeast London Borough, (a mixture of independent and state-maintained schools). Some of the research participants, the schools, and the location were familiar to me and so access negotiations could commence from this point. Access was also achieved with the help of personal contacts. This familiarity

[51] See Fig 3.3(1) & 3.3(2) in appendix A of the appendices for a sample copy of the Letter of Intent to Conduct Research.

avoided difficulties with the practical aspects of gaining or negotiating access with gatekeepers, which can often be a very time consuming and problematic process (Cook and Crang 1995). For the schools where there were no personal contacts, a number of cold calls were made, and emails were sent to target schools using the information published on their websites. In relation to some institutions, it was not possible to overcome the barriers raised by the secretaries or receptionists, who often acted as initial gatekeepers, and two of the schools denied access completely, citing busy schedules. However, the persistent cold calling paid off; interviews were secured and arrangements made for meetings with the appropriate people in four of the target institutions. These were usually the head teacher, the head of Year 9 or the head of IT.

Before the start of the fieldwork, I telephoned the local contacts at all of the secondary schools to ascertain whether an access agreement document needed to be sent to the gatekeepers. Their response was that the document was not required and that a photocopy of a CRB disclosure certificate would suffice.[52] As suggested by the school gatekeepers, I kept the original copy of the disclosure while on the school premises during the research activities so it could be presented if required. At some of the schools this was inspected by the teachers, who were also involved in part of the research activities.

[52] Criminal Records Bureau (CRB) disclosure, now called Disclosure and Barring Service (DBS) is a check undertaken for applicants applying to work in jobs where certain people could be at risk. Anyone who wishes to conduct research with minors (children, teenagers etc.) will require this check to be done as a standard procedure.

3.4 Research participants and recruitment process

For the purpose of this research, a total of 164 teenagers (79 boys and 85 girls) from 21 different secondary schools in the Southeast London Borough area were recruited as participants.[53]

Table 3.4(1): List of schools and participants

School	Sch Type	Boys	Girls
Cherry School	AC - Boys	1	0
Ash School	AC - Mixed	8	8
Elm School	GR - Girls	0	1
Rowan School	GR - Girls	0	2
Violet School	LEA - Boys	1	0
Krimsone School	LEA - Girls	0	1
Goldenrain School	LEA - Girls	0	1
Juneberry School	LEA - Girls	0	2
Beech School	LEA - Girls	0	18
Pine School	LEA - Mixed	8	8
Willow School	LEA - Mixed	13	17
Oak School	LEA - Mixed	30	20
Maple School	IND - Boys	16	0
Hawthorn School	IND - Boys	2	0
Linden School	IND - Girls	0	1
Snowbell School	IND - Girls	0	1
Tulip School	IND - Girls	0	1
Yellowreed School	IND - Girls	0	1
Dagwood School	IND - Girls	0	1
Unicorn School	IND - Girls	0	1
Fringe School	IND - Mixed	0	1
Total		79	85
Key: Ind = Independent AC = Academy LEA = Local Educational Authority GR = Grammar (Grammar schools are LEA selective schools)			

[53] The list of 21 local secondary schools featured in the research includes six main participant schools (as highlighted in table 3.4(1) below) and a mixture of 15 other schools attended by the teenagers from the Wazobia Youth Club. See Table 3.4(2) in appendix A of the appendices for a detailed profile of the schools.

Initially, as mentioned above, I sent a Letter of Intent to Conduct Research with a brief summary of the research activities to be conducted, to nine schools.[54] The letter was followed up a week later with a number of phone calls to the individual head teachers of those initial schools to confirm if the letters had been received and if a meeting could be arranged to discuss the research further. Initial feedback from some of the schools was promising, especially from Oak School, where there was a personal relationship and familiarity with the head teacher. For some of the other schools, progress was more problematic and access negotiations lengthier.

At first, some of the schools were not certain they wanted to be part of the research but, at the same time, did not want to reject the request outright and were willing to meet up for further discussions. Head teachers were concerned about whether the school calendar would be able to accommodate three 90-minute sessions during the term as the students were busy and had other commitments. As a result of this particular feedback, the research activities were adjusted and the sessions reduced to one 90-minute session for the actual completion of questionnaires, the creativity map exercise, the group/individual interviews and the discussion, as well as for answering any questions and addressing any concerns. I agreed with the schools that I would come back at a later date to hand out £10.00 Love2shop vouchers to thank participants for their time and to address any further concerns or questions the teenagers may have. My email address was also provided on the research brief that was handed to the students as part of the consent slip so that participants could forward any extra queries they wanted to be addressed.

[54] See Figs 3.3(1) & 3.3(2) in appendix A of the appendices.

As I was interested in the actual subject choices made by the students, as well as their perceptions of IT as a possible subject choice, I also requested that these be made available to me as part of the research process. The schools committed to do this once the students' subject choices had been finalised, at the end of Year 9 and the first few weeks of Year 10. In due course, towards the end of the first term in Year 10, I contacted the schools, supplying a list of research participants, and the school secretary provided the information.

After two meetings with the head teachers of the various schools to discuss the format of the agreed research activities, seven out of the nine schools that I initially approached agreed to participate in the research, with the proviso that they would select the research participants. The two schools that declined participation (an independent co-ed boarding school and an independent day school for girls) advised that they were unable to commit to the research due to what they cited as 'bad timing' and an already 'full academic calendar'. The final selection of schools (the seven that agreed) was a mixture of single-sex and co-ed schools within the independent and the state sector.

Unfortunately, as discussed in Bryman (2012), research does not always go according to plan: one of the seven confirmed schools, an independent day school for girls, pulled out of the research on the day of their creativity map exercise and, given the short notice, a replacement school could not be sourced. As stated in Townsend and Burgess (2009), there is a need for flexibility and perseverance in research; the research design was able to accommodate the disappointment of the school pulling out. Its non-participation did not have any noticeably adverse effects on the rest of the research. According to the school's head teacher, some of the parents had objected to the research being conducted using the girls' actual names. The school was happy for the research to go ahead but, as advised, the students' real names were required initially to make it possible to link the comments and perceptions of the students correctly, with pseudonyms being used in the writing up of the research findings.

According to Bryman (2012, p.389), reliability and validity are important criteria in establishing and assessing the quality of research. Mason (1996, p.21) also argued that reliability, validity and generalizability are important kinds of measures of the quality of the research. Rigour and the wider potential of the research are achieved according to certain methodological and disciplinary conventions and principles; as such, validity refers to whether the researcher is observing, identifying, or measuring what they say they are measuring (Mason 1996, p.24). As stated earlier, it was therefore very important that accurate and reliable data were recorded before any substitutions were made.

The schools themselves took responsibility for selecting participating students and teachers. The original intention was for students to be selected randomly, possibly using the school register, but as has been outlined above, most schools that agreed to take part wanted to select the participants themselves. There is a possibility, as in Potter (1996), that the students were selected by the teachers based on efficiency or convenience; furthermore, sometimes, evidence is collected from those people who are easily available to support the research arguments, thereby potentially skewing the data. The teenagers in some of the sessions seemed exceptionally knowledgeable and articulate, which may indicate there might have been some selection by anticipated behaviour or sets. Lincoln and Guba (1985), however, have emphasised that one guiding principle of sampling in qualitative research is convenience, and an important consideration in sampling is whether there are people available who will allow data about them to be collected.

During the research activities, the main schools provided one or two teachers who worked on a rota of 10-15 minutes each during the creativity session. They were on hand to assist and ensure the activities were conducted in an acceptable manner (as agreed by the school) and in line with the rules regarding conducting research with minors. At all times during the research activities, there was a teacher present in the room to assist. This was quite beneficial to the entire process as it meant the teenagers were very co-operative and demonstrated good behaviour throughout the session; however there is a possibility that the presence of the teachers during the creativity map exercise influenced the teenagers' responses.

Apart from the seven schools selected, an additional 18 teenagers were recruited from the Southeast London Borough local community Wazobia Youth Club. This group of teenagers were initially recruited to act as a test platform for my research activities, to sample the questionnaire and the creativity map exercise, but thereafter contributed to increase the number of participants. The teenagers (boys and girls) were made up of students from 15 different local schools from both the state and independent sector. The selection criterion was students in Year 9 or aged 14 years old, and recruitment was by announcement and by informing parents. I handed the parents a copy of the research activities document and briefed them verbally about the activities, after which they verbally consented to their children participating in the research because all were from the same community and knew me personally. The research exercises for these children were undertaken as part of the Youth club activities for the day.

3.5 Reflections on the research methods used

For my study, a mixture of various research methods, both quantitative and qualitative (participatory action research, questionnaire, creativity map exercise, focus groups, participant observation, and interviews) were used to collect and analyse the data. The act of mixing methods in research is not a new phenomenon; Tashakkori and Teddlie (2003, 1998) used the term ‘mixed methods research’ to refer to all procedures for collecting and analysing both quantitative and qualitative data in the context of a single study. So, although I am not referring to mixed methods here as a methodology in its own right, the term ‘mixed research methods’ refers to the mixture of the various methods that I used as part of my study. This research benefited from the use of mixed methods (through data analysis and logical explanations or observations) or triangulation (Johnson 1997, Benz and Newman 1998) as the different methods in combination with a participatory action research approach provided me with a learning and understanding platform that could be used to deal with an interesting research area – 14-year olds’ subject choices and their perceptions of IT as a subject and as a possible future career. See Table 3.5 in appendix A of the appendices for detailed reflections of the fieldwork activities.

3.6 Research ethics

According to the Social Research Association Ethical Guidelines, any person conducting research:

> Must strive to protect subjects from undue harm arising as a consequence of their participation in research. This requires that subjects' participation should be voluntary and as fully informed as possible and no group should be disadvantaged by routinely being excluded from consideration. (December 2003 p.14)

During the formal and informal meetings with the head teachers of the various schools, the informal meeting with some of the parents, and the creativity sessions with the participant teenagers, an effort was made to explain the entire research and its process effectively to all parties. I created a research brief and sent it to the head teachers of the schools with the Letter of Intent to Conduct Research.[55] This brief was provided to the school and also included with the consent form handed to the participant teenagers for their parents/guardians so that they were aware of to what their children/wards had been invited to contribute.[56] According to the literature reviewed in Bryman (2012), researchers prefer to obtain the informed consent of research participants by getting them to sign an informed consent form; the benefit of such a form is that, from the outset, it gives the respondents the opportunity to be fully informed of the nature of the research and the implications of their participation. Furthermore, the researcher then has a signed record of consent if participants – or others – subsequently raise concerns. (Bryman 2012). According to the Economic and Social Research Council (ESRC) framework for Research Ethics 2010, updated September 2012:

[55] See fig 3.3(1) & (2) in appendix A of the appendices for a copy of the research brief and Letter of Intent to Conduct Research.

[56] See fig 3.6(1) in appendix A of the appendices for a copy of the consent form sent to parents to be completed and returned back to the school office or handed directly to me during the creativity session.

> In the case of research on children, one cannot expect parents alone to provide disinterested approval on their children's behalf. In such cases, every effort should be made to deal with consent through dialogue with both children and their parents (or legal equivalent). Again, there may be circumstances where seeking consent from parents could jeopardise the research (for example, in research into teenage sexuality or teenage pregnancy). In such circumstances, researchers will need to regard the potential risk to the principal participants of the research as a priority.

As mentioned previously, during the first creativity session - which was the pilot session (mixed group) - consent for participating teenagers was granted verbally by parents present at the Wazobia Youth Club.[57] For the majority of the other research participants, the school provided consent on their behalf. A few of the teenagers came in with the signed consent slip from their parent/guardian(s), which I collected. Regarding those not returned voluntarily, I did not insist on having them because it has been argued that a signed consent form could actually damage the rapport between the researcher and the research participants:

> Some qualitative researchers believe that the informed consent procedure can damage rapport with potential subjects. Like a prenuptial agreement, goes this line of thought, the informed consent might remind them of what could go wrong and therefore spoil the 'romance' the researcher is trying to create. However, one can cultivate good relations in an initial meeting and then sit down with the person for an informed consent briefing. The spirit of good faith that informed consent promotes may even help the process of building rapport. (Lindlof and Taylor 2002, p.92)

In addition, some researchers have pointed out that signing an informed consent form actually compromises anonymity, especially because research material has no legal privilege (Lipson 1994, Price 1996, Warren 2001). In cases where participants are illegal immigrants, for example, or are members of legally marginal populations, a tape-recorded verbal consent would preserve anonymity better as no names would ever need

[57] The pilot creativity session participants (mixed group) were a mixture of 14-year old boys and girls from various independent all girls, independent all boys, independent co-ed, all girls state grammar, all boys academies and all girls state local educational authority schools.

to be used. Since consent forms largely protect institutional interests, it is assumed that the research participants (teenagers) will have little time or no interest or patience for procedural matters (Fine et al. 2000). So in this case, rather than insist on a written consent form, the notion of consent as a process was employed (David, Edwards and Alldred 2001). During the creativity session, in those instances when the teenagers did not understand or were not sure of what was required, further clarification was provided by me (the researcher) and the teacher. The teenagers were offered opportunities for questions or issues to be raised, and there was constant reiteration of the fact that participation in the research was solely by choice.

At all times, I ensured that the key principles of ethical research with regards to children and young people were adhered to, and made sure informed consent was requested/obtained from both the teenagers and their parents/guardians/school; the teenagers were also assured that they had the right to withhold their consent and stop being involved at any point in the research, including the withdrawal of their data. The teenagers were free to refuse either to complete the questionnaire or to join in during the creativity map exercise, but this did not happen in any of the sessions. The teenagers at the end of the session were offered an opportunity to review their contribution, but they said that they were more than happy with the responses they had made and felt privileged by their involvement in and contribution to the research. The teenagers' confidentiality was respected at all times in line with the Children's Act 1989, and efforts were made to reimburse the teenagers for their time and assistance during the research: lunch and refreshments were provided during the session and 'Love2shop' vouchers were issued to all the research participant teenagers. Adequate time was given to the teenagers to complete the questionnaire and the other creativity session tasks so they did not feel pressured or forced to hurry their answers. Clarification about how the data/information would be produced and used was made at the start of the research session.

For the duration of this research, the ethical guidelines as stated by the University of Sussex, School of Law, Politics and Sociology (LPS) were acknowledged and adhered to.[58] As part of the research, the University of Sussex made a CRB Enhanced Disclosure application on my behalf; all the necessary checks were conducted and completed. This disclosure was presented to the schools before any research activity was arranged, and a copy was in my possession at all times during my visit to the schools. A major consideration in this research was to ensure that the research participants (especially those who were minors) did not experience any adverse effects or undue bias due to their participation. Utmost care regarding this aspect was employed from the start of this project; as agreed by all involved in this research (the teenagers, teachers, researcher, and project supervisors), the real names of all participants (schools, location of research, teachers, and teenagers) are disguised and pseudonyms used instead.

Since my study involves group discussion there are specific ethical issues, which must be considered (Homan 1991). A particular ethical issue to consider in the case of focus groups is the handling of sensitive material and confidentiality, given that there will always be more than one participant in the group. I minimised the ethical issues here by keeping participants informed about the expectations of the group and topic, and not pressurising participants to speak. At the outset of the research, I explained and made

[58] See fig 3.6(2) in appendix A in of the appendices for a copy of the Standards and Guidelines on Research Ethics for LPS as the University of Sussex.

clear to all that each participant's contributions would be shared with the others in the group as well as with me (the researcher). The research participants were encouraged to keep confidential what they heard and discussed during the session, and I re-affirmed my commitment and responsibility to anonymise the data/information received from the group.

3.7 Conducting the research

This section provides an account of the activities of a typical session/day and an overview of the entire research methodology and the tools that were planned and used for the research and were put into action. The research activities were split into three main phases: data collection, documentation of the data collected and coding of all the information collected into NVivo and SPSS followed by analysis. To a certain extent, all the phases overlapped each other because the teenagers did not finalise their subject choices until the end of the first term in Year 10, which was after the fieldwork had been completed.

A total of seven research sessions were conducted: three sessions were held during the morning hours and four were held in the afternoon at the agreed or allocated lab time for IT. The very first session, which was the pilot session, was held on a Saturday at the Wazobia Youth Club. See fig 3.7 below for the schedule, which shows the activities as they were carried out:

Fig 3.7: Schedule of creativity sessions

Session No	School	No of Participants Boys	Girls	Date	Time	Questionnaire	Creativity Exercise	Interviews	Focus Group	No per FG session	Session Recorded
1	Mixed*	4	14	13-Oct-09	16:00-18:00	√	√	√	√	9 / 2	√
2	Pine	8	8	15-Dec-09	09:00-11:00	√	√	√	√	8 / 2	√
3	Oak	30	20	05-Feb-10	10:00-12:00	√	√	√	√	10 / 5	X
4	Ash	8	8	10-Feb-10	08:30-10:30	√	√	√	√	8 / 2	X
5	Willow	13	17	10-Mar-10	12:00-14:00	√	√	√	√	6 / 5	√
6	Beech	0	18	25-Mar-10	12:00-14:00	√	√	√	√	6 / 3	√
7	Maple	16	0	09-May-10	13:00-15:00	√	√	√	√	8 / 2	X

*Mixed comprises of the following schools

Cherry	Linden
Elm	Snowbell
Rowan	Tulip
Violet	Yellowreed
Krimsone	Dagwood
Goldenrain	Unicorn
Juneberry	Fringe
Hawthorn	

On the allotted days for the research activities, I arrived at the school 15-30 minutes before the agreed time, made contact with the teacher representative and was advised of the number of student participants. In all the sessions conducted apart from the very first session (pilot session), the questionnaires, creativity maps, pens and paper were placed on a table set up to accommodate between four to eight students. The recording equipment was set up in preparation for each of the sessions. The student participants and the teachers came in at the agreed time. I guided the students to the various seats as they entered the room. In the co-ed schools, the students were mixed so as to have both sexes in each group.

Consent for recording was requested; this was either granted or rejected. Where recording was granted the video/tape recorder was switched on, and where recording was rejected the equipment was put away before continuing with the session. An explanation was given to the students regarding the activities of the day, their rights and compensation for their time. The students began by completing the questionnaires, which took between 10-15 minutes, and following that a brief explanation regarding the creativity map exercise. The students started off with mind mapping exercises, discussing with each other (mini focus groups/group discussions), while I was moving around between the various groups/tables and started interviewing students (individually and as a group). In-between this, the session participant observation occurred (observing the activities in the room and the students' group conversations). During the sessions, I started reading responses from some of the questionnaires, asked some of the students for further clarification of things they wrote and provided explanations to the teenagers and responded to their questions. Students were also advised and encouraged to review their data and responses, especially if they felt concerned, but they seemed fine and satisfied with their contribution. The sessions with the students lasted for 90 minutes and were divided into three sections: the questionnaires, the creativity map activity (focus group) and the group/individual interviews.

In the time between sessions the information (data) gathered from a previous session was coded; changes and amendments were constantly being made and reviewed with a focus on how to improve the levels of coding and the processing and presentation of the data. A basic analysis was conducted and the information was coded and grouped into the themes I initially identified.

I wanted to see if participation in my study, especially in light of its action research element, had any influence on the subject choices made by the participants. Therefore I initially designed my study so as to record their intended subject choices at the beginning of the research and compared this to their actual subject choices, as supplied by the school later on. However, during the first term of their academic year (10), IT became one of the compulsory subjects for KS4. Due to these educational changes, the research was unable to address or investigate whether the ‘action’ element (participatory action research) of this research did, in fact, bring about any changes in subject choice, although an assessment of the extent to which it brought about shifts in participants’ perception during the data-collection sessions will be made below.

As agreed with the school and documented in the consent form,[59] I promised to go back to the various schools and the youth group towards the end of term to make myself available to the students for 30 minutes to give them an opportunity to ask questions or get further clarification on IT as a subject or possible career for the future and to distribute shopping vouchers. Unfortunately, the students did not seem to want to explore the possibility of getting more information on IT careers. I distributed the vouchers to the student participants as promised, and also provided them with my email address for them to make contact if anything came to mind.

The teachers who assisted during the sessions advised that they were happy with the sessions, as the students had been well behaved and expressed a level of maturity both during and after. They were also pleased with the mode of delivery of the research activity and asked if I would be willing and available to assist in a couple of career choice events the school put in place during the academic year. Although no firm

[59] See Fig 3.6(1) in appendix A, in the appendices for a copy of the consent form.

commitment was made at the time, I did agree to assist, subject to my DPhil schedule and, subsequently, attended career events put on at Oak, Willow and Beech Schools.

3.8 Research data set collected in total

At the end of the fieldwork, the amount of data collected was encouraging. A total of 170 questionnaires had been completed and submitted by the students; however six questionnaires had to be discarded due to the fact they had no personal details. After the filtering process, the remaining 164 questionnaires were input into a spreadsheet (85 girls and 79 boys) and copies subsequently transferred to NVivo (qualitative) and SPSS (quantitative), the tools used to analyse the data. See Table 3.8 below for the total data collected for my study:

Table 3.8: Total research data collected for the study:

Session	**Creativity Map Data**	**Interview Data**	**Recorded Data**	**Field notes**
1. Mixed Group	2 x A3 sheets	24 x A4 pages	103 minutes	2 x A5 pages
2. Pine	2 x A3 sheets	23 x A4 pages	110 minutes	3 x A5 pages
3. Oak	6 x A3 sheets	20 x A4 pages	none	2 x A5 pages
Ash	4 x A3 sheets	18 x A4 pages	none	2 x A5 pages
Willow	7 x A3 sheets	30 x A4 pages	120 minutes	3 x A5 pages
Beech	2 x A3 sheets	20 x A4 pages	98 minutes	1 x A5 pages
Maple	2 x A3 sheets	15 x A4 pages	none	1 x A5 pages

3.8.1 Coding of the questionnaires using Excel and SPSS

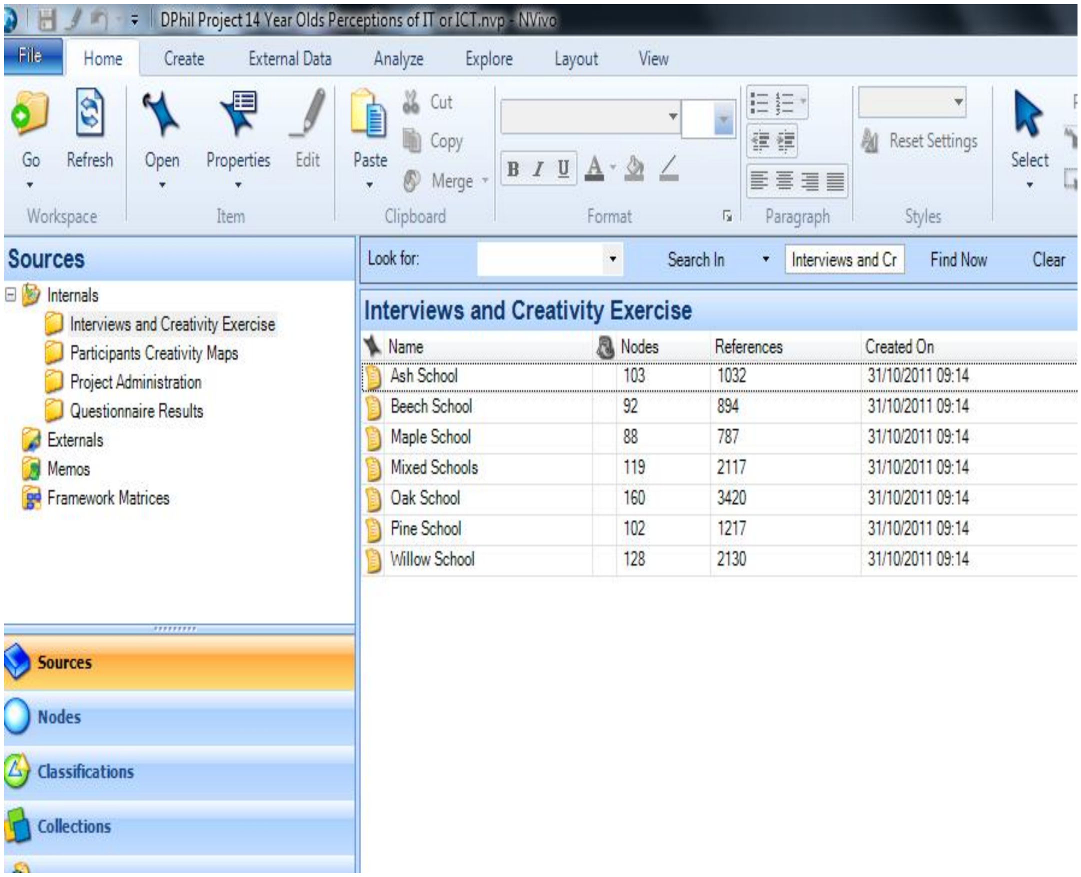
Background and attitudinal information from the questionnaire was manually input into an Excel spreadsheet, with heading columns for all of the items on the questionnaire, and a record was created for all the students in the Excel sheet named '14-year olds' questionnaire'. The next task was to anonymise the data. Firstly, the schools were given a pseudonym in alphabetical order from A-Z,[60] and the students were also given pseudonyms based alphabetically on the prefix of their school. The data was checked and crosschecked for errors, making sure the boys and girls were recorded accurately with regard to their schools, and all their information and perceptions were updated in the spreadsheet. Secondly, as I had decided to use SPSS, I created a code book, which involved defining and labelling each of my close-ended and open-ended items on the questionnaire (variables) and assigning a number to each of the possible answers. For example: male = 1, female = 2.[61] Once this was completed, I then had to import the Excel file that had all the information already prepared and anonymised into SPSS 18 for initial data analysis. In SPSS, I was able to view the generated code book and use it to check for any errors of labelling, whether different names should be assigned and if the field types increased, and so on. Finally, a number of various other reports were run, such as IT subject choice by gender; the questionnaire data were now ready for running further queries.

3.8.2 Coding of the interviews (qualitative data) using NVivo

All the qualitative information generated as part of this research, namely the interviews, the participants' interpretations of the creativity maps, the completed questionnaire, the research documentation, and the transcribed recordings from the sessions, were anonymised and imported into NVivo 9 to be analysed.

[60] See Table 3.4(2) in appendix A of the appendices for the participants' schools profile.
[61] See Table 3.8.1 in appendix A of the appendices for a copy of the Code Book.

Fig 3.8.2(1): Data Coding and Presentation in NVivo:



The first task was to look at the data in general and code to higher-level nodes. As the research was all about IT as a subject, as a career and as a general area, the first few higher level themed nodes coded were more obviously linked to the research theme. The next task was to run a text search and look for documents that had in them the selected top-level theme nodes. These were then coded. Then all the interviews were read and parts of the text assigned to the created nodes; as the read through progressed, new themes emerged and text was assigned to newly created nodes, with more sub nodes being added to accommodate other interesting text.

<u>Fig 3.8.2(2): Themed Nodes (NVivo).</u>

Name	Sources	References	Created On
IT or ICT	1	1	31/10/2011 11:02
Engagement of IT or ICT	11	91	31/10/2011 11:22
Positive Engagement of IT	9	84	03/11/2011 15:27
Negative Engagement of IT or ICT	6	11	07/11/2011 11:48
Attitudes of IT or ICT as a Career	9	44	31/10/2011 11:12
Positive Attitudes as a Career	11	64	31/10/2011 11:14
IT Career as a Backup Plan	6	23	14/11/2011 11:28
Negative Attitudes as a Career	10	107	31/10/2011 11:14
Long Hours and Presenteeism	5	10	14/11/2011 13:10
Other Interests	8	113	03/11/2011 20:07
Boring as a Career	8	28	03/11/2011 20:12
Uncertainty of IT as a Career	9	53	31/10/2011 11:17
Careers Advice	9	38	03/11/2011 20:17
Attitudes of IT or ICT as a Subject	9	45	31/10/2011 11:05
ICT Topics	5	23	06/02/2012 19:24
Positive Attitudes	11	134	31/10/2011 11:07
Easy Subject	6	17	07/11/2011 15:24
IT is an OK subject and Compulsory	5	20	30/11/2011 06:29
Enjoyable, Like and Interesting	11	88	03/11/2011 19:44
External Influence	6	14	03/11/2011 19:48
Right levels of homework	4	4	07/11/2011 12:00
Fun and Interactive Subject	9	37	07/11/2011 13:12
Negative Attitudes	9	76	31/10/2011 11:10
Too much course work	5	20	14/11/2011 12:38
Boring Subject	10	59	03/11/2011 14:37
Teacher Involvement	7	28	03/11/2011 14:39
Hard or lack of interest	10	49	03/11/2011 15:41
Uncertainty of IT or ICT as a subject	5	13	31/10/2011 11:18
Curriculum	12	135	03/11/2011 14:48
Mixed Perception of Curriculum	4	6	30/11/2011 06:21
Negative Perception of Curriculum	9	55	03/11/2011 14:52
Positive Perceptions of the Curriculu	11	110	03/11/2011 18:58
Students Expectation of IT or ICT	12	96	03/11/2011 14:57
Mixed Perceptions	6	16	03/11/2011 18:55

Once the task of finding themed nodes had been completed, the open-ended questionnaire data were also coded; each participant's questionnaire was coded and linked to their interview data so that initial reports, such as the code summary report, node classification summary report and node structure report could be generated. Other reports, such as the matrix modes for the engagement of IT and gender, were produced. While going through the interviews and free form text in the questionnaires, I had the opportunity to make additional notes based on the responses made by the students. I also coded the creativity map data generated by the students.

3.8.3 Qualitative and quantitative data analysis

Data analysis involved using the quantitative data responses recorded from the questionnaire, the qualitative research data extracted and coded from the creativity map/short focus groups, and interviews. Both qualitative and quantitative data together were used to get a better understanding of the views of the participants. The qualitative responses from the students benefited the research as it further explained in detail - and highlighted the problems with - IT as a subject and as a career as previously identified earlier on in this study during the literature review.

3.9 Conclusion

This section has explored the research methodology used for this research. There has also been a discussion about research ethics and the role of the researcher, as well as valuable insight into the issue of gaining access. Within the different sections, a descriptive breakdown of activities, of the various tools used, and of the use of the participatory and comparative methods has been discussed, as well as a reflection on the strengths and the weaknesses of the chosen methods provided. An attempt has been made to show that this research was designed to facilitate exploration rather than causal analysis and, therefore, has made use of a diverse range of methods and approaches. The next part of this thesis will discuss in detail the analysis of the data collected and will present the findings of the fieldwork undertaken in an informed and structured format.

Chapter Four: Perceptions of IT as a subject

4.0 Introduction

As stated earlier in the literature review (Chapter Two), technology has continued to evolve and permeate every aspect of our daily lives, and this has had a significant impact on how IT is taught in the classroom. Students are increasingly attracted to online technologies and are using the Internet to access information on social networks; thus, engaging the students with learning content is becoming an on-going challenge for teachers in schools. According to the 2010 report by International Education Advisory Board (IEAB):

> Today's 14-year-old students, born at the turn of the 21st century, spend on average 6.5 hours each day saturated in electronic, digital, broadcast and news media. They listen to and record music; view, create, and publish internet content; play video games; watch television; talk on mobile phones and instant message every day and also expect technology to support their learning and do what they need it to do. (p. 6)

Teachers are seeing their work and their classrooms transform as they improve their lessons and teaching using technology (Pvtel 2006). Learning must be relevant to students; content must be specific and concise, and delivered quickly. Students are eager for information and will search for it on their own if teachers do not present what their students perceive to be relevant.

This chapter provides an analysis of IT as a subject as viewed by the students who participated in this study. As mentioned earlier, many studies have explored the perceptions and attitudes of young people towards IT; these studies have concentrated mainly on collecting data from students already enrolled in computer and business courses (Wilson et al. 2007, Akbulut et al. 2008), while others have focused on the lack of female higher education students studying ICT (Mbarika et al. 2007, Lynch 2007). However, this study focuses on gender differences amongst secondary school students in Southeast London Borough during a period when they were making important choices in their academic life, choices that were linked to what they wanted to be in the future.

This chapter explores the findings related to the students' perceptions in order to address research questions raised earlier regarding IT as a subject. The questions addressed in this chapter are as follows:

1. How do teenage girls and boys perceive IT as a subject in their schools?
    a. Do they like or dislike IT as a subject in their schools?
    b. What would they like to learn as part of IT as a subject taught in school?

Using the information gathered from the students' contributions, gender differences and similarities are explored regarding participation in, and experience of, IT as a taught subject in school.

4.1 Students’ perceptions of IT as a subject

During this study, all the participating students (79 boys and 85 girls) were asked about their perceptions of IT as a taught subject. Statistical information recorded and compiled from the questionnaire[62] completed by these students provided an initial breakdown of their responses.

Table 4.1(1): Results of Q7: students’ views of IT as a subject by gender

		% (n) Boys	% (n) Girls	% (n) Total
Q7 Do you like IT as a subject?	Yes	80 (63)	62 (53)	71 (116)
	No	11 (9)	25 (21)	18 (30)
	Not Sure	9 (7)	13 (11)	11 (18)
	Total	100 (79)	100 (85)	100 (164)

The information in Table 4.1(1) above shows that a greater percentage of boys than girls confirmed that they liked IT as a subject, while a greater percentage of the girls said they did not like, or were ‘not sure’ about, IT as a subject. A chi-square test was conducted on the sample in relation to Q7 to determine whether the difference between boys’ and girls’ responses were significant. The result of the test was significant and confirmed that the boys were more likely than the girls to say that they liked IT as a subject, $\chi 2$ (2, N = 164) = 6.34 p < .001.

A further analysis of the initial quantitative data as recorded in Table 4.1(1) above was conducted to review students’ responses based on their school environment: single-sex vs. co-ed. The results are displayed as follows:

[62] Students were asked the question ‘Do you like IT as a subject?’ The students were presented with three options and were expected to select one option from ‘yes’, ‘no’ or ‘not sure’. See copy of the questionnaire Fig 3.2.3 in appendix A - Question 7.

Table 4.1(2): Do you like IT as a subject?: students' responses by their school environment - single-sex vs. co-ed

	Boys (% (n))			Girls (% (n))		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
Yes	75 (15)	81 (48)	80 (63)	55 (17)	67 (36)	62 (53)
No	15 (3)	10 (6)	11 (9)	32 (10)	20 (11)	25 (21)
Not Sure	10 (2)	9 (5)	9 (7)	13 (4)	13 (7)	13 (11)
Total	100 (20)	100 (59)	100 (79)	100 (31)	100 (54)	100 (85)

According to the data displayed in Table 4.1(2) above, a greater percentage of boys (75%) than girls (55%) in single-sex environments said that they liked IT as a subject. Similarly, in co-ed environments a greater percentage of boys (81%) than girls (67%) said that they liked IT as a subject. Also, in single-sex environments a greater percentage of girls (32%) than boys (15%) said that they did not like IT as a subject, and a greater percentage of girls (20%) than boys (10%) in co-ed environments said that they did not like IT as a subject. Finally, a slightly higher percentage of the girls (13%) than the boys (10%) in single-sex environments said they were 'not sure' they liked IT as a subject, and in co-ed environments, a slightly higher percentage of girls (13%) than boys (9%) also said they were not sure they liked IT as a subject.

Similar statistics as in Table 4.1(2) above were run using the private vs. state school variable but due to the small number of students from private schools to report on (25 students in total: 18 boys and seven girls), this study will no longer include the private vs. state school sector variable in further analysis (see Table 4.1(3) in appendix B of the appendices for the results).

As part of this study, the students were also asked to respond to a number of perception statements relating to their experiences of studying IT (see questionnaire Fig 3.2.3 in appendix A of the appendices for items in Q8), and the results are worth reflecting on as they will help us to understand the gender differences identified in Table 4.1(1) above, in respect of the 'like' 'don't like' or 'not sure' responses to IT as a subject. Students were asked to select one option from a Likert-type scale ranging from 'strongly agree' to 'strongly disagree'. Table 4.1(4) below provides the percentages and frequency count for all the students' responses grouped by gender.

Table 4.1(4): Perception results of Q8 response frequencies

		% (n) Boys	% (n) Girls
Q8(i) IT is an easy subject:	Strongly Agree	25 (20)	18 (15)
	Agree	52 (41)	35 (30)
	Neutral	20 (16)	43 (36)
	Disagree	3 (2)	2 (2)
	Strongly Disagree	0 (0)	2 (2)
	Total	**100 (79)**	**100 (85)**
Q8(ii) IT is a fun subject:	Strongly Agree	35 (28)	14 (12)
	Agree	32 (25)	40 (34)
	Neutral	25 (20)	24 (20)
	Disagree	4 (3)	14 (12)
	Strongly Disagree	4 (3)	8 (7)
	Total	**100 (79)**	**100 (85)**
Q8(iii) I really enjoy IT:	Strongly Agree	34 (27)	21 (18)
	Agree	29 (23)	33 (28)
	Neutral	27 (21)	26 (22)
	Disagree	6 (5)	13 (11)
	Strongly Disagree	4 (3)	7 (6)
	Total	**100 (79)**	**100 (85)**
Q8(iv) IT is useful for my future job/career:	Strongly Agree	33 (26)	20 (17)
	Agree	35 (28)	41 (35)
	Neutral	23 (18)	26 (22)
	Disagree	8 (6)	11 (9)
	Strongly Disagree	1 (1)	2 (2)
	Total	**100 (79)**	**100 (85)**
Q8(v) IT is important for adult life	Strongly Agree	43 (34)	24 (20)
	Agree	34 (27)	44 (37)
	Neutral	21 (16)	29 (25)
	Disagree	1 (1)	2 (2)

		% (n) Boys	% (n) Girls
	Strongly Disagree	1 (1)	1 (1)
	Total	**100 (79)**	**100 (85)**
Q8(vi) IT is useful for me now:	Strongly Agree	39 (31)	28 (24)
	Agree	35 (28)	35 (30)
	Neutral	20 (16)	31 (26)
	Disagree	5 (4)	5 (4)
	Strongly Disagree	0 (0)	1 (1)
	Total	**100 (79)**	**100 (85)**
Q8(vii) There is too much course work for IT:	Strongly Agree	19 (15)	15 (13)
	Agree	24 (19)	20 (17)
	Neutral	43 (34)	47 (40)
	Disagree	10 (8)	15 (13)
	Strongly Disagree	4 (3)	3 (2)
	Total	**100 (79)**	**100 (85)**
Q8(viii)We do too much IT:	Strongly Agree	11 (9)	9 (8)
	Agree	11 (9)	7 (6)
	Neutral	33 (26)	37 (31)
	Disagree	30 (23)	35 (30)
	Strongly Disagree	15 (12)	12 (10)
	Total	**100 (79)**	**100 (85)**
Q8(ix) I do not feel challenged in IT class:	Strongly Agree	20 (16)	5 (4)
	Agree	33 (26)	25 (21)
	Neutral	27 (21)	38 (33)
	Disagree	14 (11)	27 (23)
	Strongly Disagree	6 (5)	5 (4)
	Total	**100 (79)**	**100 (85)**
Q8(x) I am really glad I am doing IT:	Strongly Agree	34 (27)	14 (12)
	Agree	27 (21)	34 (29)
	Neutral	33 (26)	32 (27)
	Disagree	5 (4)	12 (10)
	Strongly Disagree	1 (1)	8 (7)
	Total	**100 (79)**	**100 (85)**
Q8(xi) I have made good progress so far:	Strongly Agree	32 (25)	20 (17)
	Agree	40 (32)	43 (37)
	Neutral	23 (18)	29 (25)
	Disagree	4 (3)	4 (3)
	Strongly Disagree	1 (1)	4 (3)
	Total	**100 (79)**	**100 (85)**

As part of the analysis, a series of independent samples t-tests were conducted on items in Q8, as mentioned above, to determine whether there were any significant gender relationship differences between the participants' responses. See Table 4.1(5) below for the results of the independent samples t-test:

Table 4.1(5): - Results for Q8 independent samples t-test

	Boys Mean	Girls Mean	t	df	Sig (2 tail)
Q8 (i) IT is an easy subject.	2.00	2.36	-2.84	162	.005
Q8 (ii) IT is a fun subject.	2.09	2.62	-3.11	162	.002
Q8 (iii) I really enjoy IT.	2.16	2.52	-1.99	162	.048
Q8 (iv) IT is useful for my future job/career.	2.09	2.34	-1.63	162	.105
Q8 (v) IT is important for adult life.	1.84	2.14	-2.26	162	.025
Q8 (vi) IT is useful for me now.	1.91	2.15	-1.69	162	.093
Q8 (vii) There is too much course work for IT.	2.56	2.69	-0.87	162	.387
Q8 (viii) We do too much IT.	3.25	3.33	-0.43	162	.669
Q8 (ix) I do not feel challenged in IT class.	2.53	3.02	-2.99	162	.003
Q8 (x) I am really glad I am doing IT.	2.13	2.66	-3.22	162	.002
Q8 (xi) I have made good progress so far.	2.03	2.27	-1.70	162	.092

The results of the independent samples t-tests as displayed in Table 4.1(5) show items Q8 (iv), (vi), (vii), (viii) and (xi) were non-significant, and this indicates that the boys and the girls did not differ significantly in their responses to these measures. The results of the independent samples t-tests as displayed were significant for items 8 (i), (ii), (iii), (v), (ix) and (x), and this shows that the boys were more likely to rate their feelings more positively towards the various measures. On Q8 (i), there were significant differences between the scores for the boys ($\underline{M}$ = 2.00, $\underline{SD}$ = .75) and the girls ($\underline{M}$ = 2.36, $\underline{SD}$ = .88; t(162) = -2.84, $\underline{p}$ = .005); the boys were more likely to agree that IT was an easy subject. On Q8 (ii), there were significant differences in the scores for the boys ($\underline{M}$ = 2.09, $\underline{SD}$ = 1.05) and for the girls ($\underline{M}$ = 2.62, $\underline{SD}$ = 1.14; t(162) = -3.11, $\underline{p}$ = .002); the boys were more likely to agree that IT was a fun subject. On Q8 (iii), there were significant differences in the scores for the boys (M = 2.16, SD = 1.09) and for the girls (M = 2.52, SD = 1.17; t(162) = -1.99, p = .048); here, the boys were also more likely to agree that they really enjoyed IT. On Q8 (v), there were significant differences in the scores for the boys (M = 1.84, SD = .88) and for the girls (M = 2.14, SD = .85; t(162) = -2.26, p = .025); the boys were more likely to agree that IT is important for adult life. On Q8 (ix), there were significant differences in the scores for the boys (M = 2.53, SD = 1.15) and for the girls (M = 3.02, SD = .95; t(162) = -2.99, p = .003); the boys were more likely to agree that they felt less challenged in IT class. Finally, on Q8(x), there were significant differences in the scores for the boys (M = 2.13, SD = 0.99) and for the girls (M = 2.66, SD = 1.12; t(162) = -3.22, p = .002); the boys were more likely to agree that they felt glad that they were doing IT.

The students were also asked in Q6: 'Do you feel comfortable and confident using computers?' Table 4.1(6) below provides the percentages and frequency count for all the students' responses grouped by gender.

Table 4.1(6): Results of Q6: students' views of 'do you feel comfortable and confident using computers?' by gender

		% (n) Boys	% (n) Girls
Q6 Do you feel comfortable and confident using computers?	Yes	96 (76)	93 (79)
	No	0 (0)	0 (0)
	Not Sure	4 (3)	7 (6)
	Total	100 (79)	100 (85)

Table 4.1(6) above provides a summary of the quantitative findings in relation to the responses provided by the research participants. The figures show similar levels of comfort and confidence using computers between the boys and girls in relation to Q6. A

slightly higher percentage of boys (96%) compared to girls (93%) said ‘yes’ they felt confident and comfortable using computers, and a slightly higher percentage of girls (7%) compared to boys (4%) said they were ‘not sure’ whether they felt confident and comfortable using computers. A chi-square test was then run on the data to see if there were any significant gender differences between the responses provided by the boys and girls, but the results were non-significant.

A further analysis was conducted to review the students’ responses based on their school environment (single-sex vs. co-ed) and this is displayed in Table 4.1(7) below.

Table 4.1(7): Results of students’ responses to ‘do you feel comfortable and confident using computers?’ by gender and by school environment

		Boys (% (n))			Girls (% (n))		
		Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
Responses for ‘Do you feel confident using computers? by gender, by single-sex vs. co-ed.	Yes	95 (19)	97 (57)	96 (76)	97 (30)	91 (49)	96 (79)
	No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Not Sure	5 (1)	3 (2)	4 (3)	3 (1)	9 (5)	7 (6)
	Total	100 (20)	100 (59)	100 (79)	100 (31)	100 (54)	100 (85)

The data displayed in Table 4.1(7) above shows similar results for the boys and girls across the school environments. In co-ed environments, a slightly higher percentage of the girls (9%) than the boys (3%) said they were not sure they were comfortable and confident using computers. Overall, only a very small number of students in both single-sex and co-ed environments (three boys and six girls) mentioned that they were not sure they were comfortable and confident using computers.

According to the data recorded in Table 4.1(1) above, the overall statistical results reinforce salient points from the literature reviewed earlier, which suggested that IT as a taught subject is more positively rated by boys than by girls (Nelson et al. 1991, Lindah

2003, SSDA 2004, Anderson et al. 2006, Gras-Velazquez et al. 2009). The results in Table 4.1(2) above show that a higher percentage of the boys than the girls in single-sex and co-ed environments agreed that they liked IT as a taught subject in school, a finding similarly identified in other studies (Blenkinsop et al. 2006, OECD 2009). Finally, the results in Table 4.1(6) and 4.1(7) confirm the findings elsewhere, which suggest that the differences in IT confidence between boys and girls are narrowing (Faulkner 2002, Sanders 2005, Volman 2005).

As mentioned earlier in Chapter Three, part of this study included a creativity map exercise and group/individual interviews. The students provided qualitative data to complement the quantitative data collected from the completed questionnaires. A data analysis exercise was performed with the qualitative interviews within NVivo[63]. Here, the results provided a good example of the value of a mixed methods approach. When quantitative data are presented in isolation, they can have the tendency to provide a limited interpretation or exploration of meaning (Courtney et al. 2006). For example, Table 4.1(1) provides an overall response to ‘Do you like IT as a subject?’ When viewed in isolation without further information, the data does not provide in-depth understanding, and it is not possible to convey the richness of the students’ perceptions, related to their answers here, without detailed explanations and comments from the interviews. Paris, from Pine School, provides an illustration of this point. In relation to Q7 (Do you like ICT as a subject?) she placed a tick in the ‘yes’ box (quantitative) and then during her interview (qualitative) made the following further comments to explain her initial response:

[63] See fig 3.8.2(2) in Chapter Three for the Themed Nodes coded in NVivo.

> ICT as a subject in school is very interesting; we learn to use computers properly and get to understand how to put the various features in different software packages to good use. I like everything we do in ICT at school. (Paris$_{\text{(girl)}}$, Pine School$_{\text{(co-ed)}}$)

At different points during the study, the quantitative and qualitative data provided by the students have not supported, but have instead challenged, each other. Therefore, the benefits of a mixed methods approach is that it has allowed me to analyse the data together and to make overall sense of the entirety of the data-set, including the contradictions encountered. It should be remembered, however, that for any data emerging solely from the interviews, the students had also been exposed to information from me as part of the action research element of the study. It should also be noted that this aspect of the data is more likely to arise in relation to findings regarding IT as a career (see Chapter Five) as the information I provided focused on that subject.

The students also participated in a creativity exercise with the use of a creativity map, which was designed for them to review the visual information and get their creative minds thinking about IT as a subject and as a career (see fig 3.2.4(1) in Chapter Three). As mentioned earlier, the students sat in groups to discuss their views (similar to short focus groups). As this was prior to the action research element of the data collection process, there was no input from myself, and so the information recorded by the students was a representation of their own perceptions.

Analysis of the creativity map data raised a number of concerns similar to those identified by the students during their interviews. Some of the students mentioned that they found IT as a subject boring due to what they were being taught and sometimes also found it complicated. They expressed their concerns about their teachers' negative attitudes towards the subject. They also expressed their need to learn new, interesting and exciting topics. (See Figs 3.2.4(2) through to Fig 3.2.4(15) in the appendices for examples of information produced from the use of the creativity map).

Analysis of the qualitative (interviews) and quantitative (questionnaire) data provided by the participants and their perceptions has been grouped under three main headings as follows:

a. Students who like IT as a taught subject.
b. Students who did not like IT as a taught subject.
c. Students who are not sure about IT as a taught subject.

The students have been separated into these three main groups based on the responses provided to Q7 of the questionnaire. The reasoning behind this is so that detailed analysis can be conducted on those students with similar reported broad feelings about IT as a subject.

4.2 The perceptions of students who liked IT as a subject

Using the questionnaire data (quantitative data for Q8) the frequency report and independent samples t-test was re-run using the data just from the students who said that they liked IT as a subject,[64] and the results are displayed in Tables 4.2(1) & 4.2(2) below:

[64] The students (63 boys and 53 girls) who said ‘yes’ they liked IT as a subject as displayed in table 4.1(1) above.

Table 4.2(1): Perception results of Q8 for students who said they liked IT as a subject - response frequencies

		% (n) Boys	% (n) Girls
Q8(i) IT is an easy subject:	Strongly Agree	30 (19)	19 (10)
	Agree	52 (33)	47 (25)
	Neutral	16 (10)	34 (18)
	Disagree	2 (1)	0 (0)
	Strongly Disagree	0 (0)	0 (0)
	Total	**100 (63)**	**100 (58)**
Q8(ii) IT is a fun subject:	Strongly Agree	44 (28)	21 (11)
	Agree	37 (23)	57 (30)
	Neutral	18 (11)	21 (11)
	Disagree	0 (0)	1 (1)
	Strongly Disagree	1 (1)	0 (0)
	Total	**100 (63)**	**100 (58)**
Q8(iii) I really enjoy IT:	Strongly Agree	43 (27)	30 (16)
	Agree	35 (22)	49 (26)
	Neutral	19 (12)	19 (10)
	Disagree	3 (2)	2 (1)
	Strongly Disagree	0 (0)	0 (0)
	Total	**100 (63)**	**100 (58)**
Q8(iv) IT is useful for my future job/career:	Strongly Agree	38 (24)	30 (16)
	Agree	35 (22)	47 (25)
	Neutral	21 (13)	19 (10)
	Disagree	5 (3)	2 (1)
	Strongly Disagree	1 (1)	2 (1)
	Total	**100 (63)**	**100 (53)**
Q8(v) IT is important for adult life:	Strongly Agree	51 (32)	32 (17)
	Agree	29 (18)	51 (27)
	Neutral	18 (11)	15 (8)
	Disagree	1 (1)	0 (0)
	Strongly Disagree	1 (1)	2 (1)
	Total	**100 (63)**	**100 (53)**
Q8(vi) IT is useful for me now:	Strongly Agree	44 (28)	40 (21)
	Agree	41 (26)	36 (19)
	Neutral	13 (8)	23 (12)
	Disagree	2 (1)	1 (1)
	Strongly Disagree	0 (0)	0 (0)
	Total	**100 (63)**	**100 (53)**
Q8(vii) There is too much course work for IT:	Strongly Agree	22 (14)	4 (2)

		% (n) Boys	% (n) Girls
	Agree	24 (15)	13 (7)
	Neutral	38 (24)	56 (30)
	Disagree	11 (7)	23 (12)
	Strongly Disagree	5 (3)	4 (2)
	Total	**100 (63)**	**100 (53)**
Q8(viii)We do too much IT:	Strongly Agree	14 (9)	2 (1)
	Agree	13 (8)	0 (0)
	Neutral	32 (20)	32 (17)
	Disagree	24 (15)	47 (25)
	Strongly Disagree	17 (11)	19 (10)
	Total	**100 (63)**	**100 (53)**
Q8(ix) I do not feel challenged in IT class:	Strongly Agree	24 (15)	6 (3)
	Agree	33 (21)	25 (13)
	Neutral	25 (16)	39 (21)
	Disagree	10 (6)	26 (14)
	Strongly Disagree	8 (5)	4 (2)
	Total	**100 (63)**	**100 (53)**
Q8(x) I am really glad I am doing IT:	Strongly Agree	43 (27)	23 (12)
	Agree	30 (19)	49 (26)
	Neutral	25 (16)	26 (14)
	Disagree	2 (1)	2 (1)
	Strongly Disagree	0 (0)	0 (0)
	Total	**100 (63)**	**100 (53)**
Q8(xi) I have made good progress so far:	Strongly Agree	37 (23)	30 (16)
	Agree	42 (26)	45 (24)
	Neutral	18 (11)	23 (12)
	Disagree	2 (2)	0 (0)
	Strongly Disagree	1 (1)	2 (1)
	Total	**100 (63)**	**100 (53)**

The results as displayed in Table 4.2(1) above show that the boys were more likely to rate their feelings more positively towards the various measures listed than the girls, who rated their feelings more moderately.

Table 4.2(2): Results for Q8 independent samples t-test for students who said that they liked IT as a subject

	Boys Mean	Girls Mean	t	df	Sig (2 tail)
Q8 (i) IT is an easy subject.	1.89	2.15	-1.95	114	.053
Q8 (ii) IT is a fun subject.	1.78	2.04	-1.77	114	.079
Q8 (iii) I really enjoy IT.	1.83	1.92	-0.66	114	.513
Q8 (iv) IT is useful for my future job/career.	1.97	1.98	-0.75	114	.940
Q8 (v) IT is important for adult life.	1.75	1.89	-0.87	114	.384
Q8 (vi) IT is useful for me now.	1.71	1.87	-1.05	114	.298
Q8 (vii) There is too much course work for IT.	2.52	3.09	-3.11	114	.002
Q8 (viii) We do too much IT.	3.17	3.81	-3.14	114	.002
Q8 (ix) I do not feel challenged in IT class.	2.44	2.98	-2.65	114	.009
Q8 (x) I am really glad I am doing IT.	1.86	2.08	-1.44	114	.153
Q8 (xi) I have made good progress so far.	1.92	1.98	-0.37	114	.712

According to the independent samples t-test results as mentioned in Table 4.2(2), most of the items were non-significant with the exception of 'There is too much coursework for IT' and 'We do too much IT'. On items Q8 (vii), there were significant differences between the scores for the boys ($\underline{M}$ = 2.52, $\underline{SD}$ = 1.11) and for the girls ($\underline{M}$ = 3.09, $\underline{SD}$ = .82; t(114) = -3.11, $\underline{p}$ = .002); the boys were more likely to agree that there was too much coursework for IT. Finally, on Q8 (viii), there were also significant differences between the scores for the boys ($\underline{M}$ = 3.17, $\underline{SD}$ = 1.28) and for the girls ($\underline{M}$ = 3.81, $\underline{SD}$ = .81; t(114) = -3.14, $\underline{p}$ = .002); here, the boys were also more likely to agree that they did too much IT.

A re-run of the statistics for questionnaire item Q6: 'Do you feel comfortable and confident using computers?' for the students who said that they liked IT as a subject was performed and Tables 4.2(3) and 4.2(4) below provides the percentages for these students' responses grouped by gender and by school environment (single-sex vs. co-ed).

Table 4.2(3): Results of Q6: 'do you feel comfortable and confident using computers?' for students who liked IT as a subject by gender

		% (n) Boys	% (n) Girls
Q6 Do you feel comfortable and confident using computers?	Yes	98 (62)	100 (53)
	No	0 (0)	0 (0)
	Not Sure	2 (1)	0 (0)
	Total	100 (63)	100 (53)

The figures in Table 4.2(3) show similar levels of comfort and confidence using computers between the boys and the girls in relation to Q6.

Table 4.2(4): Results of Q6: 'do you feel comfortable and confident using computers?' for students who liked IT as a subject by gender and school environment

		Boys (% (n))			Girls (% (n))		
		Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
Responses for 'Do you feel confident using computers? by gender and by single-sex vs. co-ed school type.	Yes	100 (15)	98 (47)	98 (62)	100 (17)	100 (36)	100 (53)
	No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Not Sure	0 (0)	2 (1)	2 (1)	0 (0)	0 (0)	0 (0)
	Total	100 (15)	100 (48)	100 (63)	100 (17)	100 (36)	100 (53)

The data displayed in Table 4.2(4) above also show similar results for the boys and the girls across the school environments.

During the interviews, the students (54% boys and 46% girls) who said that they liked IT as a subject[65] spoke very passionately about the subject and mentioned a number of reasons why they enjoyed studying it. Based on their qualitative comments a number of themes were identified: Table 4.2(5) below provides an overview of the number of

[65] The 116 students, (n=63 were boys and n=53 were girls) in this group (those who said they liked IT as a subject).

students in the group who contributed qualitative data against each identified theme. Due to small numbers of participants per cell, whole numbers have been used instead of percentages.

Table 4.2(5): Breakdown of the number of students (who liked IT as a subject) who provided qualitative data for the various themes identified

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. IT as a subject that students enjoy	6	19	25	5	13	18
2. IT as a fun subject	4	10	14	5	9	14
3. IT as an easy subject	3	6	9	2	9	11
4. IT as an interesting subject	4	5	9	4	6	10
5. IT as beneficial for the future	0	5	5	3	3	6
6. IT can be a hard subject	0	2	2	0	2	2
7. IT as a subject can be boring	2	0	2	1	1	2
8. IT involves too much coursework	0	0	0	0	2	2
9. IT as an interactive subject	1	0	1	0	0	0
10. Mixed views towards liking IT as a subject	0	0	0	1	0	1

4.2.1 IT as a subject that students enjoy

During the interviews, 43 students[66] said that they liked IT as a subject and found it enjoyable, and this was the most common view. Furthermore, these students were also quick to discuss their interaction with and level of enjoyment of technology. One of the comments, which was representative of the 25 boys interviewed, reflected:

> I like ICT. It is an enjoyable subject; it is actually one of my favourite subjects at school, and I am very good at it. I enjoy playing games and chatting online with my friends. (Parker$_{\text{(boy)}}$, Pine School$_{\text{(co-ed)}}$)

The views from the 18 girls in this group were similar to those identified by the boys. Quotations from the girls interviewed revealed how much they enjoyed what they were learning in ICT:

[66] Of the 18 girls, five were in single-sex and 13 were in co-ed environments, whilst of the 25 boys, six were in single-sex and 19 in co-ed environments.

> I like ICT as a subject, and I enjoy the ICT lessons at school; they are much better than what was on offer at my previous school… I like learning things that seem complicated and enjoy opening up a computer and looking at the internal structure… I am very good with technical things and gadgets. (Orchid$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

A review of the comments made by the 43 students in this group, especially the quotes from both Orchid and Parker, shows that they all enjoyed IT as a subject and were all confident with their uses of IT within and outside of school. This finding confirms the relatively recent findings of Gras-Velazquez et al. (2009), where students, especially girls, were found to enjoy ICT studies and were also competent users of computers and computer operating systems.

4.2.2 IT as a fun subject

The second theme identified by the students (both the boys and girls) who said that they liked IT as a subject was that IT is perceived as a fun subject. During the interviews, 28 students (14 boys and 14 girls)[67] mentioned that they thought IT was a fun subject. Comments from these students reflected how they perceived all activities on a computer as fun, but further analysis revealed gender differences in the kinds of activities they associated with both technology and fun: the boys focused on gaming technology and the girls focused on social networking. Views from the 14 boys included an interesting comment:

> I like IT because it is a fun subject. I like playing games on the computer, I like playing on my consoles and at any free time I am online looking at the different games released… I go online and play games at school… For me, IT is all about having fun on the computer (Marbia$_{\text{(boy)}}$, Maple School$_{\text{(single-sex)}}$)

The girls who said that IT was a fun subject similarly proceeded to talk more about

[67] Of the students who perceived IT as a fun subject, 14 were boys, four in single-sex and 10 in co-ed environments while 14 were girls, five in single-sex and nine in co-ed environments.

what they were using the technology for, rather than its content as an academic subject they were studying in school. Amongst the 14 girls who shared similar views,, Peggy clarified their shared position by saying:

> I like ICT; it is a fun subject… While at school I can surf online, chat with my friends, and keep up with the latest fashion trends… Now, that is all fun. (Peggy$_{(girl)}$, Pine School$_{(co\text{-}ed)}$)

During the creativity exercise, I observed that, in most of the co-ed school sessions, the majority of girls had their phones out on the desks and were constantly interacting with them during the exercise, unlike the boys, who were happier to interact with the computers in front of them. This observation supports Ofcom's findings (2008) that girls show a significantly higher level of mobile phone usage than boys.

It is important to note that both boys and girls in this group confirmed they liked IT as a subject and associated it with the general 'fun' and that they were experienced users of technology generally, despite having gender-differentiated preferences in relation to how they broadly interacted with technology.

4.2.3 IT as an easy subject

During the interviews, 20 students (nine boys and 11 girls)[68] suggested that they perceived IT as an easy subject taught in school compared to some of the other subjects that they were studying. These students, during their interviews, talked about their learning experiences: what topics they were learning and how IT lessons were delivered. The eight boys in this group explained that they found IT easy because of the amount of technology that they interacted with in their personal lives both in and out of

[68] This group of students comprised of nine boys, three in single-sex and six in co-ed environments, while there were 11 girls, two in single-sex and nine in co-ed environments.

school. For example, Obed commented:

> I like ICT; it is an easy subject to learn at school. ICT is all about computers and technology that surround us. We use computers and technology in different ways every day so it should be easy. ICT here in school is good and I enjoy what we learn, but it would also be nice if we can do more complicated stuff in school. (Obed$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

The girls also made similar comments to the boys. For instance, Patricia commented:

> I like ICT because it is an easy subject… I like using computers for emailing, Facebook, Bebo, Internet shopping and online chat…I am very up to date with technology. (Patricia$_{\text{(girl)}}$, Pine School$_{\text{(co-ed)}}$)

Patricia talked passionately about IT in general. A review of both the boys' and the girls' comments does not indicate that this group of girls were disadvantaged compared to the boys in terms of their IT studies.

4.2.4 IT as an interesting subject

Information (qualitative data) gathered from the students (nine boys and 10 girls) [69] during the interviews showed that they were curious about and interested in IT generally. They talked about what they were learning and how they used computers and, again, linked their study experiences to how they used other peripherals and gadgets as part of their daily lives. The boys as well as the girls were eager to express their perceptions of IT as a subject that is 'exciting' or 'fascinating', and were keen to talk about what they were learning, what they would like to learn, the skills they had acquired, and how they used the IT tools provided at school and at home (out of school)[70]. For instance, Christos, as well as the other eight boys, seemed positive and

[69] Only eight boys (four in single-sex and five in co-ed environments) and 10 girls (four in single-sex and six in co-ed environments) out of 116 students have contributed qualitative data for IT as an interesting subject. This has been used for the analysis for 4.2.1.

[70] The students' uses and engagement of IT will been discussed in detail in Chapter Six.

happy about the skills he was learning:

> I love ICT because it is a very interesting subject. My school is an all-boys academy; we have lots of new software in our computer rooms. We are taught new, exciting and interesting applications, such as Photoshop, Director; we make sprites and different kinds of animation. I like the way we are taught in school. The teachers are very helpful, and we learn a variety of new technologies. (Christos$_{\text{(boy)}}$, Cherry School$_{\text{(single-sex)}}$)

His views were echoed amongst the girls. For example, Olayinka, who shared similar views with the nine other girls in this group, talked about how she found everything to do with IT as a subject interesting and fascinating:

> ICT is an interesting subject. I like everything about the subject: I like computers. I like social networking, doing research on the Internet is helpful and very interesting. (Olayinka$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

Some of the boys and girls amongst these students mentioned a number of topics that they would like to study in more depth in IT, such as programming, website designing, hardware development and so on, believing that these topics would further enhance their knowledge and add more value to their learning. Where young people (both boys and girls) had experience of studying the subject over and above the core IT curriculum, they found these IT classes valuable, interesting, and intriguing:

> At school, they do not offer ICT as an option after Year 8, but once we have completed the syllabus, we have the option to take an early GCSE in ICT. As part of our learning, we were taught Cisco networking and basic programming using Pascal. Even though my mum kept saying the language was too old, I actually found this every interesting. (Herbert$_{\text{(boy)}}$, Hawthorn School$_{\text{(single-sex)}}$)

> ICT is so intriguing and interesting. I like programming and software designing. My father is an electrical engineer, and we do very interesting things on our home computer. He designed and built the computer network we have at home; he has helped me to develop an interest for programming. (Alicia$_{\text{(girl)}}$, Ash School$_{\text{(co-ed)}}$)

It is interesting to note that the girls in this group joined the boys in wanting more technical and interesting topics as part of their learning, and not just word-processing and Excel as some literature seems to suggest (Lynn et al. 2003). The girls in this group showed that their interest in IT had led them to actively programme for leisure like the boys, a finding that contradicts research conducted by Eurydice (2005).

Where the teenagers did not have access to supplements to their curriculum, some felt frustrated. Further comments from Alicia also show that she strongly believes there is room for improvement in how IT is taught in schools, and more opportunities should be provided to learn and acquire new skills:

> IT in school is good, but they could teach us more practical stuff. It would be nice to design websites or even build a network. Building PCs is the kind of practical stuff that will make ICT in school cool and more interesting. (Alicia$_{\text{(girl)}}$, Ash School$_{\text{(co-ed)}}$)

Similarly Onedo commented during his interview:

> I like ICT very much, and we learn interesting things like how to use sql, use other applications, how to run searches on the internet, but I would like to learn how to code, how to design and make games, not forgetting games, I like playing games. (Onedo$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

4.2.5 IT as beneficial for the future

Another interesting finding derived from the qualitative responses from the students who said that they liked IT as a subject was that they identified the importance of IT as part of the curriculum, understood that IT is important for adult life, and recognised that the skills they were learning in school would be beneficial for their future careers: this was mentioned by 11 students from the group (six girls and five boys)[71] during their interviews. All five boys in the group were very aware of the different skills they were

[71] Here, all the boys were in co-ed environments, for the girls, three were in single-sex and the other three were in co-ed environments.

learning and how relevant they were to their future careers. This was exemplified in Palaney's interview:

> ICT as a subject can be challenging sometimes, but it is useful for future cultural development and as a career pathway. I enjoy what we learn here, and I am happy with our ICT lessons. The skills I learn will be valuable for me as an adult and my future. (Palaney$_{(boy),}$ Pine School$_{(co\text{-}ed)}$)

The six girls in this group similarly commented that they also understood that IT offered skill and versatility. For example, Winnie commented:

> I like ICT as a subject because it teaches valuable skills that I will need at my future workplace especially as most work is done on the computers, so ICT is important in all aspects of our life. (Winnie$_{(girl)}$, Willow School$_{(co\text{-}ed)}$)

The views expressed by the 11 students in this group are similar to those identified in Anderson, Lankshear et al. (2008): that girls, as well as boys, can appreciate the link between what they were learning in school IT lessons and its possible application or contribution to their future careers. They understand that IT knowledge is required for them to perform basic functions in all areas of society, that it 'underpins most sectors of the economy' (Heywood 2006, p.7), and that technology is also important for adult life.

4.2.6 IT can be a hard subject

During the interviews, only four students (two boys and two girls)[72] mentioned that they found IT as a subject hard, even though they also perceived it as a 'fun' and 'enjoyable' subject. These students did not talk about IT negatively; they actually spoke positively about what they were learning at school and also understood that IT skills would be important for their future. They recognised that they found some of the topics taught as part of IT hard to understand. One of the two boys discussed the different topics he was

[72] All students mentioned here (both the boys and girls) were in co-ed environments.

learning and how he found some topics less interesting and more challenging than others:

> ICT is a challenging subject because it is one of those subjects you either like or dislike… When I like a topic, I do well in the work, but if I do not like the topic, I find it hard; when we were learning sql stuff, I could not understand what it was all about. I just found it really hard. (Ormand$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

The two girls' contributions were similar: they were also interested in IT and they talked about how they found some of the topics easy to understand while they found others hard:

> I like ICT as a subject even though I sometimes struggle to get my head around it…In Year 7, the subject was really hard… I do not like the sql stuff - it is really hard - but I like other things in IT, and I enjoy using the computers… (Ozora$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

4.2.7 IT as a subject can be boring

According to the four students (two boys and two girls)[73] who contributed, IT could be either a fun or boring subject depending on what they were doing at school. During the interviews, one of the boys talked about his interests in IT as a subject but this interest was because he enjoyed technology overall rather than what he was doing in school. The two boys in this group reported liking playing games and using computers generally for tinkering, and it was clear that this basis for liking technology was distinct from a liking of the subject, which could be 'boring':

> I like IT and enjoy everything about it… Sometimes I find IT boring due to the way it is taught - we do not really do much - but as a subject in general, I like IT because I learn a lot about computers… I like programming and I like exploring new things on my own… We do spreadsheets, Word, PowerPoint, emailing, and then the rest we read from a book. The teacher says it is something we have to cover for the GCSEs. There is not really much to it. (Manish$_{\text{(boy)}}$, Maple School$_{\text{(single-sex)}}$)

[73] Of the two girls, one was in a single-sex while the other was in a co-ed environment while both the boys were in single-sex environments.

Again, the two girls' contributions were similar to those of the boys. They enjoyed IT as a subject in school and said that it was interesting and fun, but perceived a problem in the repetitive topics, which made the subject 'boring' sometimes. Okemsi from Oak School underlined this view:

> IT can be fun sometimes, and at the same time can be boring… Because I enjoy using the computers, I like working on the different tasks at school, but at the same time, some of the topics are repeated so it gets boring… When we were learning about CD ROMs and storing data, the teacher went on and on; I really hated it… SQL was good: I would like to learn more about websites and programming. (Okemsi$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

Both the girls' and boys' contributions more generally show that they perceived IT as an interesting and fun subject which they enjoyed, but they were concerned about how they were being taught, and whether the curriculum, and its delivery, was interesting enough. Even in the case of fully engaged students who liked IT as a subject, repetitive and boring topics had the capacity to put some of these students off learning but did not diminish their enjoyment of the subject, or technology overall.

Finally, the two boys and two girls mentioned in this paragraph were very aware of how technology assists in quick communication, such as e-mails and online chat, to contact one another with ease, and how technology has dramatically changed the way they work, learn, interact, and spend their leisure time.[74]

[74] This will be discussed under students' engagement with technology in Chapter Six.

4.2.8 IT involves too much coursework

During the interviews, only two girls[75] out of the group that liked IT as a subject talked about the coursework. In contrast, the boys did not mention this. One of the girls (Farika) found IT as a subject interesting, interactive, exciting, fun and explorative, but also complained about the amount of coursework, especially when compared to coursework in other subjects at school:

> I actually like ICT, and I enjoy working with computers… At school, I like the lessons, I like the way it is taught, I enjoy everything about ICT at school; the only downside is just that we have too much coursework. (Farika$_{\text{(girl)}}$, Fringe School$_{\text{(co-ed)}}$)

Although the boys did not talk about problems with homework or coursework in IT as a subject, analysis of the quantitative data mentioned in Tables 4.2(1) and 4.2(2) Q8 (vii and viii) shows that the boys were concerned and more likely to complain that they did too much course/homework in IT. This suggests that the fact that they chose not to mention it during the (qualitative) interviews does not mean that it was not of concern and important to them, but that this concern was not as salient as concern about other aspects of taught IT.

4.2.9 IT as an interactive subject

Another theme identified during the interviews by one of the boys who said that he liked IT as a subject was that he perceived IT as an interactive subject. During his interview, he explained that IT was practical and creative in nature, and was something he could relate to due to his interest in designing websites and creating games, especially those he could interact with:

[75] These two girls – Farika from Fringe School and Ozora from Oak School were both in co-ed environments.

> I am happy with what I learn in ICT because it is so up-to-date and interactive… I design additional characters for a game I play at home, and I am able to make it come alive… The websites do things I ask it to [sic]. (Macaulif$_{(boy)}$, Maple School$_{(single\text{-}sex)}$)

Macaulif's liking for interactive elements in the IT curriculum was confirmed during observations made around the interviews that were conducted in Maple School's computer suite. The computer suite was fitted out with state of the art up-to-date technology such as an interactive whiteboard, projectors, Apple Mac computers, various recording equipment and sound technology.

4.2.10 Mixed perceptions towards liking IT as a subject

Finally, a notable interviewee was Kristina, who was the only student to talk about the speed at which technology changes. On her questionnaire, she identified herself as a student who enjoyed and liked IT as a subject. During her interview, she was positive about her engagement with IT; however, she explained that she found the pace at which new technology was introduced to be confusing as well as exciting and interesting. In this extract, Kristina expresses this mixed perception of IT as a subject and demonstrates that the ever-evolving pace of IT may be putting people off enjoying and liking the subject:

> One thing I do notice about IT is that it changes very quickly…Last year, they were teaching us about operating systems, and the teacher was going through the evolution from Windows 3.11 to Windows 95, NT, XP and Vista… I am still trying to understand these operating systems and now there is talk about Windows 7 and cloud computing… It is all confusing but exciting and interesting…IT is valuable, but it keeps changing! It is scary though; before you master something, it has moved on, and you feel as if you have not learnt anything… The changes need to slow down so that people can take in the technology and form an interest in IT… The speed of changes may be putting people off IT. (Kristina$_{(girl)}$, Krimsone School$_{(single\text{-}sex)}$)

Kristina’s concern is that the IT curriculum as it stands is not in line with the expectations of employers who require that their future employees have up-to-date knowledge of technology.

4.3 The perceptions of students who did not like IT as a subject

Due to the small sample of students (nine boys and 21 girls) who said that they did not like IT as a subject, only the results of the frequency analysis initially run on Q8 of the questionnaire as displayed in Table 4.1(4) were re-run. See Tables 4.3(1) and 4.3(2) below. The results are showing whole numbers rather than percentages.

Table 4.3(1): Perception results of Q8 for students who said that they did not like IT as a subject - response frequency

		Boys (n)	Girls (n)
Q8(i) IT is an easy subject:	Strongly Agree	0	4
	Agree	6	4
	Neutral	2	10
	Disagree	1	1
	Strongly Disagree	0	2
	Total	**9**	**21**
Q8(ii) IT is a fun subject:	Strongly Agree	0	1
	Agree	1	1
	Neutral	4	3
	Disagree	2	9
	Strongly Disagree	2	7
	Total	**9**	**21**
Q8(iii) I really enjoy IT:	Strongly Agree	0	0
	Agree	0	1
	Neutral	4	5
	Disagree	2	9
	Strongly Disagree	3	6
	Total	**9**	**21**
Q8(iv) IT is useful for my future job/career:	Strongly Agree	0	0
	Agree	4	4

		Boys (n)	Girls (n)
	Neutral	2	9
	Disagree	3	7
	Strongly Disagree	0	1
	Total	**9**	**21**
Q8(v) IT is important for adult life	Strongly Agree	1	1
	Agree	5	7
	Neutral	3	12
	Disagree	0	1
	Strongly Disagree	0	0
	Total	**9**	**21**
Q8(vi) IT is useful for me now:	Strongly Agree	2	2
	Agree	0	7
	Neutral	5	10
	Disagree	2	1
	Strongly Disagree	0	1
	Total	**9**	**21**
Q8(vii) There is too much course work for IT:	Strongly Agree	1	8
	Agree	2	6
	Neutral	6	7
	Disagree	0	0
	Strongly Disagree	0	0
	Total	**9**	**21**
Q8(viii)We do too much IT:	Strongly Agree	0	6
	Agree	1	4
	Neutral	2	8
	Disagree	6	3
	Strongly Disagree	0	0
	Total	**9**	**21**
Q8(ix) I do not feel challenged in IT class:	Strongly Agree	0	1
	Agree	5	6
	Neutral	2	7
	Disagree	2	6
	Strongly Disagree	0	1
	Total	**9**	**21**
Q8(x) I am really glad I am doing IT:	Strongly Agree	0	0
	Agree	0	2
	Neutral	6	4
	Disagree	2	8
	Strongly Disagree	1	7
	Total	**9**	**21**

		Boys (n)	Girls (n)
Q8(xi) I have made good progress so far:	Strongly Agree	2	1
	Agree	3	7
	Neutral	4	9
	Disagree	0	2
	Strongly Disagree	0	2
	Total	**9**	**21**

Table 4.3(2): - Results for Q8 independent samples t-test for students who said that they did not like IT as a subject

	Boys Mean	Girls Mean	t	df	Sig (2 tail)
Q8(i) IT is an easy subject.	2.44	2.67	-0.53	28	.600
Q8(ii) IT is a fun subject.	3.56	3.95	-0.94	28	.353
Q8(iii) I really enjoy IT.	3.89	3.95	-0.18	28	.858
Q8(iv) IT is useful for my future job/career.	2.89	3.24	-1.02	28	.317
Q8(v) IT is important for adult life.	2.22	2.62	-1.49	28	.147
Q8(vi) IT is useful for me now.	2.78	2.62	0.41	28	.685
Q8(vii) There is too much course work for IT.	2.56	1.95	1.83	28	.078
Q8(viii) We do too much IT.	3.56	2.38	2.99	28	.006
Q8(ix) I do not feel challenged in IT class.	2.67	3.00	-0.87	28	.393
Q8(x) I am really glad I am doing IT.	3.44	3.95	-1.40	28	.172
Q8(xi) I have made good progress so far.	2.22	2.86	-1.65	28	.110

The results of the independent samples t-test on the whole sample were non-significant. This shows that there were no statistical gender differences in the participants' responses; the students who did not like IT as a subject expressed negative perceptions of IT as a subject taught in school.

The results as displayed in Table 4.3(1) show that girls responded 'strongly disagree' more frequently (items Q8 (i), (ii), (iv), (vi), (ix), (x) and (xi)) to most of the positive perception statements compared to the boys (items Q8 (iii)), who more moderately responded ‘disagree’ to most of the perception statements. Overall, the responses from both boys and girls are similar regarding their ‘disagree’ and ‘neutral’ responses to most of the positive perception statements.

A re-run of the statistics for questionnaire data Q6: ‘Do you feel comfortable and confident using computers?’ for the students who said that they did not like IT as a subject was performed, and the results are displayed in Table 4.3(3):

Table 4.3(3): Results of Q6: ‘do you feel comfortable and confident using computers?’ for the students who did not like IT as a subject by gender and school environment

		Boys (n)			Girls (n)		
		Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
Responses for ‘Do you feel confident using computers? by gender, by single-sex vs. co-ed.	Yes	3	6	9	9	8	17
	No	0	0	0	0	0	0
	Not Sure	0	0	0	1	3	4
	Total	3	6	9	10	11	21

The data displayed in Table 4.3(3) above show that the nine boys (three in single-sex and six in co-ed environments) in the group who said they did not like IT as a subject felt comfortable and confident using computers. However, of the 21 girls who said that they did not like IT as a subject, four said they were not sure that they felt comfortable and confident using computers whereas the rest of the 17 girls (nine in single-sex and eight in co-ed environments) said that they felt comfortable and confident using computers.

During the interviews, the students who said that they did not like IT as a subject cited a number of reasons for their dissatisfaction. Amongst other reasons given, both boys and girls frequently mentioned the word ‘boring’. However, further analysis revealed that this term encompassed other factors. These have been broken down into the following themes for a more detailed exploration: table 4.3(4) below provides an overview of the number of students in the group who contributed qualitative data, which have been analysed for each identified theme:

Table 4.3(4): Breakdown of the number of students (who did not like IT as a subject) who provided qualitative data for the various themes identified

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. IT as a boring subject	3	3	6	8	9	17
2. IT as a hard subject	1	4	5	8	8	16
3. IT is not required for the future	1	1	2	3	5	8
4. Negative teacher - student experience	2	1	3	6	4	10
5. Fellow students’ attitudes of familiarity with technology	0	0	0	0	1	1

4.3.1 IT as a boring subject

Of the 30 students within this group who said that they did not like IT as a subject taught in school, 23 cited ‘boring’ as one of the reasons for their negative perception of IT as a subject[76]. Reviewing the information provided during the interviews, a higher number of girls (17) than boys (six) perceived IT as boring, and this generally supports the findings in the literature reviewed in Chapter Two, that 14-year olds find IT lessons boring and that girls lose interest more often than boys (Pau et al. 2005).

During the interviews, the 23 students were encouraged to talk about the meaning of ‘boring’, and it was interesting to note the different interpretations of this word between the boys and the girls. The boys discussed the meaning of IT as ‘boring’ in relation to *how* they were taught rather than *what* they were taught at school. By contrast, the girls

[76] Six boys (three in single-sex and three in co-ed environments) and 17 girls (eight in single-sex and nine in co-ed environments) mentioned ‘boring’.

focused on *what* they were taught in school rather than *how* they were being taught. For instance, Anthony conveys the views of the six boys in this group when he comments:

> I do not like ICT because of the way it is taught. The subject is boring because the teachers try to talk us through things that should be done on the computer without one. The teacher talks about data and records, and instead of using a computer to teach this, she just talks. This goes on forever, and then you just lose interest; then it gets boring. (Anthony$_{(boy)}$, Ash School$_{(co\text{-}ed)}$)

Conversely, one of the girls interviewed talked about how the topics Word and Excel did not impress her:

> I do not like ICT as a subject because it is boring; and because it is boring, learning becomes challenging. Learning how to use Word and Excel does not impress me. The things we learn at school, I can read up and teach myself. The topics they teach in ICT is [sic] just not interesting enough to stop me getting bored in class. (Juliette$_{(girl)}$, Juneberry School$_{(single\text{-}sex)}$)

While still discussing the 'boring' theme, the students also revealed their differences in opinion with regard to their interest in IT generally. Although some boys did not have an interest in IT and found it boring as a subject taught in school, this did not seem to affect their enjoyment of IT in general. Ackram from Ash School said that IT as a subject taught in school was boring, but a review of his possible career options that he completed in the questionnaire shows he was considering engineering as a future career. This extract from the interview develops his position:

> I just do not have any interest in the subject. I do like IT - I enjoy working on the computers and designing things - but I just do not have any interest for ICT. The ICT we do here is all about teaching us how to use databases, Word and spreadsheets. I am not really interested in that kind of thing. (Ackram$_{(boy)}$, Ash School$_{(co\text{-}ed)}$)

Ackram's comments, and those of other boys, confirm the findings of Pau et al. (2005), that boys view lesson enjoyment (or not) and careers as different issues. On the other hand, a review of the interview data from the girls shows that they held different opinions, as they did not view lesson enjoyment and future career options as separate issues:

> ICT is rubbish and boring! I do not know why, but I just do not like the subject. I do not find the subject creative; we learn the same things over and over, exactly the same since primary school. I have no interest in the subject whatsoever because I find it boring, and it will not be part of my future career. (Oprah$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

Oprah's comments, and those of other girls support the research findings in studies conducted by others (Margolis et al. 2003, Pau et al. 2005, Lomas 2008), which state that girls take into account their enjoyment of lessons when considering their future careers, that gender differences in attitudes to technology occur at a young age, and that girls view technological studies as not appropriate or of no interest to them.

During the interviews with this group of students,[77] they further commented that the way IT was taught at their school was a de-motivating factor that was putting them off enjoying classes and they also felt that this contributed to making it 'boring'. Both the boys and girls explained that they were concerned there were no differences between what they had learnt in primary school and what they were currently learning in secondary school; if anything the lessons were a repetition, with the differences being only the examples used and, in some cases, the versions of the applications used. For instance, where they had learned to use Microsoft Office 2003 in primary school, they were now learning and using the 2007 and 2010 versions. Ackley confirmed this:

> We get stressed out to do subjects that we have no interest in; lessons are boring and repetitive. I do like computers - I enjoy my games, online chatting and surfing the Internet - I just do not like the ICT we do in school. In primary school, we were taught how to use Word and spreadsheets; here at high school, we are taught exactly the same thing. (Ackley$_{(boy)}$, Ash School$_{(co\text{-}ed)}$)

[77] Those who do not like IT as a subject and mentioned that IT as a subject is boring.

This finding confirms those elsewhere that suggest the way IT is taught in schools is a major barrier for students, as they find it uninspiring and lacking creativity (Dorman 1998, Newmarch et al. 2000, Kennedy 2013).

Another concern raised by one of the girls who said that IT was boring was the level of assessment and the qualification at the end of the course. During her interview, not only did she report her dissatisfaction with IT because it was a ‘boring subject’, but her concern that the qualification at the end of the course was worth only half a GCSE. Gabriella advised that at her school, they took modules from Religious Studies or Business Studies to make up the other half of the GCSE, or they could complete a Diploma in Digital Applications (DIDA):

> I do not like ICT because it is a stressful and boring subject, and then the school tells you that the qualification is only worth half a GCSE module. Then you think [that] after all the hassle, you do not even get a good qualification out of it. My teacher is only interested in card games, so every task revolves around cards and games. I am not a games person, and all the other tasks are as boring as the games. (Gabriella$_{\text{(girl)}}$, Goldenrain School$_{\text{(single-sex)}}$)

These responses confirm the findings of a study conducted by Larsen (2009), which found that the lack of interest in pursuing IT as a subject is due to the students’ limited experience of the subject in school. Larsen’s participants overwhelmingly agreed that IT focused on little more than developing keyboard and word-processing skills through mundane and repetitive tasks.

4.3.2 IT as a 'hard' subject

Another negative perception recorded during the interviews by some of the students (five boys and 16 girls)[78] who said that they did not like IT as a subject related to their perception of IT as a 'hard' subject. Due to the small numbers of students here, no statistical analysis has been undertaken, but a basic count of the students shows that more girls than boys say that IT is a hard subject, and this finding was similarly identified in the research study conducted by Gras-Velazquez et al. (2009).

Both girls and boys mentioned the idea that IT is too 'hard'. During the interviews (qualitative data), the students gave a number of reasons as to why they perceived IT in this way. It was seen as 'hard' due to the amount of homework and coursework that they had to cover as part of the module (subject). The five boys said that they found IT school work difficult because they were more interested in just playing games than doing ICT schoolwork:

> I am not interested in ICT as a subject, but I love computers and playing games. I find the work they expect us to do at school in ICT really hard, and I struggle to complete the course work. (Oscar$_{(boy)}$, Oak School$_{(co\text{-}ed)}$)

The 16 girls in this group expressed views similar to those of Oscar; they talked at length during the interview session about what they did not like about IT in school and when asked to contribute further to the discussion, one of the girls said:

> I do not like ICT; it is a hard subject especially as I have no interest in computers. Teachers should stop giving out complicated boring course work and teach us the interesting and practical side of ICT. (Orla$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

[78] 21 students mentioned that IT as a subject is hard, eight girls and one boy were in single-sex environments while eight girls and four boys were in co-ed environments.

However, the girls' also said that they were more interested in social networking than in the teacher's instructions in class.

Here, the students' perceptions confirm the findings of the literature reviewed earlier, specifically, that technology and technology subjects are perceived as being difficult because they are too theoretical and rigidly structured (Newmarch et al. 2000). However, my study reveals that this problem arises not only with the girls (as suggested in Newmarch et al. 2000), but also with some of the boys, as their concerns were identical.

4.3.3 IT is not required for the future

Those students (two boys and eight girls)[79] who said they did not like IT as a subject did not perceive IT similarly to those students who liked IT as a subject[80]. Generally, this latter group had a good awareness of, and understood completely, the importance of IT and the impact technology was having - and would have - in their lives. Comments from these students show that they were not sure about its importance for their future and also could not identify the link between what they were learning as part of IT as a subject and their future career:

> I like computers, I enjoy playing computer games, but I do not like ICT at school and do not see this as something I will consider for the future. (Henry$_{(boy)}$, Hawthorn School$_{(single\text{-}sex)}$)

[79] 10 students mentioned that IT will not be required for their future - Of the two boys, one was in single-sex and other in co-ed environments, whilst of the eight girls, three were in single-sex while five were in co-ed environments.

[80] See Table 4.2(5) No.5 and paragraph 4.2.5 for the students who perceived IT as required for their future.

Henry had no awareness of the transferable skills and tools that IT delivered as a subject, which could assist in any future career. One of the girls interviewed expressed similarly negative perceptions:

> I do not like ICT. There are too many buttons to press, too much unnecessary information to input. I am not interested in IT, and I do not need ICT for styling or makeup. (Adriene$_{\text{(girl)}}$, Ash School$_{\text{(co-ed)}}$)

These interview responses from Henry and Adriene represent the views of the two boys and eight girls in the group, and support the previous research by Millar et al. (2001), and Margolis et al. (2003).

Eight of the girls interviewed also suggested that they were not interested in IT because the subject was not creative and that they could not see IT as being part of their future, a finding similar to other research (Newmarch et al. 2000, Timms et al. 2006). At the same time, this perception supports the findings in the Victoria State Government's (2001) report that schools do not teach students an awareness of how technology is shaping the modern workplace. The perception that IT is not creative existed even in situations where one of the students who participated in this study (Sarah from Snowbell School) was familiar with IT and IT-related careers:

> I have never enjoyed ICT as a subject even though I am familiar with IT because both my mother and aunt work as IT consultants. The subject I do not find creative. I do not feel engaged in class, as it just does not arouse my interest. I think if you are interested in a subject, you will make an effort to learn more and work harder; as I am not considering IT for the future I have no interest in the subject. (Sarah$_{\text{(girl)}}$, Snowbell School$_{\text{(single-sex)}}$)

This concern was not echoed in the boys' commentary, confirming similar findings in Newmarch et al. (2000). For most girls, 'pressing buttons successfully is not enough' (Newmarch et al. 2000).

4.3.4 Negative teacher and student experience

The attitude of IT teachers is another concern flagged up by 13 students (three boys and ten girls)[81] in this group. These students were not happy with the way their IT teachers related to them. Much of the literature reviewed in Chapter Two discussed how a lack of interest or dislike of computing studies was due to a lack of teacher assistance (Courtney et al. 2006); in my study, more girls than boys voiced this concern. This may have been because, like the participants in Turner et al. (2002), the girls took discouragement or encouragement from teachers in high school more seriously than the boys. The three boys who did feel dissatisfied with their teaching of IT suggested that this did have an effect on their IT studies:

> In Year 7, our ICT teacher was not helpful or enthusiastic about the subject she was teaching. Learning Word and Excel over and over again does not help, especially as the Year 7 and Year 8 topics seem to be the same. This is why I am not interested in ICT as a subject. (Odakota$_{(boy)}$, Oak School$_{(co\text{-}ed)}$)

> The teachers do not seem happy to be teaching ICT; they talk about things in isolation, and there does not seem to be any direction, nothing new to learn. I could probably teach the subject myself; Word and Excel are not that difficult to teach. (Victor$_{(boy)}$, Violet School$_{(single\text{-}sex)}$)

The ten girls, however, seemed to have stronger feelings on this issue:

> I hate ICT. The two teachers I had were being really bad and very unhelpful. They come into the class and just tell you what they want you to do. It just seems as if they do not care. Probably explains why they do not last and why we are not interested in the subject. (Rosanne$_{(girl)}$, Rowan School$_{(single\text{-}sex)}$)

> I do not particularly like ICT because it is just a wonky subject, and you get the feeling no one knows how to teach. The teachers take it for granted that because we have been born into technology, we know what to do with it; therefore, rather than teach us, they expect us to Google it or stand back and just give instructions on what to do. (Edith$_{(girl)}$, Elm School$_{(single\text{-}sex)}$)

[81] 13 students mentioned negative teacher and student experience; two boys were in single-sex and one in co-ed environments, while six girls were in single-sex and four in co-ed environments.

The students reiterated the importance of dedicated IT teachers who are interested in the subject and able to provide valuable knowledge. They also recognised the importance of changing not just the teaching content, but also a change in attitude towards the medium and how the knowledge is conveyed and communicated, which could improve their interest in IT as a subject.

Courtney et al. (2006) have also suggested that students reported that the teachers contributed significantly to their dislike of IT. Further research has shown that schools where IT was integrated into other curriculum subjects suffered from having inexperienced or uninspiring IT teachers, an aspect that contributes to teachers not being able to generate enough enthusiasm and interest to teach IT effectively (Crawford 1998, 2000). This issue was identified in further comments made by the ten girls in this group, such as the following:

> I had a worthless teacher and did not learn much. It is ridiculous. My Year 7 teacher got fired because she got caught helping us to curl our hair during an ICT lesson. The lessons were boring, we wanted to do our hair curly, and so she curled it. I did not enjoy the lessons, and for most part of the lessons, I was not paying any attention. (Ulrika$_{\text{(girl)}}$, Union School$_{\text{(single-sex)}}$)

> I am talking from my experience of having bad ICT teachers in Year 7 and Year 8. The teachers do not explain the tasks properly, they do not care, and they just want you to get the work done. My dislike for ICT started in high school; there was so much to cover, and the subject was not even interesting either. (Yasmin$_{\text{(girl)}}$, Yellowreed School$_{\text{(single-sex)}}$)

The students also suggested that ICT teachers expected them just to ‘get on with it’ simply because they had been born into a technological age (cf. Crawford 2000).

4.3.5 Fellow students' attitude to and familiarity with technology

Some girls (such as Ortavia from Oak School) who said that they did not like IT as a subject suggested that their dislike was partly because the boys were always disruptive and 'showing off' in IT classes. Ortavia said she found this off-putting and advised that it was affecting her learning. The literature reviewed earlier suggested that female students often feel inferior to and dominated or intimidated by boys within learning settings (Cisco Systems 2002, Gurer et al. 2002), and this can be a cause and effect of girls viewing themselves as being low in confidence and awareness with respect to IT (AAUW 2000, Beckwith et al. 2005). A review of the quantitative data (Q6 of the questionnaire) and qualitative data (interviews) provided by Ortavia during her interview confirmed this link.

Other literature reviewed earlier also did confirm that the presence of boys in the learning environment (in class) discourages girls (Comber et al. 1997), and Ortavia was quick to point this out during her interview:

> It has been the same since primary school and even more so now that we are in high school: the boys in class show off all the time when we are in ICT lessons. They are always in a hurry to get the work done; they are so disruptive, it is all just wrong. (Ortavia$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

It is worth noting that during the creativity exercises and subsequent interviews for this research in the co-ed environment schools, disruption from the boys was not particularly obvious. However, the speed at which the boys tackled the tasks given during the session was significantly faster than that of the girls. The boys were quick to start working on the activities while the girls asked for further clarification before getting on with the task. Research suggests that this can be a function of girls viewing themselves as low in confidence and awareness with respect to ICT (AAUW 2000, Beckwith et al. 2005). However, this did not seem to be a concern for those girls in my study who were being educated in single-sex environments.

As suggested in Chapter Two, girls' interest in computers tends to develop later than that of boys; consequently, boys enjoy a head start in computer awareness, which then becomes assumed knowledge within high school curricula (Cohoon 2003). This explanation could account for the widely reported lack of interest shown by girls when provided with the opportunity to choose technical computing subjects (Millar et al. 2001).

Overall, during the research activities, the boys emerged as more comfortable and confident with IT: they were quick to try things out by themselves, they completed the questionnaire with limited instructions, and they asked fewer questions and needed less clarification than the girls. In essence, the boys exhibited a tremendous amount of confidence that allowed them to independently tackle all the activities.

4.4 The perceptions of students who were not sure about IT as a subject

A small group of students (seven boys (9%) and 11 girls (13%))[82] in this research were not sure whether they liked IT as a subject. Further analysis was conducted on these students using the information recorded on the questionnaire (quantitative data), and the results show that in single-sex environments, a slightly higher percentage of the girls

[82] See details in Table 4.1(1) above.

(13%, n=4) than the boys (10%, n=2) said that they were ‘not sure’ about IT as a subject. Similarly in co-ed environments, a slightly higher percentage of the girls (13%, n=7) than the boys (9%, n=5) also said that they were ‘not sure’ about IT as a subject.[83] These results suggest that both the boys and the girls were confused (‘not sure’) and were not fully aware of how technology is shaping 21st century living, as suggested in the research findings for the Victoria State Government (2001).

During their interviews and a review of their completed questionnaires these students chose the option ‘not sure’ to the question ‘Do you like IT as a subject’. An opportunity was given to them to explain further, and the reasons provided by these students for their uncertainty seemed to be a mixture of positives and negatives regarding IT as a subject, similarly identified and discussed in the previous sections.

The first reason was that IT as a subject in school was boring and that the teacher’s lack of enthusiasm and assistance teaching the subject made the students less confident in tackling the tasks given in class. Various responses included topics in secondary school being similar to those learnt in primary school and IT lessons not being challenging or interesting enough. One of the girls interviewed explained how she felt about IT:

> ICT is boring; there is nothing interesting about the subject. I like things that are creative, interesting. ICT is so set, you are either learning how to use Word or Excel, or the teachers are talking about some data. We do the same topics over and over again. I like IT, but mainly for research, social networking, online shopping and just general surfing on the net. I do like IT, but it is different from the IT we do in school (Orielle$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

Another student discussed his experiences of IT as a subject. He expressed difficulties and lack of concentration during IT lessons, mixed perceptions of IT as a subject,

[83] See details in Table 4.1(2) above.

specifically, it being both a ‘hard’ and ‘easy’ subject. A combination of all these factors made him indecisive as to whether he actually liked IT as a curriculum subject:

> I am not sure about IT as a subject because sometimes I find the work hard, and when it is hard, I find it difficult to concentrate, and I do not understand what I need to do. (Pablo$_{(boy)}$, Pine School$_{(co\text{-}ed)}$)

Generally, the boys who were ‘not sure’ of their opinion regarding IT as a subject were ambivalent about it, unlike some of the other boys who participated in my study, namely those who said they liked IT and those who said that they did not like IT. As mentioned earlier by one of the boys, because IT is compulsory in KS3 and KS4 in most of the state schools (optional in independent schools), it was viewed in a similar way to any other curriculum subject, such as Maths and English. The fact that IT is compulsory means that their interest or lack of interest in the subject was not overly dwelt upon. The boys who said they were not sure they liked IT as a subject did not express any particular interest in or passion for IT, and they could more easily be grouped with the students who said outright that they did not like IT as a subject than those who liked it. For instance, when Masoud was interviewed, he made this very clear:

> I have not enjoyed ICT here. My experience of the subject has been negative. I do not like ICT; it is boring. In Year 7, the ICT teacher was not helpful, she was not enthusiastic about the subject, and she was teaching us how to use Word and Excel, topics I do not like. The topics were the same all through the term; I use Word at home, so I did not learn anything new. (Masoud$_{(boy)}$, Maple School$_{(single\text{-}sex)}$)

Masoud harboured negative perceptions regarding IT, and his contributions lent credence to the suggestion that if the subject were not compulsory, he probably would de-select it at the earliest opportunity (when he made his GCSE subject choices). The IT curriculum as it currently stands was seen by these students as uninteresting and uninspiring and, according to existing research, insufficient IT resources at schools could mean that students may have an insubstantial curriculum upon which to base their decisions about and interest in IT; this may affect their ongoing perceptions, especially for girls (Crawford 2000).

Pablo from Pine School (above) mentioned the lack of concentration in class, and although this was not particularly talked about amongst the girls in the session, a girl from the group of students who did not like ICT as a subject (Ortavia from Oak School)[84] did complain about distractions from the boys, and their 'showing off' tactics in class. Either way, the girls who said they were not sure that they liked IT as a subject confirmed that IT as a subject could be both hard and easy, which they also attributed to the amount of coursework involved in IT and that what they were learning as part of the subject was boring. One of the girls interviewed tried to explain her perceptions of IT being both a hard and an easy subject:

> I do not like ICT because they give us too much coursework at school, and it is boring! ICT is easy. I think because the subject feels so easy, there is not really anything interesting about the subject, sometimes no motivation to get the work done. Not sure why it is a subject, as it feels like all we do is typing in Word, working on a few spreadsheets, and then the teacher talks to us as if we are dumb. (Jennifer$_{\text{(girl)}}$, Juneberry School$_{\text{(single-sex)}}$)

The comments from both the girls and boys above show that they were not interested in IT as a subject and due to the various reasons identified subsequently, they were not sure whether they liked IT as a subject. These attitudes and perceptions confirm research findings elsewhere, which have suggested that the enjoyment of IT lessons decreases by the age of 14 for both genders (Pau et al. 2005, Lomas 2008). My study shows that the teenagers who were not sure that they liked IT as a subject were concerned about their negative experiences at school, low levels of enjoyment of IT

[84] See paragraph 4.3.5 – Fellow students' attitude to and familiarity with technology.

lessons, as well as the other reasons as identified by them (both girls and boys) in this section. Indeed, the research reviewed earlier confirmed that the main differences identified between boys' and girls' use of IT are related to IT outside of school, because in school the instructions and learning are formally passed to boys and girls equally (Wilson 2002, Colley et al. 2003, Becta 2008). These girls and boys were confused or not sure how they perceived IT because they either did not understand the opportunities learning IT skills offers, or they did not want to form an opinion regarding the subject.

4.5 Ethnic background, parents' occupation (class) and students' perceptions of IT as a subject

As part of the data collected for this study, ethnic background and parents' occupation was recorded for each of the participants. The different job types of the parents reported by the students was recoded into eight main groups using the standard occupational classification 2010 codes (SOC2010). The data input into SPSS was analysed based on the parent with the highest socio-occupational class (the parent with the highest ranked job) to see if there were differences between social class, ethnic background and their perceptions of IT as a subject. Due to limited numbers, participants were grouped into four main ethnic groupings comprising of Asian (16.5%), Black (42.7%), Mixed/Other (11%) and White (29.9%). See table 4.5 below for a full breakdown of the students' data:

Table 4.5: Students by ethnic background, parents job and perceptions of IT as a subject:

Ethnic Background	Social Occupational Classification 2010 (SOC % (n) per ethnic background)		Boys (n) Like IT as a Subject				Girls (n) Like IT as a Subject			
			Yes	No	Not sure	Total	Yes	No	Not sure	Total
Asian	Lower Managerial Administrative Professional	4.9 (8)	4	1		5	3	0	0	3
	Intermediate Occupations	1.2 (2)	1	0		1	1	0	0	1
	Small employers and own account workers	5.5 (9)	8	0		8	0	0	1	1
	Semi routine occupations	1.8 (3)	2	0		2	1	0	0	1
	Routine occupations	2.4 (4)	1	1		2	1	1	0	2
	Unemployed	0.6 (1)	1	0		1				
	Total	**16.5 (27)**	**17**	**2**		**19**	**6**	**1**	**1**	**8**
Black	Higher Managerial Administrative Professional	8.5 (14)	3	1	1	5	3	5	1	9
	Lower Managerial Administrative Professional	16.5 (27)	11	2	2	15	4	7	1	12
	Intermediate Occupations	7.3 (12)	3	0	1	4	6	2	0	8
	Small employers and own account workers	3.7 (6)	2	0	0	2	3	1	0	4
	Semi routine occupations	4.3 (7)	3	0	0	3	2	0	2	4
	Routine occupations	1.2 (2)	1	0	1	2				
	Unemployed	1.2 (2)					1	1	0	2
	Total	**42.7 (70)**	**23**	**3**	**5**	**31**	**19**	**16**	**4**	**39**
Mixed/Other	Lower Managerial Administrative Professional	4.3 (7)	3	0	1	4	1		2	3
	Intermediate Occupations	1.8 (3)	0	1	0	1	2		0	2
	Small employers and own account workers	1.8 (3)	2	0	0	2	1		0	1
	Lower supervisory craft and related occupations	1.8 (3)	1	0	0	1	2		0	2
	Routine occupations	0.6 (1)					1		0	1
	Unemployed	0.6 (1)					0		1	1
	Total	**11 (18)**	**6**	**1**	**1**	**8**	**7**		**3**	**10**
White	Higher Managerial Administrative Professional	0.6 (1)					1	0	0	1
	Lower Managerial Administrative Professional	10.4 (17)	5	2	0	7	7	2	1	10
	Intermediate Occupations	4.9 (8)	1	0	0	1	6	1	0	7
	Small employers and own account workers	3.7 (6)	3	0	0	3	2	0	1	3
	Lower supervisory craft and related occupations	3.7 (6)	3	0	1	4	1	0	1	2
	Semi routine occupations	3.7 (6)	3	0	0	3	2	1	0	3
	Routine occupations	1.8 (3)	2	1	0	3				
	Unemployed	1.2 (2)					2	0	0	2
	Total	**29.9 (49)**	**17**	**3**	**1**	**21**	**21**	**4**	**3**	**28**
Total	Higher Managerial Administrative Professional	9.1 (15)	3	1	1	5	4	5	1	10
	Lower Managerial Administrative Professional	36 (59)	23	5	3	31	15	9	4	28
	Intermediate Occupations	15.2 (25)	5	1	1	7	15	3	0	18
	Small employers and own account workers	14.6 (24)	15	0	0	15	6	1	2	9
	Lower supervisory craft and related occupations	5.5 (9)	4	0	1	5	3	0	1	4
	Semi routine occupations	9.8 (16)	8	0	0	8	5	1	2	8
	Routine occupations	6.1 (10)	4	2	1	7	2	1	0	3
	Unemployed	3.7 (6)	1	0	0	1	3	1	1	5
Total		**100(164)**	**63**	**9**	**7**	**79**	**53**	**21**	**11**	**85**

Analysis of the data in table 4.5 above reveals that the majority of the participants were Black, followed by White, Asian and Mixed/Other. This was a reflection of both the demographic profile of the area (Southeast London Borough), therefore most of the participants pre-selected by the individual schools used in the study and the Wazobia group of children were Black. The majority of the Black participants ($^{53}/_{70}$) came from homes of higher to lower managerial, administrative or professional occupations and intermediate occupations, whilst participants from the other ethnic backgrounds were more evenly distributed amongst the various job types. The data also indicates that the overall majority of students ($^{108}/_{164}$) who participated in the study were from middle class socio-occupational homes, their parents occupations were either lower managerial administrative professional, intermediate occupations or small employers.

With regards to the students' perceptions of IT as a subject in-relation to their parents' socio-occupational class and ethnic background, no substantial and clear differences emerged. The absolute numbers for the boys and girls perceptions of IT as a subject ('yes', 'no' or 'not sure' if they like IT as a subject) as displayed for each group by ethnic background and parent's occupation were similar; a majority of the boys (63) and girls (53) like IT as a subject, but of the girls (21) who said that they did not like IT as a subject (no), the girls (16) from Black ethnic background recorded the highest number compared to the Asian (one), and White (four) girls. It may be that the ethnic background of this particular group of girls led to a higher rate of participants not liking IT. However, there is no additional support for, or clarification of this suggestion available in the qualitative data.

Overall, the dataset shows that in all ethnic backgrounds, the boys like IT as a subject more than girls, although it was noted above that the girls in single-sex environments were more likely to say that they like IT as a subject (see table 4.1(2) above). Interestingly, a review of the information recorded on the questionnaire also shows that the Black parents favoured single-sex environments (both state and independent) for their girls (22)[85] more than the parents of the other ethnic backgrounds (Asian (three), Mixed/Other (three), White (three)): since no further analysis was conducted due to the limited sample, the dataset is unable to offer any further explanation as to why this is the case, nor shed more light on the potential association between ethnic background and the perception of ICT.

Moreover, regarding any further clarification of whether or not there was a relationship between social class based on parents occupation, ethnic background and students perception of IT as a subject; unfortunately the appropriate feeder questions that could have specifically assisted with clearly identifying whether these background characteristics played a part in determining whether the teenagers liked IT as a subject, were not included in the study. Although parents occupations were recorded on the questionnaire, some students were not sure if their parents were in managerial positions and just provided their job title, which was recoded using SOC2010 codes, where possible, but a lot of data was imprecise or missing. As such it has not been possible to draw out any clear and precise conclusions between ethnic background, social class based on parents occupation and opinions of IT as a subject.

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[85] Of the 22 Black girls, 10 said' Yes', 10 said 'No' and two said 'Not sure' to liking ICT as a subject.

4.6 Conclusion

This chapter has discussed IT as a subject in school, focusing on the perceptions of the students who participated in this study. The students' data has been analysed together and within three separate groups of participants: from those who said that they 'liked', 'did not like', or were 'not sure' about IT as a subject. Overall, the quantitative findings (questionnaire data) in this chapter show that a greater percentage of the boys generally liked IT as a subject compared to the girls. Additionally, a number of differences and similarities between the boys' and the girls' responses were noted with regard to the IT perception statements they were asked to rate. Here the results showed that a greater percentage of the boys agreed more strongly with positive statements about IT as compared to the more moderate responses from the girls.

Differences identified (quantitative data) with regard to how the boys perceived IT as an easy, fun and enjoyable subject were recorded and showed that a greater percentage of the boys than of the girls had positive perceptions of IT. The boys also rated more positively the idea that IT is important for adult life and were glad that they were doing IT but felt less challenged compared to the girls. There were similarities noted with regard to boys' and girls' perceptions of whether IT was useful to them, either now and/or for their future career, the amount of IT and coursework undertaken, and the progress they had made so far. Furthermore, similarities were recorded for the boys and girls regarding comfort and confidence levels when using computers. Due to the small number of students who participated in my study, only the differences and similarities between the students in single-sex vs. co-ed environments were reviewed, whilst those between students in private vs. state schools were reviewed as part of the analysis but were not explored here because of the very small numbers of participants in each cell. According to the quantitative data, more of the boys than the girls in both single-sex and co-educational environments said that they liked IT as a subject.

Regarding comfort and confidence using computers, the results between the boys and the girls across all the school environments were similar. Interestingly, my quantitative data also shows that the girls in single-sex schools did not feel more positive about IT as a subject than did those in co-ed schools, which contradicts some literature claiming otherwise (Spielhofer et al. 2002, Bateson 2008, Sudgen 2009).

Analysis of the creativity map data collected from the students during the session, regarding IT as a subject, reveals similarities to what the students said during their interviews. For example, they talked about IT as a subject being boring, complicated and hard. They expressed their concerns about how IT as a subject is taught and the negative attitudes from the teachers. The students were allocated into groups to enable them to spark debates. Their views were mixed and displayed both positive and negative perceptions of the subject. As the session was mixed, gender differences could not be recorded because there were no names or gender attached to the comments made.

The qualitative data recorded during the interviews show that the students who said they liked IT as a subject were very positive about their studies and learning at school; they viewed IT as an interesting, interactive, easy, fun and enjoyable subject. These boys and girls also perceived IT as beneficial for their future, which meant that they had an equal understanding of the opportunities that learning IT skills can afford individuals and the importance of IT in 21st century living. Similarly, both boys and girls perceived themselves as comfortable and confident computer users. Among these students who said that they liked IT as a subject, a number of common concerns were raised by them, which were that they had mixed perceptions towards their liking of IT, said that IT involves too much coursework, IT can be hard, and sometimes that IT as a subject can also be boring. As mentioned earlier, the views expressed among this group of students were similar; apart from the differences in the number of boys and girls who contributed the qualitative data, there were no major differences in perceptions identified.

However, this was not the case for all students who participated in this research study. As stated earlier, the way IT is taught in schools is of great concern to all students, but more particularly to those students who said that they did not like or were not sure if they liked IT as a subject, and the design of IT as a curriculum subject was perceived as inherently flawed. The students who said that they did not like and those who were not sure about IT as a school subject thought it was boring and/or hard; they mentioned that IT at school lacked creativity, and they did not see what they were learning at school as something that was required for their future or possibly for their career. In addition, the students noted their teachers were not helpful and did not provide enough support, assistance, or encouragement; a factor that the students agreed was a hindrance to their learning of, and interest in, IT studies. Also, a further concern was raised by one of the girls during the interviews regarding the attitude of boys in the classroom; she perceived that the boys in her IT class were noisy, boisterous and disruptive.

Amongst the students who said they did not like or were not sure about IT as a subject, a number of subtle differences were noted and recorded with regard to how the boys and girls viewed what they were learning in IT at school, the boys being more concerned with *how* they were being taught while the girls were more concerned about *what* (the content) they were learning. More of the girls than the boys found IT ‘boring’, and this word had different meanings for the boys and for the girls. More boys than girls suggested that topics such as programming and designing were easy and therefore unchallenging. In contrast, the girls thought that IT was boring because it was a difficult and uninteresting subject; they also showed greater concern about the negative attitudes of the teachers than did the boys. As has been suggested above in section 4.5, this study could not confirm whether parental socio-occupational class, or ethnic background were determining factors for students who like, did not like or were not sure about IT as a subject they learn at school, because of the small sample size and the fact that this was not the focus of this research and therefore there was limited questioning in relation to these areas.

Finally, an interesting finding that applies to the majority of the students who participated in this study is that they expressed a high level of satisfaction with IT; this seems to be mainly because the students enjoyed their use of IT in itself. In addition, the students had been exposed to and had access to a number of different gadgets, computer games and various portable devices such as laptops, android tablets and mobile phones; and this had nurtured their interest in technology overall. Although students today are benefitting from the wide range of technology available, in this study, they still considered that what they were learning stifled their creativity, therefore they did not see themselves as technology creators but ultimately as technology consumers. These students wanted to learn programming, designing, and other new emerging technologies whilst in school and did not want to wait until they were in the Sixth Form or further education before they could enjoy the full potential of IT as a subject. In addition, some of the girls in my study dispelled stereotypical perceptions that they were afraid of programming and coding.

Chapter Five: Perceptions of IT as a career

5.0 Introduction

IT is one of the most important industries for any nation in the world. It makes possible global communication, international trade opportunities, and support mechanisms for domestic and international services; in this respect, it is seen as a global business and economic enabler (Kreitner & Kinicki 2004, Ramsey & McCorduck 2005, Huang & Trauth 2006, Trauth & Quesenberry 2006, Lewis, Lang & McKay 2007). As discussed in Chapter One, the IT industry is a sector in which women are significantly underrepresented. Whilst employment in professional IT occupations has consistently grown in the past few decades, the representation of females within the IT industry has also steadily declined. According to statistics provided by UKRC (2012), there were 782,000 male STEM graduates in 2008. Of these, 391,000 were employed in SET occupations, compared to the 620,000 female STEM graduates, of whom only 185,000 were employed in SET occupations, a figure of concern to the IT industry. The literature reviewed earlier in this thesis has shown how science and technology are reshaping our world and how we interact with ICT. As mentioned earlier, STEM and ICT innovations are also serving as economic drivers and tools for realising knowledge societies based on freedom of expression, respect for cultural diversity, and access to information. As such, women and girls are, arguably, disadvantaged by their relative underrepresentation in STEM and ICT careers, and their greater representation might drive significant change in scientific, social, economic, and political spheres.

This underlines the importance of gaining improved understanding of teenagers' perceptions of IT careers as it is from amongst them that the industry will recruit in the future.

This chapter focuses on my participants' perceptions with regard to IT as a possible future career. The main questions addressed here are as follows:

1. How do teenagers perceive IT as a career?
    a. What are their reasons for viewing IT careers positively or negatively?

2. Would teenagers consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future?
    a. What are the reasons for their decision?

3. How and to what extent do gender differences exist with regard to teenagers':
    a. perceptions of IT as a career?
    b. willingness to consider IT as a possible career choice?

5.1 Students' perceptions of IT as a career

Q9 of the questionnaire asked, 'Would you consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future?' Below is an initial breakdown of participants' responses.

Table 5.1(1): Results of Q9: students' views of IT as a career for the future, by gender

		% (n) Boys	% (n) Girls	% (n) Total
Q9 Would you consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future?	Yes	40 (32)	18 (15)	29 (47)
	No	37 (29)	43 (37)	40 (66)
	Not Sure	23 (18)	39 (33)	31 (51)
	Total	100 (79)	100 (85)	100 (164)

Table 5.1(1) above provides a summary of the quantitative findings in relation to the responses provided by the research participants. A greater percentage of the boys (40%) than of the girls (18%) agreed that they would consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future, and, concomitantly, a greater percentage of girls (43%) than boys (37%) said 'no' to this question, and a greater percentage of girls (39%) than boys (23%) said 'not sure' to working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future.

A chi-square test was conducted on the sample as displayed in Table 5.1(1) above to determine whether the differences between the boys and the girls were significant. The result shows that the test was significant; this confirms that the boys were more likely than the girls to say that they would consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future: $\chi 2$ (2, N = 164) = 11.33 $p < .005$.

A further analysis of this initial quantitative data was performed to review the students' responses based on their school environment (single-sex vs. co-ed) and the results are displayed as follows:

Table 5.1(2): Results of Q9 - students' responses by gender and school environment (single-sex vs. co-ed):

	Boys % (n)			Girls % (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
Yes	25 (5)	46 (27)	40 (32)	19 (6)	17 (9)	18 (15)
No	50 (10)	32 (19)	37 (29)	52 (16)	39 (21)	43 (37)
Not Sure	25 (5)	22 (13)	23 (18)	29 (9)	44 (24)	39 (33)
Total	100 (20)	100 (59)	100 (79)	100 (31)	100 (54)	100 (85)

The information in Table 5.1(2) above shows that a higher percentage of the boys (25%) than of the girls (19%) in single-sex environments and a much higher percentage of the boys (46%) than of the girls (17%) in co-ed environments said that they would consider working in the IT sector or working as an IT consultant in another industry, whereas a slightly higher percentage of the girls (52%) than of the boys (50%) in single-sex environments and a slightly higher percentage of the girls (39%) than of the boys (32%) in co-ed environments said that they would not consider working in the IT sector or working as an IT consultant in another industry. Finally, a much higher percentage of girls (44%) than boys (22%) in co-ed environments and a slightly higher percentage of girls (29%) than boys (25%) in single-sex environments said they were not sure if they would consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future. Interestingly, the data also show that a slightly higher percentage of girls in single-sex environments (19%) than girls in co-ed environments (17%) were more likely to consider working in the IT sector or working as an IT consultant in another industry. In other words, single-sex school environments, for both genders, appear to be somewhat more conducive to students' positive willingness to consider IT as a career than co-ed environments, although it should also be noted that girls and boys in single-sex environments were more likely to say 'no' to a future working within IT.

The students in private schools (18 boys and seven girls) did not seem to view IT careers positively in general and so were less likely to consider IT as a possible career choice for their future. Only four boys and one girl said they would consider IT as a future career whilst the majority said 'no' (12) or 'not sure' (seven). However, due to the small size of the participant sample for those attending private schools, further statistical analysis of the students' school type (private vs. state) has not been explored as the majority of students who participated in this study were in state schools (61 boys and 78 girls).

The students were asked in Q4 to provide four possible options regarding which job (career) they would like to consider when they grew up. The results are displayed as follows:

Table 5.1(3): Results of Q4 - students' career choice options by gender:

Career /Job	Career Option 1 % (n)		Career Option 2 % (n)		Career Option 3 % (n)		Career Option 4 % (n)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Entertainment & Media	7 (6)	14 (12)	11 (9)	16 (14)	9 (7)	20 (17)	13 (10)	17 (14)
Medical	11 (9)	19 (16)	8 (6)	18 (15)	8 (6)	19 (16)	5 (4)	9 (8)
No Response	0 (0)	0 (0)	3 (2)	2 (2)	14 (11)	7 (6)	28 (22)	26 (22)
Business & Enterprise	10 (8)	6 (5)	4 (3)	9 (8)	5 (4)	7 (6)	8 (7)	2 (2)
IT	9 (7)	1 (1)	10 (8)	6 (10)	17 (13)	1 (1)	6 (5)	2 (2)
Fashion & Design	0 (0)	9 (8)	0 (0)	8 (7)	1 (1)	13 (11)	0 (0)	11 (9)
Legal	5 (4)	8 (7)	7 (6)	4 (3)	3 (2)	8 (7)	4 (3)	4 (3)
Sports	15 (12)	1 (1)	9 (7)	1 (1)	5 (4)	0 (0)	6 (5)	4 (3)
Engineering	10 (8)	0 (0)	11 (9)	1 (1)	9 (7)	0 (0)	8 (6)	0 (0)

Career /Job	Career Option 1 % (n)		Career Option 2 % (n)		Career Option 3 % (n)		Career Option 4 % (n)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Scientist	3 (2)	2 (2)	4 (3)	2 (2)	6 (5)	2 (2)	6 (5)	5 (4)
Skilled Labour, Trades & Transport	5 (4)	0 (0)	6 (5)	2 (2)	9 (7)	0 (0)	5 (4)	0 (0)
General Animal Care	1 (1)	4 (3)	1 (1)	8 (7)	0 (0)	6 (5)	0 (0)	5 (4)
Forces & Secret Services	9 (7)	2 (2)	4 (3)	1 (1)	1 (1)	0 (0)	3 (2)	1 (1)
Aviation	3 (2)	5 (4)	4 (3)	2 (2)	4 (3)	0 (0)	1 (1)	1 (1)
Architect, Property Dev, Const & Interior Design	4 (3)	2 (2)	1 (1)	5 (4)	0 (0)	0 (0)	5 (4)	1 (1)
Hotel & Catering	0 (0)	1 (1)	3 (2)	1 (1)	3 (2)	2 (2)	0 (0)	4 (3)
Administrative	0 (0)	4 (3)	4 (3)	1 (1)	1 (1)	1 (1)	0 (0)	1 (1)
Artist	0 (0)	4 (3)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	2 (2)
Domestic & Caring	3 (2)	1 (1)	1 (1)	1 (1)	0 (0)	1 (1)	0 (0)	1 (1)
Journalism & Photography	0 (0)	4 (3)	0 (0)	1 (1)	0 (0)	4 (3)	0 (0)	0 (0)
Theology & Social Care	0 (0)	2 (2)	0 (0)	1 (1)	1 (1)	2 (2)	0 (0)	1 (1)
Total	100 (79)	100 (85)	100 (79)	100 (85)	100 (79)	100 (85)	100 (79)	100 (85)

The information in Table 5.1(3) above shows that, with the exception of medical careers, which were more popular with the girls than with the boys, careers such as IT, engineering, science, and sports were more popular with the boys than with the girls. The girls reported more interest in the non-technical, social and caring careers, such as fashion and design, entertainment and media and general animal care. This finding in my data with regard to science, engineering, and IT - Technology (SET) occupations being chosen by the boys supports other widely reported research studies which have confirmed the dominance of boys in IT careers (Multimedia Victoria 2004, Lynch 2007, Rommes et al. 2007, McKinney et al. 2008). Similarly, the process of the girls’ choice of occupations is in line with Gottfredson’s (1981) development theory of occupational aspirations (1981), which suggests that girls go through a process of eliminating and retaining occupational choices, and then considering only those occupations within an area bounded by their acceptable levels of prestige and sex type (Gottfredson 1981, EOC 2001, Woodfield 2007). This means that the girls who participated in my study seem to relate to and have selected familiar careers: those portrayed as acceptable by their environment, including the media, parents, extended family and friends.

Finally, for Q5, the students were asked who or what had influenced these choices. The results are as follows:

Table 5.1(4): Results of Q5: students' influences on job and career choices by gender[86]

		% (n) Boys	% (n) Girls	% (n) Total
Q5. Who has influenced your decision with regards to your job choices for the future? (Please tick as many boxes that apply to you):	Self (choice made Independently)	80 (63)	77 (65)	78 (128)
	Parents	49 (39)	45 (38)	47 (77)
	Other Family Members	38 (30)	44 (37)	41 (67)
	Media	27 (21)	38 (32)	32 (53)
	Peers/Friends	18 (14)	22 (19)	20 (33)
	School/Teachers	13 (10)	15 (13)	14 (23)
	Others	10 (8)	7 (6)	9 (14)
	Career Advisors	8 (6)	2 (2)	5 (8)

The information displayed in Table 5.1(4) above shows that, regarding a possible future career and job choices, the majority of the students (both boys and girls) were most influenced by their own inclinations: most reported that they made their choices independently; secondarily, they were influenced by other people they saw as their role models, such as their parents and other family members; thirdly, by what they saw in the media; and finally, by their friends' and their peers' perception of them. The results,

[86] The students were given an option to select and list as many influences that applied to them and their circumstance.

as displayed in the table and show a comparative lack of influence by the schools (teachers and careers advisors) with regard to the students' future job and career choices. The results in table 5.1(4), above, also show gender differences with regards to the students' influences: the girls seem more influenced by the media, their peers, teachers, and other family members compared to the boys.

At each school, I conducted interviews with the students to collect more qualitative data focused on the reasons behind these career perceptions and aspirations. The students who expressed interests in IT engineering and web development talked extensively about their interest in IT generally and explained that they would like their future career to be in an IT-related sector:

> I would like to base my future work around IT. Managing a business that can be conducted through the Internet is my dream job or to be an IT designer creating websites for people. (Parker$_{(boy)}$, Pine School$_{(co\text{-}ed)}$)

Even though the quantitative results displayed in Tables 5.1(1) and (3) above show that IT as a future career was more popular with the boys than with the girls, 15 of the girls[87] were also considering IT as a possible career choice or as a backup career choice for the future. The literature reviewed earlier cited 'individual differences' as one of the reasons why some girls do consider IT careers: girls' personality traits, enjoyment of computers and overall outlook are some of the characteristics accounting for these differences (Trauth et al. 2004). Additionally, it is arguable that with the amount of technology girls become involved with and have access to, such as social networking, wireless and mobile networking and online shopping, it is not surprising that some girls would enjoy using and creating technology and would subsequently consider IT as a

[87] See career options 1, 2, 3 and 4 in Table 5.1(3) above.

possible career option. The girls in my study who were interested in IT careers were indeed different from the others (those girls who said 'no' or 'not sure' to IT careers) and they consciously were choosing not to conform to social pressure regarding the stereotypical images portrayed of IT workers:

> I will consider working in IT as a career option because I enjoy IT and computers. I know it will be a good career choice even though my friends think I will become a 'geek'. I am interested in software engineering. (Wallis$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

Wallis suggested her parents wanted her to pursue an accounting or medical career, but she had an interest in an IT career and saw technology as an interesting and good career path. Similarly, the other girls who were interested in IT careers further commented that companies and businesses would need technology and digitally skilled workers to succeed. Indeed, they were convinced that IT would provide a fulfilling career despite the 'geeky' image portrayed.

Another reason cited by previous researchers as to why boys tend to outnumber girls with regard to possible IT careers is that, apart from IT being perceived as a 'masculine' career, boys, influenced by their peers' 'gaming culture', enjoy playing and experimenting with or 'tinkering' on computers more than girls (Turkle 1984). Boys love technology, which is the reason why they are more willing to consider IT careers. This is reflected in my study: the initial statistics for the boys as displayed in Tables 5.1(1), (2) (3) and (4) above) show their much stronger interest as a group in considering IT as a possible career choice for the future. During the interviews with the students, the 'tinkering' theme was directly mentioned:

> I am passionate about IT; I love computers and I enjoy tinkering with the processors and making the computer work faster. Designing processors is definitely my thing. (Omaha$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

The lower percentages[88] recorded for the girls from the questionnaire compared to the boys considering IT as a possible career for the future is striking because, as mentioned in Chapter Four (IT as a subject), the girls generally liked and enjoyed ICT studies, although not as much as the boys did, while the statistics displayed in Tables 4.1(6) and 4.2(3) confirm that they were comfortable and confident users of computers and various devices and peripherals. However, my quantitative data (see Tables 5.1(1), (2), (3) and (4) above) shows that, despite this, and in contrast with the boys, the girls' enjoyment of IT as a subject had not filtered through and garnered enough interest for the girls to consider possible IT careers. The reviewed literature suggests some girls drop out of studying and lose interest in IT due to the persistent stereotypical view that the IT sector is better suited to men than to women (Gras-Velazquez et al. 2009). Other research has indicated that among the strongest characteristics that define an occupation is its sex-type, and an awareness of this develops early in a child's life. By adulthood, the perceived sex-type of an occupation is generally associated with its actual sex-typing, and occupational stereotypes are strongly linked to career choices later on (Gottfredson 1981, EOC 2001, Woodfield 2007). It is important therefore to gain a better understanding of students' perceptions of IT and how this informs their career choices (especially the girls).

The second activity involved using the creativity map to encourage a debate on the willingness of students to consider IT careers for their future. The students from the various groups discussed and documented a number of interesting points about IT careers. They mentioned that IT careers can be interesting and financially rewarding,

[88] As displayed in the qualitative data in Tables 5.1(1) and (2) above.

but also negatives, such as long working hours, boredom, lack of role models and an anticipation that the sector would be full of ‘geeky men’. These perceptions of the students were similar to what they mentioned during their interviews.

Although the perceptions from all the groups were similar, the Wazobia youth club group (with the majority of the girls and boys in private education and/or single-sex environments) seemed to harbour more negative views than some of the other groups. A review of their data highlighted the fact that a number of the girls and boys in that group were indeed very knowledgeable about IT careers, including the different opportunities and remunerations. They were also aware of the problems with the IT industry’s failure to recruit and retain staff, especially women. Compared to the other groups, their data brought to the forefront problems with the ‘class status’ of IT careers; a point also mentioned by Manuel, from another Independent all-boys day school, during his interview. These privately educated/single-sex students were intentionally de-selecting IT careers because they felt it was not prestigious enough for them and were instead opting for more traditional careers such as doctors or lawyers.

The findings from the creativity map data were similar to those found in the quantitative data mentioned in Table 5.1(3) above and in the interviews. A review of the data from some of the other groups seem to suggest that the state school groups were more willing to consider and explore the opportunities that IT careers had to offer, which probably explained why some of the students (in the state school groups) were willing to investigate more about IT careers during their interview (see figs 3.2.4(2) through to fig 3.2.4(15) in appendix A of the appendices for examples of information produced from the creativity map exercise).

Using the information gleaned from the students' interview contributions (qualitative data), their perceptions and differences have been explored under the following three main headings:

1. Students considering IT as a possible career for the future
2. Students not considering IT as a possible career for the future, and
3. Students not sure about IT as a possible career for the future

5.2 The perceptions of students who said they would consider IT as a possible future career

A compilation of the quantitative data in Table 5.1(1) shows that 40% of the boys (n=32) and 18% of the girls (n=15) who participated in this study said that they would consider working in the IT sector or working as an IT consultant in another industry as a possible career for the future. Of these students, five boys and six girls were in single-sex environments while 27 boys and nine girls were in co-ed environments. Although the boys and girls in this group mentioned that they were interested in incorporating IT into their future job or career, a review of their quantitative data set recorded for Q9 of the questionnaire and the qualitative dataset provided by the interviews reveals that only 20 out of the 32 boys and two out of the 15 girls (both of whom were in single-sex schools) mentioned in both the questionnaire and during the interviews that they would consider IT or IT-related jobs as a possible career choice option for the future. The remaining students (12 boys and 13 girls) mentioned in Q9 that they would consider a possible IT career, but during the interviews said that they were considering IT only as a 'back-up' (second, third or even fourth choice) career option. All the students in this group selected 'yes' to Q9 of the questionnaire (see fig 3.2.3 in appendix B in the appendices).

During the qualitative interviews, the responses from the students (boys and girls) who said that they would consider working in the IT sector show that they were very knowledgeable about IT careers: they were well aware of the prospects and opportunities available, including the financial remuneration, and had access to positive role models and mentors from amongst their parents and wider family and those working within the IT industry. The information provided during this session also shows their interest and passion for IT as a possible career, and the reasons they provided in Table 5.2(1) below give some insight into their decisions regarding their possible career choices:

Table 5.2(1): Students considering IT as a possible career for the future:

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. Influences from role models and mentors	3	11	14	4	7	11
2. IT as a desirable career	5	12	17	3	4	7
3. Good financial remuneration	4	8	12	1	3	4

5.2.1 Influences from role models and mentors

14 boys and 11 girls cited influences from role models and mentors as one of the reasons for considering IT as a possible career option. The students talked about how they were positively influenced by their parents, other family members and siblings, especially older brothers and sisters who were already studying IT-related courses at university or working in IT. During the interviews, research by Adya et al. (2006) and Gottfredson (1981, 2006) relating to the influence of same-sex siblings was supported.

For example, one of the boys interviewed talked about his influences and the careers advice he had received from his elder brother. He also mentioned that his brother was his role model, and further explained that although careers advice regarding IT careers was not offered at his secondary school, with the help of his older brother he had formed an interest in IT, which he viewed as his future career direction. This was indicative of views aired by the other 13 boys:

> I would like to be a network engineer because my brother works as a network engineer in the City. He is my role model and he encourages me to study hard so that I can achieve my goal… Here at school, they do not talk to us about IT careers. (Warrick$_{\text{(boy)}}$, Willow School$_{\text{(co-ed)}}$)

Similarly, the 11 girls who were interested in IT also talked very positively about future IT careers, their role models, and influences:

> I have selected IT as one of my career options because I like IT. My mother is an IT consultant… She has taken time out to explain about the opportunities available in IT and the different roles; I understand what an IT career is all about because of the information she has provided. (Tallulah$_{\text{(girl)}}$, Tulip School$_{\text{(single-sex)}}$)

As in the case of the boys mentioned above, the girls' comments confirmed a theme identified in the literature review (Chapter Two) that career choices are influenced by role models (Pearl et al. 2002, Adya et al. 2006, Lockwood 2006). These include people the children meet at school and, in most cases, their family members. Tallulah's circumstances and those of some of the other girls were similar to those mentioned in Adya et al. (2006); Tallulah came from a family background where her mother worked as an IT consultant and her father was in a highly rated professional job. Research by Adya et al. (2006) has shown that direct forms of parental influence, such as the degree to which students see their parents choosing IT careers or having contact with technology, are strong motivators to train for technical jobs. Research has also shown that women entering male-dominated fields come from families where mothers have degrees, mothers are working, both parents are highly educated, and success is considered critical (Jackson, Gardner & Sullivan 1993; Smith 2000).

Christos, who attended an all-boys academy, contributed further commentary on the subject of influences from role models. He talked about his interest in an IT career for the future and explained that his mother worked as an IT consultant. Similar to Warrick, Christos confirmed that he had not received any formal careers advice from his school but had been given some by his mother, who had a positive influence on his possible career choice. That his mother is his role model is interesting, as female role models are rare for male children in this study; Christos was the only boy interviewed who cited his mother as his role model while the other boys mentioned their fathers, brothers or other role models and influences:

> My mother works as an IT consultant. She works as a contractor so she is always changing roles. She used to work as a programmer, and then she moved into project management. When she talks to us about her work, she is very passionate and loves what she does. When I was in prep school, my mum designed the school website, and I really loved it; she added our class work to the site, and it looked so cool. My mum is my inspiration… She is my role model. (Christos$_{\text{(boy)}}$, Cherry School$_{\text{(single-sex)}}$)

The literature reviewed earlier has shown that exposure to role models and parental involvement during the early years of education (up to Year 9) is important and clearly has a positive influence on inspiring career choices among young teenagers. Some research has suggested that the gender of the role model is not crucial: a mother can be a role model for her son or daughter and, similarly, a father can be a role model for his son or daughter (Pearl et al. 2002, Adya et al. 2006, Gottfredson 2006, Lockwood 2006). This was similarly identified in my study, as Christos cited his mother as his role model, even though the majority in my study seemed to be inspired by their father. That

Christos was happy to have his mother as a role model does not contradict but to an extent supplements some of the findings of Kniveton (2004) and Carrington et al. (2008), that boys are more directly influenced by their fathers and that 'computer-savvy' parents are three times more likely to be male than female. My study shows that if mothers are professional IT workers then their children, either boys or girls, can emulate them. In this study, both Christos and Tallulah had 'computer-savvy' mothers, who had influenced them.

School and the IT industry were other career influences mentioned by just one of the girls interviewed. This was not common amongst the majority of the students because they had not received any careers advice from their school (or IT industry) regarding possible IT career choices for the future. Kristina, who attended an all-girls state school, was the only student who confirmed that her school had offered a careers advice session for IT careers. She advised that the school had also invited some women working in the IT industry to give talks and act as role models and mentors to the students, and that at the end of the session, the students were paired up with an industry-based mentor/role model. Following on from the careers advice session organised by the school, Kristina confirmed that she had developed an interest in an IT career and would consider becoming an IT teacher. Kristina also confirmed that the careers advice session with the industry-based women was beneficial because, prior to their sessions, she had not considered IT and had not had any idea what an IT job involved: neither of her parents had any background in this sector (her mother worked as a pharmacist and her father as a social worker). She revealed the importance of these sessions during her interview:

> For careers day, we had visits from women who currently work in the IT industry; they talked about the different areas of IT… We have been allocated

> individual mentors, and they act as our role models and talk of others... I want to become an ICT teacher in the future. (Kristina$_{\text{(girl)}}$, Krimsone School$_{\text{(single-sex)}}$)

Kristina's comments show that it is important for IT to appeal to girls in Year 9, as this is when they are making their career choices for what they will become in the future, and that small interventions can be successful. Comments from Kristina and Christos as mentioned above show the importance of role models; also, working with career advisors can highlight the appeal for the technology industry and explain the wide range of roles available in IT. This finding in my study was similar to that mentioned in Gras-Velazquez et al. (2009).

5.2.2 IT as a desirable career

17 boys and seven girls mentioned that they were interested in and would consider an IT-related career as a possible option for the future because they perceived IT as a desirable and generally good job. The 24 students in this group considered jobs in IT as versatile and a good career choice for the future. As mentioned earlier, the boys outnumbered the girls, but these girls considered IT careers desirable even though it seemed that perceived gender barriers were still an issue for them. Even amongst those interested in IT careers, there were still a limited number of girls (seven) viewing IT careers as desirable. The 24 students interviewed in this group talked about how they related to technology, expressed their interest in computer systems, and further commented on how desirable IT-related careers would be for their future:

> I want to work in the aviation industry as a computer systems engineer; I am interested in flight simulators and want a job designing them… I feel that working in IT is generally a good career. (Obed$_{\text{(boy)}}$, Oaks School$_{\text{(co-ed)}}$)

Another example of the boys' view of IT as a desirable career for the future was from Mahariva:

> I want to be a computer scientist because such jobs are really good. I want to design new computer programs… I find IT very exciting, and I am curious about learning new things. (Mahariva$_{\text{(boy)}}$, Maple School$_{\text{(single-sex)}}$)

Obed's and Mahariva's comments were representative of the 15 other boys in this group; they were positive about working in IT for the future, and their passion for an IT-related career was due to their intrinsic interest in and enjoyment of computers as well as the fact that IT-related jobs were perceived as desirable. The 11 girls' perceptions and interests were similar to those identified by the boys above. They also expressed their passion for technology, stating that they wanted a job that was versatile, interesting, creative and exciting, and that offered different opportunities. They perceived that IT-related careers were good and desirable jobs for their futures:

> IT is important for our future and everything is centred on IT. With all the different opportunities available in IT, I feel it is a good career to consider. (Pandora$_{\text{(girl)}}$, Pine School$_{\text{(co-ed)}}$)

> IT careers are good… Everything around us is all about technology… I want to be a music artist with a difference. I want to compose, record, store, mix and edit music on digital devices, and I know that my understanding of technology will give me a head start. (Barbie$_{\text{(girl)}}$, Beech School$_{\text{(single-sex)}}$)

Reviewing the comments from all 24 students, it is clear that they perceived IT careers as desirable jobs that are creative, exciting, versatile, interesting, and secure for the future. The students also perceived IT as a career path that offers an opportunity to work and create things with the latest technology. The students also perceived that IT-related jobs provide good security, a variety of opportunities, a challenging and exciting environment that allows for a creative outlet, and an opportunity to work with up-to-date technology in a growing industry (Multimedia Victoria 2004, Anderson 2006, McKinney et al. 2008).

Furthermore, the students' perceptions also generally support Margolis et al.'s (2003) observations that computing offers versatility because almost any field is computer-related. IT is one of the fastest moving industries in the world; it is a creative and vibrant sector with different areas and jobs one can be interested in (Flavell 2012).

5.2.3 Good financial remuneration

Finally, good financial remuneration was another reason mentioned by 12 boys and four girls for considering IT as a career for the future. Although this was more popular with the boys than with the girls (see Table 5.2(1) item 3 above), earning a significant wage was also an attraction for the four girls, who mentioned this theme. During the interviews, the 12 boys in this group were eager to talk more about how much people who work in IT earn; in particular, about IT contractor salaries. Interestingly, the boys who talked about money did not seem keen on exploring the opportunities associated with IT careers: for instance, how versatile and interesting IT careers can be, or about their enjoyment of computers generally; they were of the view that they would enjoy a career in IT mainly due to its financial remuneration:

> People who work in IT earn a good pay, therefore I will enjoy working in IT when I am older; with all the money I will make, I would be happy. (William$_{(boy)}$, Willow School$_{(co\text{-}ed)}$)

The other 11 boys interviewed in this group also perceived IT careers similarly to William in that they were not particularly worried about whether they would enjoy the job. Wade's comments provide another example of this focus:

> I like IT as a subject so I might as well consider working in IT. The job prospects after studying are good, the money is excellent; you cannot go wrong with a job that pays good money... I hope to make IT my career for the future. (Wade$_{\text{(boy)}}$, Willow School$_{\text{(co-ed)}}$)

In contrast to the boys' perceptions, although four girls out of the 12 who were considering an IT career mentioned good financial remuneration, they did not place it high on their list of reasons. The girls' motivations seemed intrinsic rather than extrinsic: they were more concerned with how they felt about IT, how good they were at it, and how personally rewarding it would be to them namely, doing something they would like and enjoy. When interviewed, Orchid from Oak school highlighted the difference between the boys and girls in this regard. She explained that although she was aware of the good financial remuneration associated with IT careers, she was more concerned with, and willing to talk about, her passion for IT itself and the versatility of such careers:

> I enjoy opening up a computer and looking at the internal structure... I am intrigued about networks and how they work; I like developing systems… I know that working in IT is financially rewarding, but I am more interested in an IT career because I like it. (Orchid$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

Wilma also spoke about IT careers and financial remuneration, sharing views that were similar to Orchid. She said:

> I enjoy ICT at school very much and will be considering IT as one of my career options for the future… It is nice to know that IT careers are financially rewarding. (Wilma$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

The 16 students who made comments as mentioned above all seemed to understand that IT careers offer good financial remuneration. This is in line with the findings of the survey conducted by CompTIA (2012), that IT careers offer good salaries, a variety of ongoing development opportunities, and a diverse range of exciting lucrative careers

(McGlinchey 2012). Unlike the 12 boys, the four girls' perceptions were similar to those identified by Teague (2002) and the survey conducted by Intellect on behalf of Women in Technology (2011). Here, the women interviewed mentioned that the working environment was very important to them, followed by the financial benefits. Women with programming skills also saw this as an opportunity to do what they enjoyed as well as a means to earn extra money through various short-term contracts. Furthermore, comments from the 16 students in my study (especially the 12 boys) and their perceptions regarding IT careers and the financial remuneration were similar to those identified in research that found good income to be a motivating factor for entering ICT (Teague 2002, McKinney et al. 2008, Papastergiou 2008).

5.3 The perceptions of students who said they would not consider IT as a possible future career

During the interview sessions, the 37% of the boys (n=29) and 43% of the girls (n=37)[89] who said that they would not consider working in IT discussed a number of reasons for their lack of interest. These are summarised in Table 5.3(1) below.

Table 5.3(1): Reasons given for not considering IT careers:

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. Other career interests	7	15	22	10	19	29
2. Lack of career advice	3	8	11	9	16	25
3. IT as a career is boring	2	1	3	5	8	13
4. Lack of role models and mentors	0	0	0	3	7	10
5. Gender bias	0	1	1	2	3	5
6. Long working hours	0	1	1	3	1	4

[89] Of the 29 boys and 37 girls, 16 girls and 10 boys were in single-sex environments while 21 girls and 19 boys were in co-ed environments (see Tables 5.1(1) and 5.1(2) above).

5.3.1 Other career interests

The most common reason given by the students (22 boys and 29 girls) was ‘other career interests’. It is important to note that, during the interviews, these students did not say that they viewed IT careers negatively or that they were not interested in IT generally. Some of them had a good understanding of what a career in IT might look like, recognised the importance of IT in society today, and were happy to use technology in their daily lives. However, because they had other interests, other careers planned, or other priorities, they had decided not to consider a career in IT. Thus, they did not list this as one of their career options on the questionnaire[90] and during their interviews said that IT was not a possible future career for them. During the interviews, 29 girls aired their views:

> I enjoy taking pictures of people and objects; I would like photography for my future career... Although I am not considering a career in IT, I know that the IT skills I learn in school will be useful for me in the future. (Wendy$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

> I am not opposed to IT careers; I do not have anything against IT. It is just that such careers do not really appeal to me: I would rather be an artist or an actress. (Beatrice$_{\text{(girl)}}$, Beech School$_{\text{(co-ed)}}$)

The 22 boys interviewed in this group made comments similar to the girls’ perceptions. They also mentioned their lack of interest was not due to not enjoying technology but rather that they preferred other career options:

> I will not be considering IT as a career; this is not because I do not like IT, but because I want to be a footballer or get involved in motor sports. (Wayne$_{\text{(boy)}}$, Willow School$_{\text{(co-ed)}}$)

> I enjoy other things more than IT. So I want to be a footballer, and if that fails, then I will become an accountant. (Marcus$_{\text{(boy)}}$, Maple School$_{\text{(single-sex)}}$)

[90] See Q4 – Which job (career) would you like to do when you grow up (four possible choices for the future) of the Questionnaire - fig 3.2.3, in appendix B of the appendices.

The 51 students in this group seemed to have forged their career choices within a framework in which stereotypical attitudes relating to men's and women's roles in work and society played a significant role. As a result, the students seemed to be choosing careers that they felt were appropriate for their gender. Factors including parents, siblings, friends and the media may have influenced these views. The girls chose careers in arts and entertainment or medicine, which are culturally perceived as 'feminine' and 'caring', while the boys chose accounting (mathematical) and sports-related careers, often stereotyped as 'male' and more 'technical' (Grint and Gill 1995, Bandura 1997, Woodfield 2000, Ahuja 2002).

5.3.2 Lack of career advice

This group of students (25 girls and 11 boys)[91]also gave lack of careers advice as a reason and this perception featured more strongly amongst the girls than the boys. During the interviews, it was obvious from these 36 students' contributions that there was a lack of knowledge and understanding of what IT careers were like, compared to the group of students discussed above. One of the commonly cited reasons amongst the 25 girls in this group of students was that they were de-selecting themselves from considering IT careers because they did not understand the diverse nature of IT work and felt unfamiliar with IT careers. These girls did not want to consider IT as a secondary option or 'back-up plan' and this, they said, was because of the lack of awareness and careers advice received from school and at home. The girls explained that they could see the usefulness of IT as a tool and understood the technology they

[91] A breakdown of these students shows that nine girls and three boys were in single-sex environments while 16 girls and eight boys were in co-ed environments.

used daily (phones, computers, and so on), but could not relate to this as a possible future career option or job:

> Come to think of it, I have never really given IT a thought. I do like IT as a subject, and I am good at it in school. I like doing things technical, but in school, they do not talk about IT as a job, so you feel that IT is not really a job… I think people find it hard to get jobs in IT. (Lilian$_{\text{(girl)}}$, Linden School$_{\text{(single-sex)}}$)

> I like working with people and objects, I enjoy taking photos, I like creating things, designing things... I want to be a photographer or an interior designer when I grow up … A job in IT will not fulfil my dreams because I do not see an IT job as interesting or creative. (Winter$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

Young people are unlikely to consider IT careers if they do not know what such a career involves. In some situations, the students reported that their teachers were unhelpful or unable to provide them with adequate advice or information because they themselves were not qualified to do so or because they shared the stereotypical views of such careers themselves. Newmarch et al's (2000) discussion of the 'myth and reality' of working with ICT reveals that some parents are also often 'ill-equipped' to inform students (their children) about what careers in ICT really involve because of their lack of personal knowledge. This was the case with Odera from Oak School. She mentioned that during a careers advice session she attended with a group of friends, the career advisor, a male teacher at Oak School, talked to them about stereotypical female careers whereas at home, her parents talked to her about more prestigious careers:

> I like ICT as a subject, but in the career advice session, I was advised to consider social care or hairdressing because of my predicted grades… I do not like any of those so I talked to my parents, and they asked me to consider Law. I have decided that I am going to be a lawyer as my future career. (Odera$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

Similarly the 11 boys interviewed also mentioned a number of different reasons why they had de-selected themselves from considering an IT career:

> I like computers and enjoy computer games, but I do not want a career in IT. My dream is to go into business and make good money… I am going to become a businessman in the future. (Osborne$_{(boy)}$, Oak School$_{(co\text{-}ed)}$)

Considering that 16 students in the previous section (see paragraph 5.2.3) said they were considering IT because it was financially rewarding, this highlights the lack of understanding and lack of career advice for this second groups of students.

The 10 other boys interviewed expressed their enjoyment of IT and how passionate they were about IT as a subject in school. They perceived IT as creative and exciting but still had chosen not to consider it as a career:

> I enjoy thinking; I like learning new things in ICT classes… I like playing with gadgets and building robots. ICT is easy if you are interested… I do not understand what a career in IT is all about… When we go to Connexions, it is not one of the careers they talk to us about so I cannot consider something I know nothing about. (Mario$_{(boy)}$, Maple School$_{(single\text{-}sex)}$)

The boys also expressed their views regarding the lack of clearly defined IT career paths. For instance, the students saw professions including medicine, law and accountancy to be structured and clearly defined, where progress was identifiable, as were the subjects they would need to pursue to prepare for such jobs. However, IT career paths were not clear to the participants in the same way. More specifically, there was confusion regarding which subjects were needed to progress into possible IT careers. Traditional professional careers may be easier for career advisors and students, schools, parents, the media, and others to explain. This is not always the case with newer careers, as mentioned by one of the boys during his interview:

> We are not taught about IT jobs in the early stages of our school life or even how to get into IT careers, so it will be helpful if we have an opportunity to talk with professionals who can help us understand all about IT careers. (Palaney$_{(boy)}$, Pine School$_{(co\text{-}ed)}$)

According to this subset of students, careers advice amongst 14-year olds regarding IT careers is practically non-existent. This confirms Gago's (2004) argument that at a time when students are expected to make important choices for their future, they have no insight into what science and technology can contribute to a future society or any understanding of what IT careers involve. One interviewee questioned how good a career in IT could be, given the lack of support for it:

> In school, we are not taught about IT as a job for the future; we get talks about studying law, teaching, medicine and even social care but nothing about IT… If you say IT is good, how come no-one talks to us about it? (Pearlena$_{(girl)}$, Pine School$_{(co\text{-}ed)}$)

Pearlena further explained that her school talked to students about prestigious careers such as medicine, law, accountancy, banking and finance (traditional careers), and also helped to prepare them for the Oxbridge exams, but not for possible IT careers. All 24 girls and 11 boys in this group shared Pearlena's views. Not only were they concerned about the lack of careers advice, but they also explained that the reason why they chose careers such as medicine, law, entertainment, business and sports, was because of the advice and clear career paths available for these options and the fact that these careers were widely talked about by their role models, parents, peers, older siblings, family members and media influences.

5.3.3 IT as a career is boring

Another problem mentioned by the students, especially the girls, (three boys and 13 girls) was the negative idea of IT careers as 'boring'. This is a recurring theme commonly cited by the students throughout my study. It affected their 'like', 'dislike' and 'not sure' attitudes to IT both as a subject (see Chapter Four) and as a career.

During the qualitative analysis, a text report run in NVivo on the word ‘boring’ revealed that the word was referenced 165 times throughout the entire study, which accounts for more than 10% of the data generated.

As mentioned previously, the girls reported finding IT as a subject boring because of *what* they were taught in school, while the boys perceived IT as boring because of *how* they were taught ICT at school. As these participants were of school age and had no first-hand experience of what IT careers involve; their perceptions were based on media portrayals of the IT profession. For example, television sitcoms such as *The IT Crowd*, their parents or other family members and friends, and how they perceived those school subjects (Science, Maths and ICT) that are the prerequisites for an IT career. As mentioned in Chapter Two, IT as a career still has a geeky, ‘computer nerd’ stereotype attached to it and, as such, is a career some people (especially women and girls) seek to avoid (Joshi and Kuhn 2001, Jepson and Perl 2002).

During the interviews, the 13 girls in this group talked about how IT activities were the same: repetitive and boring. In the following extract, one of the girls draws a link between her understanding of why IT is boring and its stereotypical image:

> The activities are pretty much the same; IT work is boring, pure boring… People who work in IT also look nerdy, boring, and they are mostly men. (Wilfreda$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

Wilfreda’s perception of those who work in IT was not unusual among most of the teenagers who participated in my study and reflected the consensus amongst this group of girls:

> I do like IT, but I do not want a career in IT because I have no intention of becoming a ‘nerd’ or a ‘geek’. I want a career that is fun, active, and sociable. (Blossom$_{\text{(girl)}}$, Beech School$_{\text{(single-sex)}}$)

Wilfreda’s and Blossom’s perceptions also confirm the findings of Vowler (2003), that the problem of IT careers not being viewed positively (especially by girls) starts at school. Students do not see IT as a possible career choice because they associate it with boring information around spreadsheets and databases. Girls in particular shy away from IT education, which they perceive to be the preserve of ‘geeky’ boys (Vowler, ibid). My participants also identified the media as a key factor. Television programmes such as *The Big Bang Theory* and *The IT Crowd* continue to showcase IT professionals as ‘nerds’ and as people with no social skills who are interested only in technical issues; my participants referred to these representations.

Interestingly, however, the three boys interviewed here who talked of IT careers as boring shared the same ideas as the girls about what makes IT boring. They were already spending enough time in front of a computer for leisure, and did not want to contemplate doing the same for their future work:

> IT careers are boring because they are all about computers. You have to continue doing the same task over and over again… I do not like repeating things all the time because it gets so boring. (Warren$_{\text{(boy)}}$, Willow School$_{\text{(co-ed)}}$)

This perception was not derived from direct knowledge of a career in IT *per se* but from how IT was perceived as a school subject.

The 13 girls interviewed also thought that the primary career in IT is that of a programmer who sits alone in a room working at a computer all day with little opportunity to interact with other people (Margolis et al. 2003, Beyer, Rynes and Haller

2004, Fidelman 2012). During Ashley's interview, she likened a career in IT to something for 'nerds' and said:

> I would rather be a shrink than a geek. IT is something for the nerds and the geeks; I do not want to end up in a job where I will spend my entire day talking to a computer as if I am losing it. (Ashley$_{(girl)}$, Ash School$_{(co\text{-}ed)}$)

Furthermore, during their formative years, girls may not have the same 'magnetic attraction' to computers that some boys have (Margolis et al. 2003). Girls usually do not consider themselves 'hackers' or 'computer geeks', and due to social gender stereotyping, the computer has been labelled as a boys' activity (Margolis et al. 2003, Moorman et al. 2003). Unlike the boys, the girls in this group seemed to find the nerdy image of IT careers much harder to relate to and associate themselves with: this negative image was causing the girls to de-select themselves from considering IT careers. Ortavia, from Oak School, illustrated this:

> IT has been the same since primary school and even more so now that we are in high school… (Ortavia$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

5.3.4 Lack of role models and mentors

A further interesting reason given by 10 girls from this group of students for not considering IT as a possible career was the lack of role models and mentors. None of the boys here perceived this as a problem, perhaps partly because they had better access to famous role models and mentors of the same gender. For instance, the 79 boys who participated in this study could identify with Bill Gates of Microsoft or Mark Zuckerberg, the founder of Facebook. Comments from three of the girls in this group are highlighted below, showing their lack of female role models and mentors and the problems this created for imagining IT as a possible career:

> I do not want to work in IT because I prefer a medical career, but come to think of it, I do not know of any role models to look up to in IT, unlike in medicine where I know a number of women who are doctors… IT is not favourable to women… those who work in IT are mostly men. (Basheera$_{\text{(girl)}}$, Beech School$_{\text{(single-sex)}}$)

> I want to be a physiotherapist or a paediatrician; I have a number of aunts and uncles who are doctors… I like watching medical programs such as Casualty, Holby City, ER and Dr House. (Olivia$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

Similarly, role models from within the family have proved to be beneficial, as family members can motivate career choices indirectly by encouraging girls to pursue careers perceived to be 'masculine'. Take for instance one of the girls interviewed who talked about her future career being modelled on her father's profession:

> I want a career with the police force… My father is a police inspector with the Metropolitan Police. (Wyn$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

During the interviews, I talked to the students about prominent women, such as Mary Lou Jepsen (instigator of the One Laptop Per Child project in 2005), Grace Hopper (pioneer of programming language), and Ada Lovelace (mathematician and computer programmer), but none of the students (especially the girls) were familiar with them, despite these women having had a significant impact on, and being major role models for women working in, IT.

The Reality Bytes (2001) report stated that the lack of positive IT role models for young girls, both real and within fictional popular culture, is problematic; without these positive role models to look up to, students are sometimes unable to consider IT as a possible career due to the pre-conceived negative perceptions they may have. As most of the images of IT are of a man on the computer, designing systems or working in a dark underground office, girls cannot relate to this. Similarly, the concerns raised by the girls in this group are widely articulated within the IT industry: the lack of role models, champions and mentors is commonly cited as one of the barriers to encouraging more women to take up technology careers (de Lange 2013). According to Catalyst (2008), which surveyed women working in the technology sector, women most often pointed to the lack of role models similar to themselves, to not having a mentor or champion, and to being excluded from important networks of decision-makers, as the biggest barriers to career advancement.

5.3.5 Gender bias

Gender bias was another theme identified by five girls and one boy as one of the reasons why they would not consider IT as a possible career choice for the future. Girls seemed to respond more negatively than the boys to the idea of IT careers. The girls dismissed the idea, not wanting to embark on a career in IT:

> I do not want to work in IT or as an IT consultant because people who work in IT look nerdy and boring and they are mostly men. (Witlee$_{(girl)}$, Willow School$_{(co\text{-}ed)}$)

As mentioned in Chapter Two, the way the media portrays people who work in IT has long been a problem. Women shown in computer magazines, textbooks, and recreational software are usually represented stereotypically (Na 2001). The media do not showcase women in positions of power or as active computer users, while some television advertisements show men with central, authoritative roles having more credibility than women regarding product knowledge. Furthermore, in some cases, women are shown alongside children (Na 2001). Therefore, this re-affirms students' pre-conceived perceptions of what IT people look like, and this puts them off a career in IT.

Away from the media, as Gurer & Camp (2002) argue, teenagers can be exposed to gender bias in their own homes. Some parents unintentionally provide obstacles for their own daughters to engage in technical careers and, through subtle biases, provide more support for their sons. For example, the majority of family computers are typically set up in a son's bedroom rather than a daughter's (Gurer & Camp 2002). In my study, the girls liked and chose careers they felt to be more sociable and caring (such as nursing, medicine, animal care, and social care), while viewing the mathematically based careers (including accounting and IT) as masculine. One of the boys interviewed gave an example of parental influence over their future son's career:

> I have been encouraged by my parents to pursue a career in business. My mother is a nurse but my father and grandfather own a restaurant, and I will be going into business with them once I have completed my schooling. (Patrick$_{\text{(boy)}}$, Pine School$_{\text{(co-ed)}}$).

Various comments from both the boys and the girls indicated that their parents had influenced their career choice to a certain extent, while none of the students mentioned that their parents had advised them not to choose IT careers. Also, the students not considering IT as a possible career for the future (10 boys and 12 girls) mentioned that their parents wanted them to follow certain career paths, but not because it was more favourable to a particular gender.

5.3.6 Long working hours

Another negative perception mentioned by four of the girls and one of the boys who said that they would not consider IT as a career was that people in IT careers work long hours. It is interesting that these five students commented on this, considering that the other professions favoured by them, such as medicine, sports and business, have similar working hours. The four girls were more concerned about the long working hours than the boy (see Table 5.3(1) item 6 above). During her interview, Sarah from Snowbell School stated that her mother and aunt, who both worked as IT consultants, complained about the long working hours and the difficulties of balancing family and work life because of this:

> My mother spends a lot of time at work. She is always busy; she complains about her job being stressful and comes home late on most days. My aunt is similar to my mother; she moans about being on call most of the time. She also says that her job is very demanding; she has to work long hours, too, and these are not flexible enough for her. She says when children start coming she is going to have to look for a change in career. (Sarah$_{\text{(girl)}}$, Snowbell School$_{\text{(single-sex)}}$)

Sarah confirmed that she was aware of the benefits of working in IT, including the financial rewards, but had decided against it as a result of the long working hours. When probed further, Sarah's preferred career option was neurosurgery, a profession that also has notoriously long working hours.

Paloma from Pine school noted that her mother used to work as a software programmer but had to retrain as a teacher in order to balance family life:

> My mother used to be a programmer but gave it all up and retrained as teacher. When she talks about IT, she says the IT environment is unfriendly to women, that it is hard to work in IT because of the stress involved and the long hours you have to put in. I think she says this because she found it hard to look after my brother and myself as well as working full time as a programmer. (Paloma$_{\text{(girl)}}$, Pine School$_{\text{(co-ed)}}$)

As mentioned in Chapter Two, the IT industry's long working hours culture has been identified as a key concern putting off new recruits (DTI 2004, The Intellect Report 2011). However, the reports did go on to confirm that there has been a slight decrease in the number of women who view their working environment as unsympathetic to the needs of female employees. My findings indicate that this knowledge is not filtering down into the education sector.

Interestingly, the boy in this group viewed the issue of long working hours differently. In contrast to the girls, he seemed more concerned about spending longer periods of time sitting at a computer rather than the actual working day. He said:

> Working in IT is just too much head work. I do not think I will cope with a job where you have to sit at a computer for long periods of time working. I would like to be on the beat. (Washington$_{(boy)}$, Willow School$_{(co\text{-}ed)}$)

Regardless of gender differences, the students' comments emphasised the fact that more has to be done to help dispel some of these negative perceptions and to promote the positive elements in IT careers, especially in relation to the working hours.

5.4 The perceptions of students who were 'not sure' about IT as a possible future career

Of the 39% of the girls (n=33) and 23% of the boys (n=18) who participated in my study who were 'not sure' if they would consider working in the IT sector, five boys and nine girls were in single-sex environments whilst 13 boys and 24 girls were in co-ed environments. During their interviews, these students mentioned a number of reasons to support their arguments as to why they were not sure about IT careers; the information they provided is displayed as follows:

Table 5.4(1): Students not sure about IT careers for the future

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. Other career interests	3	8	11	5	19	24
2. Lack of career advice	2	5	7	6	17	23
3. The career status of IT	1	0	0	0	0	0

5.4.1 Other career interests

One of the most popular reasons cited by this group of students (11 boys and 24 girls) for not being sure if they would consider working in the IT sector was that they had 'other interests'. This was also a popular reason mentioned by the students in the other groups' views, which I explored above. This group of 35 students ('not sure') seemed more open to IT careers, having not perceived IT as a subject or career negatively; rather, they were generally unsure if a career in IT was for them. This fact makes this group particularly interesting for the PAR aspect of my research. Perhaps, with the right careers advice and guidance, this group could potentially be more easily inspired to consider such careers. As we have seen, they were open to considering other careers proposed and explained to them by their parents, media, siblings, friends, role models, and so on.

These 35 students explained that they enjoyed IT both at home and at school; they understood the benefits of technology and how it surrounds their life, and enjoyed their recreational use of technology, while some had already opted to study IT as a subject in

KS4.[92] Nevertheless, their ambivalent positions became clear from what they said in their interviews. For instance, one boy in this category said:

> I understand and know that everything these days is computerized… I am very well aware of this that is why I am very interested in ICT… but I am not sure about working in IT… I hope to be a surgeon or a pilot… Maybe I will consider IT as a backup plan. (Paul$_{(boy)}$, Pine School$_{(co\text{-}ed)}$)

Throughout the interviews, I talked with the students about IT careers in general; therefore it is possible that some of the students who had not selected IT careers initially as one of their four choices (see Q4 of the questionnaire – see Table 5.1(3) above) started thinking about IT as a possible backup career plan. I felt this was beneficial to the students as some were keen to learn more about IT careers. Because I was responding to the specific questions they were asking, careers advice was communicated to them, at their request, without it being imposed on them.

There did not seem to be any differences between the 11 boys and the 24 girls' perceptions in this group; for instance, Breannah from Beech School voiced similar thoughts to Paul; although still unsure, her comments suggested she was undergoing a re-think about her future career, especially as her questionnaire and interview data varied:

> I am not sure about an IT career… I want to go into business or be a teacher in the future; I just have not decided what type of teacher yet… Maybe I could teach IT, but I am not sure. (Breannah$_{(girl)}$, Beech School$_{(single\text{-}sex)}$)

Here, these 35 students' indecision regarding whether or not they were interested in IT careers poses a problem. They seemed to be choosing other careers, not because they had no interest in IT, but because they had more information about other career options,

[92] Prior to September 2013, IT in state schools was not compulsory. From September 2014 ICT at schools in the state sector will be compulsory.

were undecided, afraid, or unsure of whether to consider IT, often in the context of minimal information about what such careers would involve. The students here did not seem to worry about the image of IT, but their perceptions do highlight the lack of IT careers advice, a theme that is examined again in paragraph 5.4.2 below.

5.4.2 Lack of career advice

As mentioned earlier by the students in paragraphs 5.3.2 and 5.4.1 above, the lack of careers advice was a problem that the majority of teenagers in Year 9 reported experiencing at school, despite this being a crucial year for choosing their future studies and careers. Here, the students (seven boys and 23 girls) who said that they were not sure about IT as a possible career choice also reiterated this concern.

During the interviews, the 23 girls talked about their confusion regarding IT careers and highlighted the fact that, if adequate career advice were provided before they got to the moment of choice, some of them would actually consider certain careers that they had never previously thought of. For example, Adele commented:

> I do not know what I want to do in the future… I am not sure; my mind is not made up yet… Miss, you make IT careers sound so interesting, but the things you talk about we do not do at school or even talk about it here. (Adele$_{\text{(girl)}}$, Ash School$_{\text{(co-ed)}}$)

The seven boys in this group expressed similar concerns to those of the 23 girls, saying that were not sure about IT careers because they lacked the adequate knowledge. For example, Manuel explained that he found IT interesting and fun, but was not sure how the skills he was learning could be transferred to other careers:

> I am not sure about IT because I want to go into the army… I enjoy ICT at school and playing games on the computer at home. Can someone in IT work in the army? (Manuel$_{(boy)}$, Maple School$_{(single\text{-}sex)}$)

This was a common tendency with some participants: they understood that technology surrounds their life but due to a lack of careers advice, could not see how it connects with the other industries and careers that they were interested in. The students' comments also confirmed that, apart from not being knowledgeable about IT careers, they did not even perceive IT as a job, viewing it more as a tool for supporting their non-working lives.

5.4.3 The career status of IT

Finally, the status of IT as a career was another reason mentioned by one student for not being sure if he would consider an IT-related career. Although mentioned explicitly by only one boy, this reason was implicitly evident in the words and phrases used by other participants, especially in the description of 'traditional careers' when referring to parents' encouragement. One student interviewed (Mario from Maple School) took the stance that, until IT becomes a prominent career treated like other professions, students will continue to disregard IT as a prestigious career choice. Interestingly, and relatedly, the qualitative data provided by different students highlight the fact that students from single-sex environments and the independent sector were less likely to consider IT careers; the majority of them ($^{15}/_{20}$ boys and $^{25}/_{31}$ girls) were considering more traditional careers. The data indicates that even where parents had influenced their children to consider certain careers, none mentioned that they should consider a career in IT. The students considering IT careers had modelled their choice on their parents, older siblings, or role models. Similarly, some of the students who were influenced by their parents were considering professional careers that held prestige, such as medicine, accountancy, business, law and engineering.

Throughout the various interviews at the different schools, one of the interesting outcomes was that students questioned whether IT was really ‘a job’, as they could only relate to IT as a tool or technology that they used. They queried whether, if IT was a job, then why was it not advertised and talked about frequently at Connexions or career advice sessions? The students enjoyed the idea of wanting to be a lawyer, a doctor or an entertainer, but could not relate to wanting to be an IT consultant. Mario from Maple School said that he enjoyed gadgets and ultimately was interested in IT generally, but that he was not sure about IT as a possible career for the future because he did not think that working in IT was prestigious enough or that a career in IT would be highly rated. He said:

> I am not sure about a career in IT… How do I explain what I am? How do I introduce myself? It is easy to say I am a lawyer, an NBL player, or even a footballer… How do I say I am in IT to someone who does not understand what IT is?… My parents do not even know what IT is about. (Mario$_{\text{(boy)}}$, Maple School$_{\text{(single-sex)}}$)

Parents, to a certain extent, have a great influence on their children’s future careers: they can relate to addressing and introducing their child as a doctor, lawyer or some other prestigious title, so if they cannot see IT’s potential as a possible prestigious career for the future, neither can the teenagers.

5.5 Ethnic background, parents' occupation (class) and students' perceptions of IT as Career

As mentioned in Chapter Four (4.5) the students provided their ethnic background, parental occupation and parents' job title. These were recorded as per SOC2010 to see if there were any significant relationships, differences or similarities between social class based on parents' occupation, ethnic background, and their perceptions of IT as a future career. The questionnaire data provided by the students were analysed in SPSS using the occupation of the parent with the highest ranked job, and a breakdown of the participants' ethnic background, parents' occupation and their perceptions of IT as a future career option has been provided in table 5.5 below:

<u>Table 5.5: Students by ethnic background, parents' occupation and perceptions of IT as a future career:</u>

Ethnic Background	Social Occupational Classification 2010 (SOC % (n) per ethnic background)		Boys (n) Consider IT as a career				Girls (n) Consider IT as a career			
			Yes	No	Not sure	Total	Yes	No	Not sure	Total
Asian	Lower Managerial Administrative Professional	4.9 (8)	2	2	1	5	2	0	1	3
	Intermediate Occupations	1.2 (2)	1	0	0	1	1	0	0	1
	Small employers and own account workers	5.5 (9)	5	1	2	8	0	0	1	1
	Semi routine occupations	1.8 (3)	0	0	2	2	0	0	1	1
	Routine occupations	2.4 (4)	0	1	1	2	0	1	1	2
	Unemployed	0.6 (1)	0	1	0	1				
	Total	**16.5 (27)**	**8**	**5**	**6**	**19**	**3**	**1**	**4**	**8**
Black	Higher Managerial Administrative Professional	8.5 (14)	1	2	2	5	2	6	1	9
	Lower Managerial Administrative Professional	16.5 (27)	6	7	2	15	1	7	4	12
	Intermediate Occupations	7.3 (12)	1	3	0	4	1	4	3	8
	Small employers and own account workers	3.7 (6)	0	2	0	2	0	4	0	4
	Semi routine occupations	4.3 (7)	2	0	1	3	0	4	0	4
	Routine occupations	1.2 (2)	2	0	0	2				
	Unemployed	1.2 (2)					1	1	0	2
	Total	**42.7 (70)**	**12**	**14**	**5**	**31**	**5**	**26**	**8**	**39**
Mixed/Other	Lower Managerial Administrative Professional	4.3 (7)	1	2	1	4	0	1	2	3
	Intermediate Occupations	1.8 (3)	0	1	0	1	1	0	1	2
	Small employers and own account workers	1.8 (3)	0	1	1	2	0	1	0	1
	Lower supervisory craft and related occupations	1.8 (3)	1	0	0	1	0	2	0	2
	Routine occupations	0.6 (1)					0	0	1	1
	Unemployed	0.6 (1)					0	0	1	1
	Total	**11 (18)**	**2**	**4**	**2**	**8**	**1**	**4**	**5**	**10**

Ethnic Background	Social Occupational Classification 2010 (SOC % (n) per ethnic background)		Boys (n) Consider IT as a career				Girls (n) Consider IT as a career			
			Yes	No	Not sure	Total	Yes	No	Not sure	Total
White	Higher Managerial Administrative Professional	0.6 (1)					0	1	0	1
	Lower Managerial Administrative Professional	10.4 (17)	2	3	2	7	1	2	7	10
	Intermediate Occupations	4.9 (8)	1	0	0	1	2	3	2	7
	Small employers and own account workers	3.7 (6)	1	1	1	3	0	0	3	3
	Lower supervisory craft and related occupations	3.7 (6)	2	1	1	4	0	0	2	2
	Semi routine occupations	3.7 (6)	3	0	0	3	2	0	1	3
	Routine occupations	1.8 (3)	1	1	1	3				
	Unemployed	1.2 (2)					1	0	1	2
	Total	**29.9 (49)**	**10**	**6**	**5**	**21**	**6**	**6**	**16**	**28**
Total	Higher Managerial Administrative Professional	9.1 (15)	1	2	2	5	2	7	1	10
	Lower Managerial Administrative Professional	36 (59)	11	14	6	31	4	10	14	28
	Intermediate Occupations	15.2 (25)	3	4	0	7	5	7	6	18
	Small employers and own account workers	14.6 (24)	6	5	4	15	0	5	4	9
	Lower supervisory craft and related occupations	5.5 (9)	3	1	1	5	0	2	2	4
	Semi routine occupations	9.8 (16)	5	0	3	8	2	4	2	8
	Routine occupations	6.1 (10)	3	2	2	7	0	1	2	3
	Unemployed	3.7 (6)	0	1	0	1	2	1	2	5
Total		**100(164)**	**63**	**9**	**7**	**79**	**53**	**21**	**11**	**85**

Analysis of the data in table 5.5 above shows that boys from all the different ethnic backgrounds are more likely to consider IT as a future career option compared to the girls. Although the sample is relatively small, girls from Black ethnic backgrounds seem to be more likely to disregard IT as a future career than girls from other ethnic backgrounds. This could be due to a number of reasons already addressed, such as having other career options, peer pressure, media influences and parental or family influences. It may also be that IT as a career option is not prestigious enough, compared to other careers including medicine, law, or engineering, which are more acceptable to their cultural backgrounds.

As mentioned in Chapter Four (4.5), however, this study is unable to further determine the extent to which ethnic background, social class based on parents' occupation or parental perceptions of 'appropriate' careers for their children, affected teenagers' perceptions of IT. The study did not include appropriately fine-grained feeder questions that could have assisted with clearly identifying whether these background characteristics played a part in determining the teenagers’ future career options. It is possible that if the parents were interviewed as part of the study, then this could have been further clarified.

5.6 Conclusion

Chapter Five has introduced IT as a career, discussed how technology underpins many of the organisations in society today, and focused predominantly on the students’ perceptions of working in the IT sector or working as an IT consultant in another industry as a possible career for the future.

Overall, the quantitative results produced in this chapter, as displayed in Table 5.1(1) above, show that IT careers were more popular with the boys than the girls who participated in this study, and this reflects the stereotypical image of the IT industry as ‘male-dominated’. One of the major differences was the greater percentage of boys compared to girls who said that they would consider IT as a possible career for the future; not only were there more boys interested in IT careers for the future, but there were also very few girls who listed IT as a first career choice option for the future on the questionnaire (see Table 5.1(3) above). Medical careers were more popular with the girls, as were non-technical careers, such as social care, fashion and design, entertainment and media and general animal care. However, careers such as IT, engineering, science, and sport-related occupations were more popular with the boys (see Table 5.1(3) above). Other interesting differences recorded were that girls in single-sex environments were more likely to indicate that they would positively consider IT as a possible career choice than girls in co-ed environments, although a greater percentage of them also positively indicated that they would not. Girls from Black ethnic backgrounds were less likely to consider IT as a future career option than girls from Asian, Mixed/Other or White ethnic backgrounds. Some students, especially those in private schools did not seem to rate IT careers highly, but this may possibly be due to it being a non-traditional career or its ambiguous class profile.

The quantitative data highlight a number of similarities amongst the boys and girls who participated in my study. For instance, the boys and girls recorded similar percentages for Q5 of the questionnaire - student influences on job and career choices for the future (see Table 5.1(4) above). They all agreed that their own interests influenced them first and foremost. Their parents, other family members, the media and their peers were also cited as influential figures. Some of the students suggested that careers advice at school with regard to IT was practically non-existent, with only one girl mentioning that her school provided IT advice and organised mentors. Indeed, the lack of careers advice was a problem experienced by the majority of the students at school and at home. The absence of careers advice meant that students were unable to make informed decisions and choices regarding IT careers: students' perceptions of IT jobs mirror stereotypes that do not represent the diverse, dynamic and rewarding nature of the field (von Hellens, Pringle, Nielsen and Greenhill 2000).

The quantitative data (see Tables 5.1(1), (2) (3) and (4) above) also reinforce the findings of previous research that occupational stereotypes are strongly linked to career choices (Gottfredson 1981, EOC 2001, Woodfield 2007) and that possible IT careers for the future seem to be more popular with boys than with girls. The boys in my study may have been more willing than the girls to consider possible IT careers despite the stereotypical image of the computer ‘nerd’ and because of the perception that IT careers are ‘male-domains’, more suitable for males than females (Newmarch et al. 2000, Kotarinou 2004, Frieze 2005, Rommes et al. 2007). Additionally, the students’ (especially girls’) role models and mentors played a major part in their possible job and career choices for the future (Multimedia Victoria 2001, Kniveton 2004, Ogan et al. 2005, Gras-Velazquez et al. 2009), followed by family members, and society’s expectations of them (Guichard and Lenz 2005).

Reviewing the data from the creativity map revealed that, unlike the students in co-ed environments, the boys and girls in the single-sex environments did not express stereotypical negative perceptions of IT as a career.

The qualitative data show that those students considering working in the IT sector or working as an IT consultant in another industry shared similar views; both boys and girls mentioned that they enjoyed IT and were very passionate about it, understood what IT careers entailed, stressed the importance of role models and mentors, and talked positively about their influences. These students (those who were considering IT careers) perceived that working in IT would be a desirable career for the future, as it was financially rewarding. They were aware of and had exposure to what IT careers entail and the benefits of IT careers, and were also influenced by their respective role models and mentors. The students thought that role models working with career advisors could highlight the appeal of the technology industry and explain the wide range of roles available, and as mentioned, positive role models could make STEM careers seem more exciting, interesting and relevant.

Conversely, the students in this study who said that they would not consider working in the IT sector or working as an IT consultant in another industry identified a number of reasons why they were not considering such careers. The students (29 boys and 37 girls) mentioned that they had de-selected themselves from possible IT careers due to a number of factors (see Chapter Five). A review of their social class based on the parents' occupation did not reveal any significant patterns, and it is possible that even those who did like IT still de-selected it as a career option, due to other interests. As I have discussed, this was not because they were not interested in IT generally, as a good number of the students did indeed like IT as a subject, and neither did they perceive IT careers negatively, but rather it was because they lacked knowledge about the creative and financial remuneration aspects of IT careers. To some extent, the students modelled their future career options on careers they were familiar with and jobs that their role models recommended. The chance to earn good money in a job was a criterion mentioned by the boys, and this was of more interest to them than to the girls, who were more concerned about career enjoyment and job satisfaction.

Another reason cited by the students who were not considering IT careers was the lack of career advice. This was of greater concern to the girls as 25 girls compared to 11 boys thought that IT as a career was boring. The students (three boys and 13 girls) linked the word 'boring' to *what* they were being taught and *how* they were being taught in school respectively, with the girls showing more concern about the stereotypical image attached to such careers and the boys concerned with the typical working day and functions required as part of IT work.

The lack of role models and mentors was also of greater concern to the girls than to the boys: 10 of the girls mentioned this, but none of the boys did. Thus, it is assumed that, as IT careers are perceived stereotypically, boys are more likely to have greater access to role models and mentors than girls. As a result, it was not seen as a major problem for those boys who were not considering IT careers. However, for girls, having positive role models is important when it comes to challenging persistent stereotypes, particularly of IT careers being mainly for boys. Positive role models and mentors can also highlight the appeal of the IT industry by explaining the wide range of roles and jobs available. Research has shown that the absence of positive female role models and mentors has been identified as an important deterrent for women considering a role in sectors not traditionally viewed as ‘female friendly’ (Mason and Mason Ekman 2007).

Furthermore, other reasons for not considering IT careers were identified by the students from their interview data and creativity map notes. These included the sector’s perceived gender bias, the negative image of IT and its long working hours.

Reviewing the students’ (qualitative) contributions reveals that the boys and the girls generally enjoyed technology and their use of it, but because they were not familiar with what IT careers entail, they had decided to de-select themselves from an opportunity to consider IT as a possible career option for the future. However, the findings also confirm that students are more likely to consider IT careers if they are familiar to them. For example, if they see them being pursued by their role models or positively portrayed by the mass media.

Finally, the 33 girls and 18 boys who said that they were not sure if they would consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future also cited a number of reasons. These had been identified by both those students who were and were not considering IT careers for the future. This included a mixture of the positives and negatives mentioned by the other groups of students, such as other career interests, a lack of career advice, and problems identified with the status of IT. As mentioned earlier, IT would be a fulfilling career for students to consider if they were provided with adequate careers advice during their early school years, as is the norm for other careers. This is especially important for Year 9, which is the first point where pupils are encouraged to start thinking about their career options for the future.

The information provided by the students in this chapter has also shown that career advice and role models are very important in the lives of teenagers, especially at a time when they are expected to make important choices for their future. As Pearson (2009) argues, role models working with careers advisors can highlight the appeal of the technology industry and explain the wide range of roles available, which will help the teenagers foster an early interest in IT careers for the future. Unfortunately, teachers, parents or careers advisors are currently not doing enough to dispel negative perceptions. Research has suggested the negative influence of teachers and counsellors in relation to maths, science and technology career choices reflects a gender bias steering girls toward traditional ‘female’ careers (Gates 2002, Turner et al. 2002). It is possible that if teachers, counsellors and educators harbour stereotypical perceptions regarding girls and IT careers, then it will be difficult for them to provide information to allay the girls’ concerns regarding IT as a career option.

Chapter Six: Perceptions of IT in general

6.0 Introduction

Access to technology amongst teenage boys and girls, especially in the areas of computers, mobile devices, and the Internet, has expanded dramatically over the past two decades. Teenagers can now access the Internet almost anywhere: in their bedrooms, in other rooms at home, in public spaces such as libraries, restaurants, coffee shops, on the trains or via a mobile device on the go. Most have access to various Internet-enabled devices, such as computers, electronic notebooks, net books, music players (mp3 and mp4), laptops, tablets, iPads, iPods, games consoles and mobile phones. Teenage boys and girls use these devices for social networking, playing games, downloading and watching movies, communicating with each other (online chat, instant messaging, file-sharing and blogging), creating content, emailing, reading, shopping, school work and homework (Ofcom 2013).

According to Livingston, Olafsson and Staksrud (2011), teenagers (both boys and girls) use the Internet daily: they spend on average 88 minutes per day online, with 60% of 9-16-year-olds online daily and a further 33% online at least once a week. This has changed, as reported by a BBC technology journalist in 2015 7-16 year olds spend on average 3 hours online each day (Wakefield 2015). The more a parent uses the Internet, the more likely their child is to use it, thus gaining the digital skills and benefits associated with going online (Livingston et al. 2011). Smock (2013) concluded that girls in school are less likely than boys to have positive feelings about technology in general and that they are more likely to be anxious and have less confidence in their own abilities to use it, even if their mathematical and scientific abilities are assessed as being similar to boys. However, girls' overall performance at GCSE and SAT level tells a different story: they are constantly outperforming boys even in ICT and computing subjects. Furthermore, Smock's research showed that while boys are more likely to experiment with technology and to use it playfully, girls tend to hold themselves to higher standards about how to use it successfully (Smock 2013). In addition, social and parental expectations, along with teacher bias, are commonly suggested reasons for girls' lower involvement with computers compared to boys, while differing levels of access to computers is also thought to play a significant role in creating gender differences in relation to using of technology. It has also often been reported that parents are more likely to buy computers for boys than for girls (Brown 1993, AAUW 2000, Valentine et al. 2005). Moreover, even when given equal access, as stated earlier, boys use computers at home more frequently than do girls.

Contrary to previous claims about girls lacking in confidence and not being comfortable with technology (AAUW 2000, Beckwith et al. 2005, Cooper 2006), the quantitative data displayed in Chapter Four, indicate that by comparison with the boy participants in my study (see Table 4.1(6) in Chapter Four), the girls were confident and comfortable computer and technology users. In addition, this current chapter will show that the girls in my study used technology as much as the boys, especially in areas (social networking, mobile devices, and homework) that they enjoyed most.

This chapter discusses and explores the similarities and differences between the participating boys' and girls' various uses of and engagement with IT. It also focuses on the students' usage of computers both in school and outside of the school environment. As mentioned in Chapter Two, previous research has suggested that boys use computers more frequently than girls; they use IT more in their homes, their friends' homes, at summer camps, and after-school clubs. Boys use computers to play games, for educational software and for access to the Internet. Conversely, girls use computers for emailing, instant messaging, social networking and school homework (Lupart & Cannon 2002, NCES 2004, Barker & Aspray 2006, Livingstone et al. 2011). Previous studies have reported differences between boys' and girls' practices with and attitudes towards computers: boys view the computer as something to be mastered (Morritt 1997, Turkle 1998) whereas girls predominantly use the computer as a tool for a specific purpose or to complete a task. They also seek to view the computer as something they are comfortable with (Turkle 1988, Turkle & Papert 1992, Wylie 1995, Morritt 1997). This suggests that ICT use is influenced more by attitudes towards a subject rather than by attitudes towards technology itself. Regarding IT more generally, girls are significantly more likely than boys to say that they use the Internet for schoolwork (Ofcom 2008); this was confirmed by the findings in my study. Other research studies have suggested that girls like co-operative learning based on inquiry and a diversity of topics; they prefer to use computers for goal-oriented activities with meaningful contexts and tend to be more passive, while boys tend to be more assertive and dominant about computer use (Butler 2000, Barker & Aspray 2006).

Not all the students who participated in my study discussed how they used and engaged with technology in school and at home, but some of the students (42 boys and 28 girls) did talk extensively about how they enjoyed, used, and engaged with IT. Their contributions seem to suggest that the girls' uses of technology were similar to those identified by the boys. Even though there were more boys than girls contributing data to this chapter (see Table 6.0 below), more girls than boys reported using IT for homework purposes, recreational purposes, and mobile communications. A review of the qualitative data provided by the students during the interviews also shows that the type of school they attended did not seem to be associated with differences in how they used and related to IT both at school and at their homes. Overall, the teenagers identified, used and engaged with technology in similar ways.

Investigating the group data from the creativity map shows similar engagement with and uses of technology, which the students discussed during their interviews. The uses listed by the different groups ranged from social networking, homework, emailing, online messaging, playing games on the Internet and playing on games consoles. The students all seemed very knowledgeable about technology and were happy with their hardware, such as their iPads, notebooks, laptops, wii consoles and PS3 consoles, that they used for recreational purposes.

Using the students' comments made during their interviews, the following questions will be addressed in this chapter:

1. How do 14-year old teenagers (girls and boys) perceive IT in general?
    a. Do the teenagers feel comfortable and confident with their use of computers?
        i. Are there gender differences in terms of uses or engagement?
    b. How do teenagers use and engage with IT (technology) inside and outside of school?
        i. Are there gender differences in terms of uses or engagement?

A data analysis of the interviews (qualitative) provided by the students (42 boys and 28 girls) who contributed information regarding engagement with and uses of IT was performed, and the following areas of computer use emerged:

Table 6.0: Students' engagement with and uses of IT

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. Recreational purposes	0	27	27	4	11	15
2. Programming/systems design & development	2	9	11	0	3	3
3. School homework	0	4	4	2	6	8
4. Communications/mobile technology and technical gadgets	0	0	0	2	0	2
Total	2	40	42	8	20	28

To aid data analysis, and explore and represent adequately the students' perceptions within each theme, the students have been grouped using categories similar to those used in Chapter Four: students who said they liked IT, did not like IT or were not sure about IT, have been group accordingly based on the responses they provided during the group/individual interviews (see Tables 6.1, 6.2 and paragraph 6.3 in the various sections below). The students' information and preferences have been cross-referenced with their perceptions derived from the information they provided on their questionnaire as displayed in Chapter Five: whether they perceived IT as a career positively (yes), negatively (no) or were uncertain (not sure), and their contributions in this chapter, Chapter Six (uses of and engagement with IT). For the purposes of this chapter, no further quantitative data analysis was conducted; the information used was derived solely from the completed questionnaire and further information provided by the students during their interviews (qualitative data).

6.1 Engagement and uses - students who liked IT as a subject

The majority of students (38 boys and 17 girls) whose qualitative comments contribute to this chapter were from the group of students who said that they liked IT as a subject. These students were more interested and seemed more comfortable discussing their engagement with and uses of IT compared with the other groups of participating students[93]. Although a greater number of boys compared to girls were identified in this group, this was not an unusual trend because, originally, a greater number of boys than girls said that they liked IT as a subject (see Table 4.1(1) in Chapter Four). This has filtered through to the uses of and engagement with IT out of school. This initial observation in the data reveals a strong link between students liking IT as a subject and using and engaging with technology. It also seems to suggest that students who like IT as a subject were more likely to be enthusiastic about saying how they engage with and use technology outside of school for personal, leisure and recreational uses. Table 6.1 below provides a breakdown of the students who provided qualitative data for the various themes:

Table 6.1: Engagement and uses - student who liked IT as a subject

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. Recreational purposes	0	24	24	0	6	6
2. Programming/systems design & development	2	9	11	0	3	3
3. School homework	0	4	4	2	5	7
4. Communications/mobile technology and technical gadgets	0	0	0	1	0	1
Total	**2**	**36**	**38**	**3**	**14**	**17**

[93] The other groups of students were those who said 'no' or 'not sure' to IT as a subject. See Table 6.2 and paragraph 6.3.

6.1.1 Recreational purposes

Using technology for recreational purposes, such as playing games and social networking, was popular. 30 students in this group mentioned one or more of these activities. The data displayed in Table 6.1 above indicate that a much greater number of the boys (24) than the girls (six) rated using technology for recreational purposes very highly on their preferred list of things they enjoyed about IT.

During the interviews, the 24 boys in this group talked extensively about the popularity of game playing amongst boys. The type of games they enjoyed playing were a mixture of sports, combat and challenge games. The 24 boys also talked about playing games with their friends at school, meeting up with friends to play outside of school: at their houses, youth centres and non-academic clubs. These 24 boys also discussed how they configured their game consoles to accept different formats of different games:

> I play lots of games and spend loads of money and time online researching for new and different games. I enjoy playing computer games… I have more than one game console; I am able to play different games with my friends at the same time using the different boxes… playing FIFA 09 on my PS3, Pirates of the Caribbean at World's End on my PSP… I use my IT knowledge to configure my X-box 360. (Waseem$_{(boy)}$, Willow School$_{(co\text{-}ed)}$)

Waseem's response was similar to the other boys in this category in that he enjoyed using gaming technology, and displayed extensive usage, expertise, and knowledge:

> I like playing games on my PS2 and on the computer; I spend the majority of my time thinking of ways to make the characters do different things to make the game more interesting... I play games all the time, every day. (Amari$_{(boy)}$, Ash School$_{(co\text{-}ed)}$)

On the other hand, the six girls in this group discussed playing and enjoying more educational games. These responses seemed to reflect existing gender stereotypes.

These girls, however, talked about their interests with the use of work-linked computer tools for enjoyment purposes:

> I like using PowerPoint because of the funny game-like characters you can use in presentations… I like playing games on the computer during ICT lessons. ($\text{Olga}_{(\text{girl})}$, $\text{Oak School}_{(\text{co-ed})}$)

Comments from the girls suggest that playing games is used to fill time and possibly to avert boredom during uninteresting ICT lessons. This indicates that, although the six girls in this group used computers and other mobile devices outside of school, they did not view game playing as a primary recreational (or educational) activity, as the boys did.

These gender differences resonate with findings from earlier research, which suggested that girls were less likely to be intense game players, as they play games when bored rather than as a first choice activity. In contrast, boys have a greater attachment to, use and enjoyment of games consoles (Kirriemuir and MacFarlane 2004, Valentine et al. 2005).

Social networking is known to be popular with more girls than boys (Stoller 2010, Nicholls 2012, Crouch 2012), but due to the fact that this data set was limited to those who said that they liked IT as a subject, there were more boys (24) than girls (six) who talked about the recreational uses of IT. Of the various social networking sites, Facebook and Twitter were the most popular, with most teenage boys and girls in my study confirming that they had an account with one or both of these sites. During the interviews, the boys and girls explained how they communicate with their friends regularly online, with the majority mainly using Facebook to chat with friends and play games, but also use the Internet for a host of activities: emailing, Skype, fashion tips, Bebo, Twitter, shopping, downloading music and movies, sharing photos and mobile apps:

> I enjoy using my computer daily, especially for my dose of online chat. I connect to Facebook daily to catch up with my friends online. (Willette$_{\text{(girl)}}$, Willow School$_{\text{(co-ed)}}$)

> I enjoy surfing the Internet; I can spend hours on Facebook and chatting online. (Abraham$_{\text{(boy)}}$, Ash School$_{\text{(co-ed)}}$)

The 24 boys as well as the six girls in this group expressed similar views. They explained that they enjoyed logging onto Facebook, surfing the Internet for new games, chatting online with their friends, trading copies of games on Facebook, creating mobile apps and generally communicating online. Furthermore, they expressed their love and enjoyment of using computers. They perceived IT as a subject positively and understood that the IT skills acquired would be beneficial for their future as technology becomes integrated into more subjects studied at school:

> I like the subject because I am interested in IT; we do different fun topics at school, which I enjoy, and technology is used virtually for all the subjects we do… I like playing games online and researching information. (Abraham$_{\text{(boy)}}$, Ash School$_{\text{(co-ed)}}$)

In spite of this knowledge of, and interest in, IT as a subject, the majority of the students who participated in the study either remained unsure as to whether IT could be a future career or had already chosen alternative careers. A review of the overall comments from the students, as summarised in Table 6.1 above, indicates that they were happy with their recreational uses of IT. They also seemed satisfied with the amount of time they were spending online involved in playing games and social networking activities, with the 24 boys going online at every available opportunity and the six girls going online at least once a day. These findings support those previously identified in other research on the gendered use of social networking, playing games and the Internet (Livingstone et al. 2005, Ofcom 2008, Livingstone et al. 2011).

6.1.2 Programming/systems design and development

Programming, systems design and development was another use of IT identified by the students (11 boys and three girls),[94] as mentioned in Table 6.1 above. Programming is the process of writing computer programs using a language such as C, C++, Java, COBOL and FORTRAN. While system design and development is the process of defining the hardware and software architecture: that is, the components, modules, interfaces, and data for a system to satisfy specified requirements, it also includes requirements analysis, system design, implementation, documentation and quality assurance. Although the 14 students in this group confirmed that programming and systems design and development were not part of what they were learning in IT at school, 11 out of the 14 boys talked about their programming and system design and development skills acquired from various out of school clubs. They also mentioned how they ‘tinkered’ and interacted with technology in order to use a wide variety of ICT tools available to them to expand their computer knowledge and to handle the technical tasks that they faced on a daily basis, especially in the area of designing, developing and programming of the various games they played:

> I like programming, system designing and website designing. I am good with computers… Computing is my hobby; I learn most of my programming outside of school at the community centre. Apart from playing on the computer, when things go wrong, I can take the machine apart and fix most of my problems. (Omaha$_{(boy)}$, Oak School$_{(co\text{-}ed)}$)

[94] The three girls and nine of the boys were in co-ed environments, whilst the remaining two boys were in single-sex environments.

Omaha's comments represented the views shared by the other boys in the group, who seemed confident and comfortable with programming, even though they stated that it was something they learned outside of school. These 11 boys confirmed that they liked IT as a subject, and expressed an interest in pursuing it as a possible future career:

> … computers are like my second home, my best friend… I would like to be an IT consultant, a processor designer so I can upgrade my best friends… I would like to help people know how to use computers better; I would like to take part in upgrading technology. (Omaha$_{(boy)}$, Oak School$_{(co\text{-}ed)}$)

These views suggest that the boys in my study possessed more advanced IT skills and greater knowledge and experience of using IT outside of school than the girls, which supports previous research by Eurydice (2005).

Although programming was not popular amongst the girls, three out of the 85 girls who participated were interested in and enjoyed programming outside of school. Alicia from Ash School, was taught to appreciate programming from an early age by her father, who worked as an electrical engineer. Ornella and Orchid from Oak School were both self-taught and learned to code for leisure at a 'geek club' for girls that they attended together outside of school. As mentioned in Chapter Four, they had confirmed that programming was not taught in KS3 or KS4 at their schools, so anyone interested in coding had to learn independently (outside of school) or wait until Sixth Form as some of the colleges and schools offered students detailed programming instruction as part of computing. These three girls, in contrast with the findings of Eurydice (2005), suggested that girls not only program for leisure, but also can be advanced in their use and knowledge of IT. During the interviews, the girls talked about how curious and fascinating they found programming, their interests in building computer networks and so on:

> IT is so intriguing; I like programming and software designing. My father is an electrical engineer and he does very interesting things on the home computer. He designed and built our home network. I am interested in how networks work and hope to build onto it. (Alicia$_{\text{(girl)}}$, Ash School$_{\text{(co-ed)}}$)

Alicia also explained that she liked IT as a subject because she was comfortable and confident with IT and saw it as a fun subject. Nevertheless, she was unsure about a career in IT because of her interests in a medical career for the future, but confirmed that she would always program for leisure. The two other girls, Ornella and Orchid, who were friends both inside and outside of school, showed a curiosity about programming that was unsatisfied in school and that highlighted the benefits of parental role modelling around interests and careers. These two factors - technical curiosity and home support - form a key part of the hobbyist culture:

> I am interested in system designing and programming, I enjoy it… I am always eager to know what the program will do, how the computer will process the code input... My parents encourage me to attend the girl ‘geek club’ each week. (Orchid$_{\text{(girl)}}$, Oak School$_{\text{(co-ed)}}$)

During the interviews, Orchid and Ornella discussed at length the ‘funky’ project they were working on together at the ‘geek club’, which was to design a text- and graphic-based adventure game. The game, as they explained, involved designing a house and creating virtual people who move from room to room picking up items and tokens to buy furniture for the house, as well as fashion items, such as clothes, bags and shoes for the rooms’ occupants. According to Ornella and Orchid, the characters, storyline, locations, and tokens were modelled on the game ‘Star Doll’, but re-imagined and re-created by the two of them during their ‘geek club’ sessions. Ornella and Orchid both like IT as a subject taught in school and both girls said that they would consider a career working with IT, even though neither mentioned it as a first career choice option. Both of the girls did comment on the importance of technology in their lives:

> … ICT shows us how to use the computers, which is very important because most jobs expect people to know how to use technology… (Ornella$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

Ornella was interested in aviation, and Orchid expressed an interest in the media industry but both acknowledged that because they were good with computers and generally enjoyed IT, technology would play a major role in their future careers.

Interestingly, although the three girls talked about designing a game at the 'geek club', a review of their qualitative data shows that they made no mention of having an interest in playing games. The girls' comments also seem to suggest that they viewed designing the game as an educational IT activity, whereas playing games was an activity in which they had no particular interest, similarly to research by Kirriemuir and MacFarlane (2004). Despite the girls' preference for educational games, they have been found to be more sceptical than boys about the educational value of games. They do not believe that games provide unique learning opportunities, unlike boys, who see game-based learning as just another way to learn (Dickey 2006).

6.1.3 School homework

Another interesting activity identified by the students (seven girls and four boys)[95] who said that they liked IT as a subject was that they used IT tools, such as the computer, digital and mobile devices and the Internet to conduct general research and find information to enhance their school homework, as well as researching information on possible careers for their future. During their interview, the girls talked about how they used the computers and the various ICT applications, such as Word, Excel and

[95] The four boys and five girls were in co-ed environments whilst the remaining two girls were in single-sex environments.

PowerPoint, to enhance the quality and quantity of homework they produced in school subjects, such as English, History and Art, as well as ICT, and actively talked about the impact these tools had on their academic performance in general. When interviewed, they highlighted their delight in using computers and the different functions of various technologies for homework:

> I like using Word on the computer for my homework because it presents my work well and in a tidy format. I use the spell checker to make sure that there are no errors… I look up information on the Internet to help with my homework. (Bethany$_{\text{(girl)}}$, Beech School$_{\text{(single-sex)}}$)

The seven girls in this group further commented that they liked IT as a subject because of what they saw as acquiring transferable skills for other aspects of their learning; although none confirmed that they were considering future careers in IT.

The four boys who mentioned that they enjoyed using the computer for research shared similar views to the girls. They explained how they regularly used technology and computers for their homework. During interviews, these four boys talked about how the school encourages pupils to do homework using the word processor facility on the computer; presentation was important and their teachers were constantly urging them to improve their homework, which in turn helped to improve their grades:

> I like using the computer for research, especially using Google to search for information on the Internet; it is very refreshing and fascinating to find things online, especially things you would not have thought of if not for the Internet. (Oakes$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

Oakes as well as the other three boys perceived IT positively: they liked IT as a subject in school because of the knowledge they acquired, and finding out new things using the Internet was perceived by them as fun. Furthermore, these four boys confirmed that they intend to study IT at university, and that they were considering IT careers for the future.

Table 6.1 above shows that more girls (seven) than boys (four) mentioned using computers and technology for school homework, and this finding was similar to the findings in Ofcom (2008). Overall, comments from both the boys and girls in this group displayed similar and regular use of computers and various other IT tools for conducting research that they used as part of their homework, schoolwork or other personal interests. This is in line with research conducted by Valentine et al. (2005). However, information provided by these 11 students also highlights that the girls were slightly more likely to use the computers for educational research than the boys, who were more likely to play games. This trend in my data, despite the small number of participants involved, suggests that girls may use ICT for educational purposes more often than the boys because of the underlying gender attainment gap. Research has suggested that girls are more likely to conform to school academic requirements than boys (Younger et al. 2005, Kitchen et al. 2007, Becta 2008). Moreover, research has shown that high levels of leisure-focused ICT use, which has been seen in the case of some boys, may be associated with a negative impact on educational attainment (Valentine et al. 2005).

6.1.4 Communications/mobile technology and technical gadgets

As mentioned in Chapter Two, the area of mobile phone technology and communication gadgets is one where girls are significantly ahead of boys in terms of usage. According to Ofcom (2008), girls like using their mobile phones and devices for a number of activities outside of simply making and receiving calls. The functions include emailing, chatting, texting, shopping online and generally communicating with each other. Although research suggests that this form of technology is very popular with girls

(Ofcom 2013), it was mentioned explicitly by only one of the girls who participated in this group. Interestingly, participant observation data collected during various interviews with the girls (both in single-sex and co-ed schools) revealed that they had their mobile phones, portable gadgets and devices beside them and were constantly referring to these devices for timekeeping, possibly checking Blackberry messaging or keeping up with text messages and surfing the Internet. This might suggest that their use is so extensive and integrated into their everyday lives that it has become unremarkable to them. During her interview, Lilian talked about the various mobile devices she owned, such as her Blackberry, iPad, and Kobo tablet and described what she used these devices for. Her comments highlight her passion and confidence about the devices she used:

> I love my Blackberry; I take it everywhere with me. It is my phone, my diary, my stylist when I get stuck; it is everything to me… I am very good with technical things and gadgets. (Lilian$_{\text{(girl)}}$, Linden School$_{\text{(single-sex)}}$)

Lilian perceived technology positively. Her varied use of the mobile phone and other devices lends further weight to research by Ofcom (2008) that teenage girls show a significantly higher level of mobile phone use than boys, and that girls use their phones for a broader range of purposes than boys. In her questionnaire and interview, Lilian explained that she liked IT as a subject in school because she was good with technical gadgets, but also mentioned that she would not be considering IT as a possible career choice for the future because she wanted to pursue a medical career. However, she did confirm that IT would form a major part of future career due to the technological advances in medicine today especially in the area of neurology, which is where her interests lay.

Although the boys talked about their gaming consoles and other portable gadgets they owned, during their interviews, they did not mention their mobile phones or any other handheld communication devices. Some of the boys mentioned owning tablets and PSPs, which can be used for communication, and I observed two boys checking their phones. Nonetheless, my data suggested that mobile phones were not a priority for the boys in the way they were for the girls and certainly not as important as gaming consoles. The attitude of the boys in my study was similar to the attitudes of boys identified by Ofcom (2008).

6.2 Engagement and uses - students who did not like IT as a subject

A handful of students (three boys and nine girls) who said that they did not like IT as a subject[96] mentioned a number of uses of technology similar to those identified by the students who said they liked IT as a subject as shown in table 6.2 below:

Table 6.2: Engagement and uses - students who did not like IT as a subject

	Boys (n)			Girls (n)		
	Single-sex	Co-ed	Total	Single-sex	Co-ed	Total
1. Recreational purposes	0	3	3	3	4	7
2. School homework	0	0	0	0	1	1
3. Communications/mobile technology and technical gadgets	0	0	0	1	0	1
Total	**0**	**3**	**3**	**4**	**5**	**9**

[96] 11% of the boys and 25% of the girls said they did not like IT as a subject. See Table 4.1(1) above.

6.2.1 Recreational purposes

Recreational uses of technology – social networking and playing games - were popular activities, mentioned by three boys and seven girls in this group. Although these students perceived IT as a subject negatively, it did not seem to affect their use of, or engagement with, technology. For instance, the seven girls during their interviews expressed their enjoyment of social networking outside of school:

> I am confident using computers, especially for my personal use. I like and enjoy emailing, chatting online via Facebook or Twitter, and shopping online. (Juliette$_{\text{(girl)}}$, Juneberry School$_{\text{(single-sex)}}$)

Juliette's comments echoed those of the other six girls: they all enjoyed their personal and recreational use of technology, but judged IT negatively overall. The consensus from this group was that ICT as a subject was 'boring' because they did not learn anything challenging or interesting (see Chapter Four). This was also one of the reasons they opted out of considering IT as a possible career choice (see Chapter Five). During their interviews, the three boys in this group shared similar views as the girls and discussed alternative uses of technology, such as YouTube: a social networking site commonly used by teenagers to view and post their videos online:

> I like surfing and chatting with my friends online. I enjoy creating and posting musical videos of myself on YouTube. (Odakota$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

The discussions revealed both the boys and girls were creative technology consumers, despite their dislike of IT as a subject. These students did not enjoy ICT in school because they did not find it interesting, creative or engaging in this context. Nevertheless, Bessie, one of the girls in this group was considering IT as a possible career for the future. It seemed that she was able to see beyond the 'boring' ICT curriculum:

> I am not into the subject at school, the teacher is as boring as the subject, but IT is one of my career options because I like jobs that are practical, busy and hands-on. (Bessie$_{\text{(girl)}}$, Beech School$_{\text{(single-sex)}}$)

The three boys in this group also talked about playing games, and explained how good they were at this:

> I want to learn how to design and create combat games because I am interested in games. I play lots of games with my friends online and on my PS3 at home. (Oscar$_{\text{(boy)}}$, Oak School$_{\text{(co-ed)}}$)

As mentioned earlier in this section, the three boys held negative perceptions about IT as a subject in school, which they put down to ‘not being good at it’. When probed further regarding IT as a future career choice, they were ‘not sure’ because of their interest in other careers, such as sports, rather than their lack of interest in designing, creating, and playing games.

Similar to the boys and girls in the previous sections (6.1.1 and 6.2.1), the three boys in this group enjoyed technology for recreational purposes, such as playing games, more than the seven girls who mentioned that they enjoyed technology for social networking. This echoes other research studies (Livingstone et al. 2005, 2011 and Ofcom 2008) that have indicated playing games and using games consoles is largely the preserve of boys (Kent and Facer 2004, Valentine et al. 2005, BBC 2005, Aubrey and Dahl 2008).

6.2.2 School homework

As mentioned earlier by the students interested in IT as a subject (see paragraph 6.1.3), using technology for school homework was mentioned by one girl (and no boys) from the group of students who said they did not like IT as a subject. During her interview, Rachel from Rowan School talked positively about the importance of using ICT tools for both schoolwork and homework:

> I use the computer for research and proper Internet searches for school; all my homework is done on the computer, and I am able to continually improve the work I produce. (Rachel$_{\text{(girl)}}$, Rowan School$_{\text{(single-sex)}}$)

Rachel attended an all-girls selective grammar school. Attainment was crucial to her, and she understood that technology would be important to her future. However, even though Rachel regularly used technology and the computer for schoolwork projects and general recreational purposes, her questionnaire and interview data revealed that she perceived IT as a subject negatively. This, she explained, was because she found the subject ‘boring’, felt that it involved too much coursework, and was concerned that IT as a subject was only worth half a GCSE module. She also confirmed that she would not consider IT as a career as she had other interests.

6.2.3 Communications/mobile technology and technical gadgets

The last use of, and engagement with, technology mentioned by one of the girls in this group related to mobile technology and technical gadgets. As identified in section 6.1.4 above, none of the boys here mentioned using a mobile phone. During the interviews, Rosanne from Rowan School talked extensively about the various mobile devices she owned and other equipment available at her disposal:

> I have my Blackberry with me at all times… I have a laptop, an iPad and a PSP that I use at home. (Rosanne$_{\text{(girl)}}$, Rowan School$_{\text{(single-sex)}}$)

Rosanne's comments suggest that she enjoyed the use of her various gadgets, even though in her questionnaire she mentioned not liking IT as a subject because she found it 'boring'. She also confirmed that she would not be considering IT as a future career because she perceived this as a 'boring' prospect too, and would instead consider architecture. That Rosanne and many other girls in my sample had access to and owned multiple gadgets contradicts what previous research has suggested: that girls are significantly more likely to have either no access to a computer or access to only one computer or laptop at home, whereas boys are more likely to have access to two or more computers or laptops (Valentine et al. 2005). Increasing amounts of technology and new gadgets currently available in the market, especially in the area of mobile networking, means that girls now have access to better and faster android phones, and tablets, which can now perform most of the functions that laptops or computers previously offered. Rosanne also reported that she used technology on a daily basis for fun, an observation supported by Kent and Facer (2004).

6.3 Engagement and uses - students who were 'not sure' about IT as a subject

Finally, only two girls (one from a single-sex and the other from a co-ed environment) from this group of students (those not sure about IT as a subject) mentioned social networking as one of their common uses of technology. None of the boys in this group mentioned social networking as a recreational use of technology, which confirms a point highlighted previously (see sections 6.1.2 and 6.2.1 above), that girls had greater interest in social networking than the boys, and also favoured this form of technology for various creative purposes, such as writing, developing artwork, creating music or cropping and editing photos. This also confirms some previous research (Valentine et al. 2005, Ofcom 2008). During the interviews, as with the other girls interviewed, these girls talked about how social networking is commonly used amongst teenagers today, especially girls, for a variety of functions:

> We all have emails, and we all use Facebook. I like using Facebook to communicate with my friends online. (Jennifer$_{(girl)}$, Juneberry School$_{(single\text{-}sex)}$)

> I use the computers mainly for social networking, online shopping and general surfing on the Internet. (Orielle$_{(girl)}$, Oak School$_{(co\text{-}ed)}$)

As identified above, social networking was popular amongst the girls, even in situations where they perceived IT as a subject negatively or were uncertain of it. For instance, Jennifer stated on her questionnaire that she was not sure about ICT because, although she found it an easy subject at school compared to some of the others, such as Maths and Science, she also found it ‘boring’, which was why she did not want to consider a possible career in IT; instead, she was interested in a fashion and design career for the future. Orielle’s perceptions of ICT were similar to those of Jennifer: she saw it as ‘boring’ with nothing interesting to learn. Orielle ultimately said ‘no’ to an IT career because of her lack of interest in IT, preferring to go into catering.

The comments provided by Orielle, Jennifer and other students (see paragraphs 6.1.2 and 6.2.1 above) regarding social networking, showed that the boys and girls similarly enjoyed technology and had similar uses for computers, the Internet, and social networking. They regularly and frequently used the Internet, especially as it offered a wide range of activities that appealed to them (both the boys and the girls). Thus, this finding from my qualitative data set concurs with other research (Jackson et al. 2001, Carlsson and Facht 2002), which found that girls (and women) are as frequent Internet users as boys (and men), although girls (and women) use emails and social networking slightly more than boys (and men).

6.4 Conclusion

Chapter Six has focused on engagement with and uses of IT as mentioned by the teenagers who contributed qualitative data as recorded in Table 6.0 above. The chapter started with an introduction of the role that technology (mobile devices, computers, and the Internet) plays in the lives of teenagers, and then progressed to what they used the Internet for (namely playing games, online shopping and social networking) and how frequently they used technology (time spent online daily, weekly and so on). The creativity map used as part of my study (pre-intervention data) and the subsequent interviews (post-intervention data) identified similar uses of, and engagement with technology, by both the teenage boys and girls.

The students who participated in my study talked about social networking, playing games and their recreational uses of technology. Overall, the girls preferred social networking while playing games was more popular with the boys. Despite the differences in absolute numbers between the students, the boys and girls gave similar explanations of the various social networking accounts they had access to, such as Twitter, Facebook, and YouTube, and they talked similarly about how regularly they used their social networks to communicate with their friends, to play games with each other, to share photos, download music and to upload and post personal musical videos.

Playing games was another recreational use of technology mentioned by the students, and this was significantly more popular with the boys than with the girls in the three groups of students who participated. Generally, the qualitative data confirm that girls are neither regular nor intense game players. This supports a consensus in the literature that playing computer games is one activity that accounts for much of the differences in girls' and boys' out-of-school use of ICT (Kent and Facer 2004, BBC 2005, Ofcom 2008). Although one girl mentioned playing games, and two other girls (Ornella and Orchid from Oak School) talked about designing and programming an adventure-based game at the 'geek club' they attended outside of school, in general, playing games did not seem to feature high on the priority list of things the girls used technology for. This was in contrast to the boys, for whom games featured as one of their main uses of technology. The girls in my study used their mobile devices for various activities, including social networking and playing games or emailing, but they did not discuss playing games, perhaps because they did not perceive any educational value in this. Nevertheless, the observational data collected during the creativity session revealed that the girls were constantly 'playing' with their phones. This suggests that although they did not explicitly mention that they liked playing computer games, girls were not completely not interested in the activity. Perhaps simply more of the boys than the girls played games regularly, and were more willing to talk about it.

Programming was another activity identified as being more popular with the boys than with the girls in this study. The boys were happy to talk about using their programming knowledge gained outside of school to interact with and configure their devices. In some cases they used this knowledge to take machines apart, upgrade them or find faults, and then put everything back together again. Although not common among the girls, with only a handful of them (4%, n=3) talking about this area of activity during the interviews, those girls who were interested in programming had similar views and uses to the boys. Both the boys and the girls talked about how they learned and attended programming clubs out of school with the boys going off to learn coding at the community youth centre. The girls were either taught by their parents or attended a ‘geek club’, where they learned to code and indulge in their passion for the project: to design an adventure-based game, and the desire to build a computer network.

Another use of technology, which was more popular with the girls than with the boys in this study, was the use of IT for school homework and general research. The girls explained how they used and engaged with technology to enhance the homework they did in various subjects at school. This was also mentioned by a few of the boys who said that they used technology to enhance the presentation of their homework and thereby their academic performance (to get better grades at school). The boys and girls also explained how they used the Internet to conduct research, which improved the quality of their homework. This supports previous research that indicates that girls use technology for school homework more than boys. Nevertheless, there was no significant gender difference beyond this: the boys and the girls in my study used it for similar purposes in enhancing their homework.

The use of mobile devices and technical gadgets was another use of technology that was more popular with the girls than with the boys. The girls were happy to comment on their use of mobile phone technology, which has evolved to be no longer just used a basic telephone to talk with people but rather a means of keeping in touch and communicating with online communities at large. Unlike the girls, the boys in my study did not seem to be interested in talking about their mobile phones and devices even though, during the creativity session, it was observed that they did own mobile phones as some had theirs with them during their interviews. An explanation for their attitude is that mobile phones did not feature as highly on their list of priorities for technology use as game playing did. This lends weight to Ofcom's (2008) findings that teenage girls show a significantly higher level of mobile phone use than boys and that the girls also use their phones for a broader range of purposes than boys. Although the boys in my study did own a number of handheld gadgets, such as their phones, PSPs, iPads or tablets, which they used to play games, I had no interview data from them, so it was difficult to identify any differences or similarities with use of or engagement with the technology and gadgets at their disposal.

Finally, it is interesting to see how technology has evolved from previous decades and how teenagers relate to current trends and the devices available. Research findings from the 1990s suggested that previously, girls and boys approached computers differently, that boys had more computing experiences than the girls in terms of both quantity and variety (Aman 1992; Gaines, Johnson & King 1996), that parents were more likely to buy home computers for boys than for girls (Spender 1995, Swanson 1998) and that boys were more positive about their own personal experiences with computers than girls (Busch 1997; Kadijevich 2000). However, since computers and digital devices have become much more affordable, ownership of various types of technology is now more widespread and gender differences in the quantity and usage have declined.

Chapter Seven: Conclusion

7.0 Introduction

The majority of research studies into the gender imbalance of IT workers have focused on women who are currently working in the IT industry, rather than on those who are yet to embark on a career. This thesis has attempted to collect a significant amount of quantitative and qualitative data from 14-year old teenagers who are in the midst of making decisions about their future, in order to better understand why girls are more likely to steer away from IT than boys. My study is innovative in the sense that the 163 student participants have been separated into three main groups of those who ‘like’, ‘dislike’ or are ‘not sure’ about IT as a subject and a career, so that I can compare boys and girls with similar attitudes: this approach has been neglected in the existing literature where it is more likely that boys and girls are more generally compared. The results allow me to identify and explore what students of both genders, and with the same basic attitudes to IT, feel about it as an academic subject and possible future career. My methodology and findings have permitted an analysis that goes beyond the tendency to simply generalise that boys like IT more than girls, and then explore the reasons why (such as research conducted by Gras-Velazquez et al. 2009).

This concluding chapter has been split into three main parts. The first part reflects on the research methods used and the issues encountered whilst undertaking the research. The second part is a review of the aims of the study and an overview of the key findings, linking these to existing literature and the emerging debates and policies in the area of gender balance in IT. Finally, the third part points to future research questions that have arisen out of my thesis and offers concluding remarks.

7.1 A review of the research activity

At the start of my research study, I was interested in researching the underrepresentation of women working in IT and was motivated by my own personal interests. Having worked in the IT industry as an IT consultant over a number of years in various technical, project, and supporting roles, and having met only a handful of women each time in the different IT departments, I formed a strong impression of the industry as male-dominated. A review of the available literature on women and IT, conversations with colleagues at work and further discussions with my teenage children, made me realise that the problem existed not only in the workplace but also at secondary school, which is where teenage boys and girls are exposed to the academic discipline of IT and start thinking about their future careers. At work, the conversation centred around the ratio of men to women working in the IT departments, lack of flexible working hours and different progression and succession paths between men and women, especially when moving between lower, middle and upper management. Other concerns expressed were the issues surrounding unequal pay between men and women, where men were earning more than women in the same job, despite women having the same, similar or in some instances even higher academic and professional qualifications. These concerns were in addition to the problems associated with work-life balance and childcare. Discussions at home with my children highlighted the problems they were experiencing at school with regards IT as a subject. They explained that they did not find the subject interesting or challenging even though they enjoyed using technology at home. They explained that the problem was due to the curriculum content: basic computing functions and applications such as Microsoft Word, Excel and Powerpoint. Their concerns were that ICT as a school subject was ‘boring’.

Following up on these two separate discussions, it became obvious that if children were not interested in IT as a subject, this could possibly filter through to a lack of interest in such career options, because most children base their future career options around subjects they find interesting and enjoy at school. This in turn means a reduced number of new entrants into the IT industry, which will be a problem if not enough girls are showing an interest in such careers. With regards to women already working in the IT industry, dissatisfaction with how they are progressing within the industry may result in an early exit to other available careers with better work-life balance and flexibility. This will then contribute to the underrepresentation of women working in IT.

My aims were to gain an understanding of young people’s perceptions and experiences of these issues, use this data to inform them about the various career options available (including IT) and, importantly, to provide an opportunity for reflection, whereby they might consider IT careers alongside other options for the future. I also sought to explore the issues currently affecting the underrepresentation of women working in IT, and to find effective ways to communicate these to 14-year old teenagers in a positive way that encouraged rather than persuaded them to consider IT careers.

My research study was exploratory: I sought to develop a Participatory Action Research (PAR) framework that included a mixed-method approach and participatory data collection tools and elements, such as a questionnaire, creativity map, group and individual interviews, as well as an action research element. I chose this methodology because it is child-friendly and has age-appropriate activities suitable for the 14 year-old research participants.

7.1.1 A review of the participatory action research method

As mentioned in Chapter Three, for the purpose of my study PAR was defined as research where the participants interact with the researcher to enhance the growth and development of the project. The principles of PAR focus on gaining a better understanding of problematic issues at hand through the eyes of those being researched, and empowering these research participants. In turn, I felt empowered myself, to understand the 14-year olds' perceptions of IT as a subject and career through their ideas rather than my preconceived thoughts. This helped me to participate in effective and meaningful activities with the young people, and to explore how we might best address the 'problems' with their perceptions of IT as a subject and career. PAR was an opportunity to create a dialogue with the teenagers, a discussion forum through which their voices could be heard, and to bring about a positive change in their situation.

The literature reviewed throughout the course of my study suggests that using participatory methods is good for research that involves teenagers because participatory methods are 'child-friendly' and 'child-centred', and are based on children's own competencies so as to enable them to have a say in how they are represented to others (Gallacher et al. 2005). Research studies involving young people have used participatory methods positively and effectively (Oakley et al. 2005, Steinke et al. 2007). The PAR approach used in my study has assisted the students to critically investigate and analyse the problems associated with IT studies and possible IT careers. It also contributed constructive responses to a project exploring their perceptions of IT, and was designed to produce a moment of reflection for them on the subject of IT at a critical juncture in their lives when they are considering future career choices.

The research framework I designed, and which formed the core of my study, included a questionnaire, which was completed by the students and recorded their personal details and overall perceptions of IT. A creativity map was designed to provide a visual representation of all areas of IT, and to form the basis of a group discussion (mini focus groups). Group and individual interviews followed, which involved me interacting with the teenagers and eliciting valuable information from them, as well as providing them with information on IT careers. This was often 'corrective' because in some cases students had 'misperceptions' about IT careers and asked for clarification. Due to my commitment to engage with their perceptions of IT, a decision was made in advance to provide such clarifications at the end of the data collection process as part of an action research element within the study.

Overall, the participatory research approach was beneficial to my research study as the various tools used were adaptable to the 14-year old teenager's level of understanding, and consequently valuable information was obtained. The exploratory and often 'participatory' research element of the design meant that the structure offered the opportunity to talk about the different areas and roles involved in IT careers, and to persuade the students to keep IT in mind as a future career option. As a result, my research was successful in its aim to include an'action' element, although the effective impact of this could not be demonstrated.

All of the teenagers who participated in my research study completed all of the research activities effectively and with ease. The volume and quality of data provided by the students throughout the research indicated that they understood and took to their roles as research participants well. Throughout the process, the dialogue between the researcher and the students produced valuable insight into the perceived problems with IT as a subject and common perceptions of IT as a possible career choice for the future.

7.1.2 A review of the questionnaire

As mentioned in Chapter Three, the questionnaire was the first activity the students were involved with. The questionnaire had a mixture of open and closed questions. The students were provided with information on how to complete it and no further assistance was offered to ensure no undue influence on my part.

The data derived from the questionnaire (quantitative) was transferred into an Excel sheet and subsequently exported to SPSS for detailed analysis. This provided me with an initial understanding of the students as individuals participating in my study, as well as their perceptions of IT as a subject and as a career option. Although the aim at this point was to obtain unbiased information from the students on their initial perceptions of both IT as a subject and career, it became apparent at that time there were a number of redundant questions included and valid ones missing.

Further analysis of the data generated by this study pointed to certain questions which could have been investigated, such as the relationship between the students' social class based on their parents’ occupation or income, ethnic background, and their perceptions of IT as a subject and future career as well as other career options. Unfortunately, questions designed to identify more fine-grained detail in relation to a participant’s socio-demographic background were not included in the original questionnaire. This meant that the study was unable to draw firm conclusions regarding relationships between social class, ethnic background and their influences or perceptions of IT as a subject and as a future career. It is almost certainly the case, however, that establishing the social class background of the teenagers in a more fine-grained, definitive manner would have resulted in a more complicated ethical clearance process, and fewer schools taking part. The main focus of this thesis was gender and its effects on perceptions of IT, and while the way in which social class and ethnicity intersect with gender in relation to IT remain valid and interesting topics for enquiry, they could not be further pursued in this particular thesis.

7.1.3 Creativity exercise using the designed creativity map

The creativity map designed for my research provided the students with an overview of all areas of IT as a career. The map was designed to provoke students to think about IT careers without any direct intervention from me at the point of data collection, and this worked well. At this stage, the questions the students asked were more related to the task at hand rather than IT careers.

In hindsight, I should have asked the students in the various groups to each have a sheet of paper on which they could have recorded points they personally agreed with rather than the points they developed as a group, so that I could have linked the results for each student to their questionnaire and interview data. Information (qualitative data) documented during this session was input and coded in NVivo (see examples of the output in appendix B in the appendices). It may have been the case, however, that this would have disrupted the conversational flow and resulted in less data being collected.

7.1.4 Group and individual interviews

This part of the research coincided with the ‘action’ element of the participatory approach. The student participants were interviewed alongside their peers, which meant they listened to each other’s responses, follow on questions and the questions that other students were asking regarding IT careers. The focus during the individual and group interviews was centred on future IT careers rather than on IT as a subject they were currently being taught at school. The idea was to generate interest and encourage the students to consider IT alongside the other career options they were thinking about as well as an opportunity for me to offer the students specific IT careers advice outside of the formal curriculum or advice services. As the students had the opportunity throughout this activity to ask questions, this impacted on some of their answers. It was clear at the time of the data collection, and subsequently in the analysis, that perception changes had occurred for some. It may, therefore, be the case that those who had initially harboured negative or stereotypical views of IT as a career, and who had said that they did not like IT on their questionnaire, or did not list IT as one of their possible career choice options, subsequently expressed positive ideas because of my intervention. Unfortunately, there is no way of assessing definitively whether this was indeed the case, or whether, if it was, this impact was long lasting. As has been discussed, my initial ‘test’ of the effectiveness of the action element of my research was the take-up rate of GCSE IT, but changes in educational policy rendered this mode of measurement ineffective (see below for further reflection on the impact of this policy change).

During my data analysis, an interesting finding emerged, that single-sex environments seemed to be favoured by Black girl participants more than any other background. This finding presented a missed opportunity, which could have been explored and used to enhance the study: the data collected detailing parental occupation revealed the majority of Black girls were from higher managerial administrative professional homes compared to girls of other ethnic groups. Therefore, it is possible that if the parents from the Wazobia group were interviewed regarding their school preferences and choices for their daughters then it may have been possible to see if there was any relationship between Black girls in single-sex education, their perceptions of IT as a subject and career as well as their other possible career choices.

7.2 Challenges and unanticipated issues encountered

Conducting research with young people was very interesting and rewarding, although managing the teenagers during the sessions was arguably more challenging than would have been the case with adults. Due to their age (the majority of the students were 14 years old), extra diligence and care had to be taken. Careful planning and consideration was applied to the research design: a thorough breakdown of the research activities was conducted and enough flexibility was added to the plan to accommodate the changes which occurred during the research, such as a school withdrawing its participants from the research on the day of the creativity session and three of the schools objecting to the taping or video recording of the session, contrary to what was previously agreed.

During the student participants' first term of the academic year (Year 10), a directive from the Secretary of State for Education's Office (set by Conservative MPs Nick Gibb and Michael Gove) on behalf of the DfE, meant that a number of the state schools used for this research had to undergo a restructuring of certain GCSE modules and subjects. IT became one of the compulsory subjects for KS4. Some schools, especially specialist maths and computing centres, had completed the GCSE ICT option earlier, at the end of Year 9. This had a significant impact on the planned action research element of the research insofar as it removed a key measure I intended to use to test the effectiveness of my intervention. I did, however, make the intervention and my overall assessment of its effectiveness was that it did influence the views of some students, but I have no systematic way of evidencing this.

On 1st of September 2014, the NC was completely redefined and the main change for IT as a subject in state schools was the introduction of a compulsory element of computer coding. The absence of coding from the curriculum was one of the reasons some of the participants in my study perceived IT negatively. Had this NC change not occurred, I would have strongly recommended the introduction of coding within the IT curriculum.

The teachers who acted as participant observers during the creativity session did not consent to their observations or comments being used formally for my research. These would have been valuable, as they would have provided an insight to the problems teachers experience when delivering IT as a curriculum subject within their current timetable and schools. Their comments could have addressed some of the issues regarding Computing as a subject being taught by teachers from other academic departments rather than by specialist IT teachers. If I were undertaking the research again, I would attempt to ascertain why the teachers were reluctant to allow me to record their views, and would have attempted to secure their consent via a different approach, if one were highlighted as more likely to secure it.

Transcribing the field notes from sessions that were not recorded was problematic: I experienced significant pressure to create an accurate record of the sessions, often after a tiring day with the students. There was an urgent need to document the events of those three unrecorded sessions immediately so as to not lose valuable information and raw data, which could only be recalled with maximum accuracy if documented on the day of the event. To do this was important, considering that my only backup was the information provided by the students on their questionnaire and my scribbled field notes. By comparison, in those sessions that were recorded, there was often an interesting different view that emerged during the playback of the video or tape recordings, or my attention was drawn to some of the things that could not be so easily recorded on paper in real time. Additional observations include facial expressions, participants' tacit agreement or disagreement to other people's statements and their degree of focus. In addition, further comments that I did not hear during the session became evident when reviewing the recordings, and I felt this was lost from those students whose sessions were not recorded.

During the group and individual interviews there seemed to have been a cross-pollination of ideas amongst the students as a result of the location of the interviews and time restrictions. This meant that students had to be interviewed in close proximity to each other, and in quick succession. To an extent, the students' perceptions continually changed as they were listening to their peers' contributions and they may have felt under pressure to conform. It is also possible that I contributed to this exchange of ideas and perceptions as they were listening to my talks with the other students. If time permitted, all students would have been interviewed privately and perhaps this could have produced different results, although it could also be claimed that the dynamic nature of these discussions produced richer interviews than might have been possible had they not been in a shared space.

As mentioned earlier in section 7.1.4 above, had I interviewed the parents of the Wazobia group of students, I would have gathered valuable information regarding their children's influences about their future career choices and perceptions of IT careers. One hypothesis could be that the teenagers' responses were modelled on their parents' careers and perceptions of certain career choices. A review of the data provided by this group of students revealed that they all aspired to highly professional jobs, similar to their parents, who were also in higher managerial, administrative professional jobs. Of the 18 children (four boys and 14 girls) from the Wazobia group, only one of the boys was considering an IT career and none of the girls mentioned or included IT as possible career options in their data.

Finally, the limited number of participants from the independent sector schools meant that the private vs. state schools variable I set out to investigate at the start of my study could not be fully explored. Had this been possible, I would have been able to investigate further the emergent and interesting difference in the perceived 'class status' of IT careers.

7.3 Summary of findings

This section recaps all the main questions that formed the core of my research and provides an overview of the key findings elicited from both the quantitative and qualitative data collected. There were a number of gender similarities and differences identified from the data provided; these will be summarised and explored under sections 7.3.1, 7.3.2 and 7.3.3 below.

7.3.1 Gender differences and similarities of 14-year olds' perceptions of IT as a subject

As mentioned earlier (Chapter Four), the quantitative data generated from the questionnaire completed by the boys and girls who participated in my study indicated significant differences and interesting similarities in their participation in IT as a subject. The 14-year old teenagers' provided a mixture of both positive and negative perceptions regarding IT as a subject they were learning (being taught) in school. Overall, the boys generally liked IT as a subject more than the girls, and this finding included boys in single-sex as well as co-ed environments, and across the four ethnic backgrounds (Asian, Black, Mixed/Other and White). This initial finding from my quantitative data reinforces similar findings from literature reviewed earlier that suggests: IT as a taught subject is viewed more positively by boys than girls and a higher percentage of boys than girls like IT as a taught subject in school (Nelson et al. 1991, Lindah 2003, SSDA 2004, Anderson et al. 2006, Blenkinsop et al. 2006, Gras-Velazquez et al. 2009, OECD 2009).

Secondly, of the 21 schools that participated in my study (see Chapter Two (2.2.3)), the quantitative data reveals that the majority of students ($^{110}/_{116}$) [97] who said they like IT as a subject attend schools where it is taught as a discrete subject (see table 4.1(2)). This represents over $^{2}/_{3}$ of both boys and girls that liked IT as a subject. Although the numbers seem to suggest that students, especially the girls in schools (single-sex and co-ed) where IT is taught as a discrete (standalone) subject are likely to view the subject more favourably and positively compared to those in other schools where IT is taught as an integrated or hybrid subject, I am unable to confirm if these particular students' responses would have been different had they been in schools where IT was taught differently (as an integrated or hybrid subject). Research reviewed earlier in Chapter Two suggests that girls in single-sex environments are more likely to enjoy and do well in traditionally male-dominated subjects such as IT, Maths and Science (Spielhofer et al. 2002, Younger et al. 2005). Unfortunately, even though my study seems to affirm this, the limited scope of my dataset means that I cannot make any wider claims about single-sex education and teaching of IT as a discrete subject. A review of their options chosen at Key Stage 4 shows majority of the students chose a mixture of double and triple Science, IT, Maths and DT. However, these are all compulsory subjects on the educational curriculum at these schools so we cannot deduce whether or not the fact they attended an all-girls school made a difference to their subject choices.

Another interesting finding when looking at the data from the 17 girls in single-sex environments who liked ICT as a subject compared to those who 'do not' or are 'not sure', was that there were more girls from Black ethnic backgrounds in single-sex

[97] 56 boys and 52 girls attend schools that taught IT as a discrete subject. Two boys attend schools that taught IT as an integrated subject. Five boys and one girl attend schools that taught IT as a hybrid subject. 15 boys and 17 girls were from single-sex whist 48 boys and 36 girls attended co-ed schools.

environments than other ethnic backgrounds (10 Black, two Asian, two Mixed/Other and three White). This could mean that parents of Black girls in my sample favoured single-sex environments for their daughters, perhaps, reflecting either the purported higher academic standards at single-sex schools (see pp 20 - 23 of this thesis) and/or the parents' own academic background or values. This would be an interesting future project: to explore the complex relationship between ethnicity, diasporas and single-sex education. As mentioned earlier, had I interviewed parents at the Wazobia group, the majority of who were Nigerian economic migrants, I might have found an explanation for this trend, as they were from middle-higher occupational backgrounds.

Further statistical analysis performed on the questionnaire data also revealed that the boys were significantly more likely to report finding IT as a subject more fun, more enjoyable and easier than the girls did. These findings corroborate those of previous research (Gras-Velazquez et al. 2009 and Ofcom 2008).

Furthermore, the boys considered IT more important for their adult life than did the girls, and so were happier that they were doing IT as a subject, even though they were also more likely to say that they felt less challenged by the subject. These findings in my quantitative data were also similarly identified and mentioned in research conducted by Anderson, Lankshear et al. (2008) and Heywood (2006).

The questionnaire data also highlighted a number of similarities between the boys and the girls: the comfort and confidence levels with regard to using computers, their perceptions of IT as being useful to their future job or career, and the amount of coursework they did for IT at school and how useful IT is to them now. These results also reflected similar perceptions across the board for the students from different educational backgrounds: namely, the boys and the girls in single-sex environments and co-ed environments, as mentioned earlier. This suggests that IT confidence between boys and girls is narrowing and is in line with the findings mentioned in more recent research studies (Faulkner 2002, Sanders 2005, Volman 2005).

The creativity map data did not highlight any gender differences or similarities because it was group data, it only reinforced the fact that the students in both single-sex and co-ed environments did have access to the same content, especially as the IT curriculum was taught relatively similarly in all schools, irrespective of their environments. As mentioned earlier, whilst the various schools the students attended had ICT different teaching models (14 discrete, five hybrid and two integrated model), the teenage boys and girls experienced similar issues that contributed to them liking, not liking or not being sure about ICT as a subject.

The students (both the boys and the girls) who liked IT as a subject[98] expressed positive perceptions; they were focused and engaged with their learning and studies. They viewed the subject as interesting, interactive, easy, fun and enjoyable. The students confirmed that the IT skills they were learning at school were applicable, transferable and beneficial for their future, even though they also raised a number of concerns regarding IT as a subject that involved too much coursework, and was sometimes hard and even boring.

[98] This group was the majority of the students who participated in my research study who liked IT as a subject: 63 boys and 53 girls.

The teenage boys and girls who ‘did not like’ or were ‘not sure’ about IT as a subject mentioned that they perceived the subject as boring or as a subject that lacked creativity, was hard and would not be required for their future. These students also mentioned that they did not see any connection between what they were currently learning in IT at school and the skills required for their adult life or future career. The students, especially the girls, viewed their IT teachers as unhelpful, lacking enthusiasm, and lacking interest in teaching the subject. They also found the teachers’ attitudes off-putting and a hindrance to their learning and progress in the subject. The girls in co-ed environments also expressed concerns over the boys’ noisy, boisterous and disruptive attitudes in IT classes. This was similarly identified in other research on single-sex vs co-educational STEM/IT lessons (Faller 2013) and remains too often accepted and as a common sense understanding of the advantage of single-sex education: ‘single-sex education is beneficial for girls because they can learn without being distracted by boys sprouting hormones everywhere and putting them off doing science’ (Lucas 2009, p.2; Kennedy 2009).

Finally, the qualitative data provided by the students regarding IT as a subject highlighted some subtle differences, which were of interest to my research. These included the girls being more concerned than the boys about *what* they were learning and the boys feeling more concerned than the girls about *how* they were taught. More girls than boys saw IT as a subject as ‘boring’, because they felt that it was an uninteresting and uninspiring subject, while the boys were interested in experiencing more hands-on practical interactions with the subject. The boys perceived IT as an unchallenging and easy subject more than did the girls, and more often expressed their desire to stretch themselves further by learning topics such as a programming language and systems design and development as part of their KS3 IT learning at school.

7.3.2 Gender differences and similarities of 14-year olds perceptions of IT as a career and their consideration of working in the IT industry

The literature reviewed in Chapter Two and the quantitative findings from my study as recorded in Chapter Five highlight interesting gender differences in relation to teenagers' perceptions of IT careers. Overall, the boys who participated in my study were more likely than the girls to agree that they would consider IT as a future career, and even where other variables such as school environment (single-sex vs. co-ed: see pp 182 table 5.1(2)), ethnic background and social class based on their parents' occupation (see table 5.5) were considered, this was still the case. As such, this indicated that the idea of an IT career was more popular with the boys than with the girls. For instance, there were 15 girls and 32 boys who were interested in possible IT careers for the future. Of these, six girls and five boys were from single-sex environments (the study had 31 girls and 20 boys in single-sex schools).

Additionally, the data in table 5.5 in Chapter Five reveal that girls (six) from white ethnic backgrounds were more likely to consider IT as a future career option than girls of other ethnic backgrounds: Asian (three), Black (five) or Mixed/Other (one); whereas there was no relationship between ethnic backgrounds and career choice regarding IT amongst the boys (Asian (eight), Black (12), Mixed/Other (two), and White (10)). Therefore, the data shows that boys from all ethnic backgrounds were more willing to consider IT careers than were the girls. Their reasons for doing so gives credence to the claim in previous research that the stereotypical way such careers are viewed - that the sector is ‘male-dominated’, viewed as ‘masculine’ and that boys are more attracted to the idea of working with technology – is a persistent factor in its current gender profile (Henwood 1996, EOC 2004, Gatrell 2004, e-Skills 2010, Intellect Report 2011), and may remain a factor in its future gender profile for some years to come.

Taking into consideration that the teenagers were only 14 years old, with no knowledge or experience of working in the IT industry, their perceptions were based mainly on their immediate family, peer and educational influences, which were both positive and negative, as well as media portrayal of such careers. As mentioned above, the teenagers’ positive or negative perceptions and influences toward IT careers are experienced, nurtured and shared while still at school; these experiences and influences were also seen to be a determining factor as to whether they considered IT as one of their career choice options. My findings suggest that parents, peers and educators, as well as the media, are all still influential in constructing the perceptions of teenagers with regard to what careers are suitable generally, but also in relation to IT specifically – with one exception: the students who had older siblings or parents currently working in IT careers viewed the IT industry more positively. This finding supports and confirms others (Gottfredson 1981, EOC 2001, Woodfield 2007). In effect, my findings confirm that if teenagers’ influences reinforce that men more readily fit the template of technology occupations then teenage girls are more likely to deselect them.

There was nothing from the data to suggest that there was a causal link between teenagers’ lack of interest in future IT careers and their social class, which was based on their parents' occupations. Although one of the boys from a single-sex independent school mentioned that an IT career in itself was not prestigious enough, this could have been based on a comparison with other career paths, such as Medicine, Law, Engineering, Sports, Accountancy, Banking and Finance. As such, my study is unable to determine if social class or ethnicity has any relationship between teenagers' perceptions of IT careers or whether it is more the fact that IT careers are relatively new when compared with others, or not publicised as much as others. Nevertheless, my findings strongly identified a lack of positive, clear and accurate career advice with regard to the IT career choices, which had a negative effect on the students when they were considering IT careers.

The qualitative data that complemented the quantitative findings provided an array of interesting results related to the reasons for the teenagers' willingness or unwillingness to consider working in the IT industry or in IT-related careers. The findings that were similarly identified by both the boys and girls are summarised in the following.

There were 32 boys and 15 girls in my study who were considering IT careers. They mentioned a number of reasons for their decision, such as exposure to positive career influences, positive role models and mentors. Some of the students had parents or older siblings who were either working in IT or studying IT-related courses at a UK university. Access to such role models and mentors meant that they had been influenced positively and exposed at an early stage (during their childhood) to what IT careers involve. The students' resulting positive perceptions are in line with those similarly identified in research studies where early exposure to unusual or gender-atypical careers can have a formative effect in children making 'unusual' work choices (Gottfredson

1981, Pearl et al. 2002, 2006, Adya et al. 2006, Lockwood 2006). These findings highlight the positive effects that role models and mentors, as well as older same-sex sibling, can have on a teenager's future career choices.

Other reasons identified by students considering IT careers were that IT careers are perceived as desirable and attract good financial remuneration, something the students, especially the boys, found to be a motivating factor and important feature of the future careers they aspired to. Although not a major factor for the girls when considering IT careers, the boys' responses were similar to, and confirmed the results of, previous industry research (CompTIA 2012, McGlinchey 2012): that is, that IT careers offer good salaries, a variety of ongoing development opportunities, and a diverse range of exciting lucrative careers.

The students in this group were also positive about their studies in IT and perceived IT careers more sympathetically. This was especially true for the girls, who did not perceive IT careers stereotypically to any identifiable degree. The views of all the students in this group were similar regardless of school setting. This suggests that, with the right kinds of interventions, there is scope within a broader group of girls to challenge the stereotypes of IT and motivate them to become more interested in IT as a subject and as a possible career choice.

Despite their widespread engagement with IT outside of school, participants remained largely ignorant of what IT careers can offer, and this included many of those who liked learning about IT within school. Generally speaking, there appeared to be a mismatch between students' levels of engagement with IT and their awareness of, and enthusiasm for, a future in paid employment using IT. Unfortunately, the private vs. state variable could not be considered further, due to the small number of students in private education who participated in my study and the fact that this finding was unexpected when it emerged in the analysis. It was therefore not included in the data collection.

As mentioned above, a larger proportion of the girls (i.e. $^{37}/_{85}$ girls) who participated in my research study perceived IT careers negatively as compared to the boys (i.e. $^{29}/_{79}$ boys), and these students cited a number of reasons that were of concern to my study.

Firstly, the most commonly identified reason was ‘other interests’. Here, although the students said they were not considering working in IT, it did not mean that they viewed IT careers negatively or had no interest in IT generally, as some of the students actually liked IT as a subject; however, they explained that they had rejected IT careers because they had other interests.

Secondly, there was a lack of career advice, which was of more concern to the girls than to the boys. The girls explained that this lack of career advice meant that they had deselected themselves from considering IT careers even before deciding what they actually wanted for a future career, and this lends credence to the findings in Chan et al. (2000), Newmarch et al. (2000) and Harris et al. (2004), namely the existence of a lack of understanding of how IT careers and IT personnel are characterised.

Thirdly, IT careers were perceived as ‘boring’. This was a gendered consideration: the qualitative data analysis identified that one-third of the girls in this group mentioned the word ‘boring’. This negative perception associated with the girls is of concern because it stemmed from the problems identified with IT as a subject and the media portrayals of the IT profession, which highlights the need for action to combat such stereotypical images attached to IT careers. Although three boys perceived IT careers as boring, they were more concerned about the activities performed as part of an IT job rather than the image of IT, as was the case with the girls. These findings confirm those of Vowler's (2003) study, which noted that girls do not view IT careers positively.

Fourthly, a lack of role models and mentors was cited as an issue by the girls, but not by the boys. This finding suggested that the profile of IT employment remains steadfastly sex-typed as masculine, rendering it vulnerable to being deselected by the majority of girls on this basis (Gottfredson 1981, 2006). The girls complained that they had no role models to identify with, and that their school career advisors and the IT industry failed to provide them with mentors or role models; they were unable to visualise themselves in IT-related careers, unlike other careers such as Medicine, Law and Accountancy. This is a worrying factor that is not limited to the girls in schools, but affects women in the industry. This is cited as one of the reasons for women's relative lack of career progression in the sector. Current research studies by others (Reality Bytes 2001, Catalyst report 2008, de Lange 2013) all confirm that not having adequate role models, mentors or champions (real or fictional) deters women and girls from both entering IT careers and progressing within the IT industry, and this study underscores the importance of them even at the school level.

Finally, the IT industry's 'long working hours' culture was also a concern cited by the girls but not by the boys. Interestingly, the girls who commented on these 'long working hours' had parents working in IT, which suggests that there is need for the IT industry to address this issue so as to attract more women and girls for the future. The long working hours culture within the IT industry, as identified in the study by DTI 2004 and the Intellect Report 2011, was of concern, as it was putting off new recruits to the industry and seemed to be a deciding factor as to whether such careers would be considered alongside others. This corresponds with findings from other research (Gottfredson 1981, 2006) that suggest that girls are more likely to consider careers if they have direct knowledge of someone who is already working in such a role. Direct experience can influence girls’ decisions to consider IT careers positively or negatively. For example, one of the girls had direct knowledge of what IT careers are like, through her mother and aunt, but this had led her to perceive the IT industry negatively and deterred her from considering an IT career. By contrast, another participant’s direct experience was positive and this was a deciding factor to consider a future career in IT. Therefore my study suggests that the image of IT, as well as elements within the sector’s organisational culture, still remains deeply problematic, even for those girls who have direct knowledge of what an IT professional might do.

The group of students, identified as those ‘not sure’ if they would consider IT as a career choice for their future, also mentioned reasons similar to those identified by the other two groups of students. They cited other career interests and a lack of career advice, and also aired their concerns about the status of IT. As mentioned earlier, both implicit and explicit class concerns regarding IT careers emerged from students in private schools, along with concerns about how to introduce themselves as an IT person should they decide to settle for an IT career. A key finding was that IT, to a certain extent, is understood by these students to be more of a tool than as a career choice.

Finally, the creativity map used as part of my study to understand teenagers' perceptions of IT careers, did not reveal any gender differences or similarities that could be analysed in depth because the students were sometimes in mixed-sex group at the co-ed schools and Wazobia sessions, and same gender in single-sex schools groups. Therefore the data provided did not highlight any issues of concern apart from the fact that the students were not as knowledgeable about IT careers and had preconceived stereotypical perceptions and views of what IT careers are all about.

7.3.3 Gender differences and similarities of 14 year olds' engagement with and uses of technology

As mentioned earlier, reported access to, engagement with, and use of, technology amongst the teenagers who participated in my study indicated that IT was widely available and accepted, with the students describing significant use of a variety of computers, mobile devices, and the Internet. The teenage boys and girls perceived technology very positively and used it daily for various reasons, irrespective of whether they 'liked', 'did not like' or were 'not sure' about IT as a subject. The quantitative data generated from the students' questionnaire confirmed that both the boys and the girls were confident and comfortable with their use of and engagement with computers and technology, and the qualitative data they provided added value to these results and explained further their various uses. This finding in my study confirms what has been identified in a number of research studies since the turn of the century (Faulkner 2002, Sanders 2005, Volman 2005), namely that the differences in IT confidence between boys and girls are narrowing.

My study identified that teenage girls and boys engaged with and used technology for a number of generic reasons. Recreational purposes, including social networking and playing games, were cited by 42 students (27 boys and 15 girls). Social networking as mentioned by the teenagers was mainly used for communicating with people in the virtual world. It was very popular with the girls in my study and they explained that they used their numerous social networking accounts, such as Facebook and Twitter, to catch up with friends, play games, download music and movies and share photos and mobile apps online. While the girls were very passionate about their social networking skills, the boys talked more about playing games as one of their most popular activities. The boys discussed the type of games they played, the frequency of play, the different game consoles they owned, and how good they were at configuring and programming the various game consoles they owned.

Programming and systems design and development was another use cited by the students (11 boys and three girls), with the majority of the programmers being boys rather than girls. The students here all confirmed that programming was an activity they did mainly outside of school at youth centres or ‘geek clubs’, rather than at school. This type of activity was not offered at KS3 in any of the state-maintained schools and was on offer at only one of the private all-boys schools mentioned in my study.

Technology used for school homework was the fourth use of and engagement with IT mentioned by the students (four boys and eight girls); this was also more popular with the girls than with the boys. The girls highlighted the importance of improving their schoolwork and homework using computers and the different applications and functionality available to enhance their academic performance.

The fourth and final use of technology popularly identified and explicitly mentioned by one of the girls was mobile technology and technical gadgets. Although not mentioned by the majority of the students who participated in my study, observational data noted that the boys and girls were constantly referring to their devices such as their phones, computers and watches throughout the creativity sessions at the various schools.

There was a mixture of participating schools: private, state, co-ed, single-sex, high, middle and lower performing schools as well as a mixture of students from various ethnic backgrounds. One focus they seemed to share and have in common was their love for the latest trending gadgets in the market. In each of the group and sessions there were a mixture of students with the latest iPhone, android phones, and even the schools had up to date equipment such as interactive whiteboards, multifunction printers, mobile devices and good spec computers in their computer suites.

A review of both the quantitative and qualitative data reveals similarities between teenage boys and girls regarding access to the Internet and uses of equipment, digital devices and software. There were not many differences identified between boys' and girls' engagement with and uses of technology inside school. Key literature reviewed earlier in my study stated that the noticeable gender difference between boys and girls regarding engagement with and uses of technology was related to the time that boys spend outside of school playing games (Wilson 2002, Colley and Comber 2003, Hayward et al. 2003, Kent and Facer 2004, Becta 2008). The findings of my study also showed playing games and programming to be one of the main differences between the boys and the girls. Other less obvious gender differences recorded in favour of the girls were more frequent use of social networking and the use of mobile devices and handheld gadgets.

7.4 Which way forward for IT

As mentioned earlier, technology has become a major part of our daily lives; it is now more easily accessible and more user friendly for everyone who is interested in using it. It plays a prominent role in our society, and it could be argued that significant power and success rests with those who know how to use this technology effectively. Thus, it is important to realise that some of the more problematic perceptions that students have of IT is not just of academic interest, but is also an issue for the IT industry, and arguably, society more generally. The context is that we are progressing into an era with increased dependence on information technologies.

Throughout the thesis this study has attempted to highlight the issues within the IT industry relating to the gender gap and understand the unwillingness amongst teenage boys and girls to take up IT studies and careers. I also hoped to encourage (though not persuade) teenagers, especially the girls, to consider IT studies and careers alongside other possible careers for the future.

7.4.1 IT as a subject

In spite of the new changes to the ICT curriculum introduced on the 1st September 2014, the teaching of IT as a subject in state-maintained schools still remains an issue of concern especially as this change is still in its infancy. IT is ubiquitous but not universal in terms of access or students' experience of it in schools. This, to a certain extent, has been due to a number of factors, such as how teachers take advice; whether IT proficiency is presented as being a key skill or whether the problem solving and creative approach is adopted; the curriculum itself, which is interpreted differently by different schools; and how the students are taught, namely whether things are done collaboratively in the classroom or if IT lessons are limited to computer suites. What should be taught as part of IT as a subject is important, because the use of ICT is widespread, and computer literacy has developed into an important survival skill for students. Therefore, acquiring relevant knowledge and technology is key for 21st century learning.

As mentioned earlier, the students in English state-maintained secondary schools started their first term on the 1st September 2014, with the introduction to the new NC and the re-branding of ICT or IT (as formerly known) to Computing. Coding is now compulsory for all. The new curriculum for Computing (IT) highlights the necessity and importance of the coding and development skills identified by the students in my study.[99] In KS2, students will be expected to learn how to write code, understand what algorithms are and create and debug simple programs. In KS3, the students will be expected to code, design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems.

The students, especially a majority of the girls who participated in my research study, perceived IT to be a 'boring' subject due to what they were learning or were being taught at school. The lessons they found dull and demotivating included those focused

[99] See appendix B in the appendices for Information in Tables 7.4.1(1) and (2) which provides an overview of what students are required to learn in KS3 and KS4.

upon learning Word, Excel and PowerPoint skills, that is, a repetition of something they had already done during Key Stages 1 and 2 at primary school. The students in my study - especially the boys - wanted to learn programming, systems design and development topics, which, they said, would enhance their knowledge and understanding of technology. Moreover, the students were of the opinion that if programming were taught in KS3 at secondary schools, then possibly more girls would get involved with and show interest in programming, especially as IT is now a compulsory subject for KS4 in state-maintained schools. Programming was perceived as creative, and both the girls and the boys enjoyed using computers and the Internet (technology) for creative purposes (Ofcom 2008). Therefore, programming skills are important for the teenagers' futures.

Unfortunately, it seems that the students who participated in my study will not benefit from these changes. Neither will those currently in Year 9, because, although the overhaul and changes have been made, the exam boards (OCR, AQA, Edexcel) are not yet examining these changes, and the individual English state-maintained schools do not have the required specialist teachers or trained personnel to deliver the new Computing curriculum. In view of these current developments, I suggest that the following strategies need to be considered:

a. More specialist teachers in Computing need to be trained or University students who have studied computer science need to be encouraged to take up teaching appointments and help students with Programming (Coding). Existing teachers who are interested in teaching Computing need to be trained further in teaching methods to enhance student participation, and encourage collaboration, discovery, evaluation and discussion.

b. There is a need to develop more user friendly and fun software that will encourage students to code both at school and during their leisure time, and importantly, make it widely available at the different schools for their use. This software should also allow students to explore the use of touch technology such as mobile devices, remote access, interactive surfaces and visualisers, printers, and build confidence with coding.

c. Schools need to ensure that they are able to offer students discrete IT lessons rather than incorporating IT into existing curriculum subjects such as business studies. Stand-alone lessons will ensure that enough time is dedicated to the subject, and give students enough time and freedom to use their imagination to approach challenges from different perspectives.

d. Work experience or taster sessions should be made compulsory for students in Year 9 (14-15 year olds) so that they will be able to develop an interest and understand how IT as a subject integrates with everyday life, especially now that technology is integrated into all subjects and industries.

e. More needs to be done by the schools to encourage students to take up the opportunities to explore more about ICT as a subject, especially at after-school clubs, weekend or summer long programs and camps. Getting students involved with creative ideas, innovative concepts and interesting projects might increase their motivation and sense of achievement with exciting challenges that require research and consideration.

7.4.2 IT as a career

The perceptions of the teenagers who participated in my study were similar to those reported by the Rhode Island Economic Policy Council (2000), who stated that teenagers stereotypically regarded IT careers as ‘uncool’, ‘nerdy’, ‘geeky’ and ‘boring’. This is disappointing, given the time between this study and my own spans in excess of a decade. Throughout my study, IT careers were perceived as ‘boring’ as a result of the media portrayal, and the stereotypical ‘image’ of IT work as ‘nerdy’, ‘geekish’, ‘male-dominated’, ‘lacking in flexibility’ and ‘unsociable’, was a recurring theme identified by $^{1}/_{3}$ of the students. The boys who participated in my study were more likely to indicate their willingness to embark on IT careers: this lend credence to other studies, which suggested that boys were more likely to consider technology careers (even in the context of limited careers advice) due to their understanding of IT jobs as being a ‘male domain’ (Newmarch et al. 2000, Kotarinou 2004, Frieze 2005, Rommes et al. 2007) and more suitable for boys than for girls (Multimedia Victoria 2004, Lynch 2007, Rommes et al. 2007, McKinney et al. 2008). Of the girls who participated in my study, 43% did not see IT careers as creative, interesting, challenging or rewarding and their decision to not consider IT as a career option was clearly related to their gender as well as other influences, such as career interests, media, parents, siblings or peers.

The lack of understanding and knowledge of what IT careers involve, and of the opportunities a career in IT can offer that stems from limited career advice, was one of the main problems identified by the students. Careers advisors at school were said to have excluded IT careers from careers advice sessions. IT had been integrated into the general school curriculum, students had stand-alone ICT lessons, and were advanced users of ICT tools, both at home and at school, but my participants received incomplete and sometime wrong careers advice on IT. The teachers and careers advisors face many difficult circumstances, including economic, technological, intellectual experience and societal pressures (Naace 2011). This all adds to the confusion: the advisors cannot provide IT-related careers advice and this leads students to have very little or no understanding of what IT careers really involve while they are in school because there is no-one to advise them as to what is expected.

Careers advice at home is also important if the students are to develop an interest in IT careers, as this will help them to make informed choices for their future. There is obviously a possible generational difficulty here as most young people are more competent IT users than their parents and the expectation of good and informed advice from parents on this topic is consequently problematic. This is a void which good-quality careers advice could fill. It is not unusual for students at the end of Year 9 to not know what they want to do in the future, but if adequate career advice is provided, then students can start to develop an idea of what they feel they might be good at. This is especially true for those students who are not, or have not been, heavily influenced by their parents, other family members, friends or the media to follow a particular career path.

The lack of role models and mentors was another problem identified by the students and was of greater concern to the girls than to the boys in my study. Creating inspirational positive role models and mentors and bringing them into contact with female students gives girls (and boys) a better understanding of what working in technology really involves (Steele 1997). For the girls, it would be important and helpful to engage with female role models and mentors, such as women or men currently working in the IT industry who are passionate about what they do and are willing to encourage more girls into IT. Kristina from Krimsone School was the only girl in my study whose school provided an industry-based role model or mentor, and this, she explained, was valuable as her interest in a future IT career was due to the mentoring sessions she received.

Furthermore, the literature reviewed earlier in this study also confirmed that IT careers often include long, unpredictable hours, which may not suit a working mother: ‘women are believed to value lifestyle integration and work-family balance to a greater degree than men’ (Joshi et al. 2001, p.122). Johnson and Miller (2002) maintained that there is evidence that having long working hours reduces software quality, and so reducing hours has business and equality benefits and could attract more women to the job. Clearer explanations should be given to school pupils (especially girls) that IT careers can offer flexible working patterns which do not necessarily mean working part-time hours, but instead offer alternative flexi-hours, such as late starts, shift patterns and continental shifts. As a corollary to this, there is obviously a need for the industry to make good on these claims.

However, students have limited insight into how science and technology can contribute to society in the future, and a limited understanding of what IT careers entail. Parental involvement clearly has positive bearings on the choice of careers for students: educating parents about IT's potential and IT career options is important, and, as the students' comments confirmed, information about IT careers, what is expected in an IT workplace, the opportunities available and the different types of jobs IT workers can do, should be provided equally to parents, teachers and students at an early stage during secondary education. This would mean that IT-related careers could be considered alongside other popular and gender-traditional careers. As previous research clearly shows, the misperception of what IT professionals do and what skills they need to succeed can deter many students from choosing IT careers. The IT sector requires 1,278,000 new entrants between 2011 and 2020 to fulfil its potential, namely to meet the demands of this technological drive. These will need to be drawn from those in education or unemployment and those wishing for a career change (Poyiadgi 2011). Therefore, IT personnel in all IT disciplines will always be in demand, especially those who are able to combine technical, managerial, business, good communication and negotiation skills.

In summary, the following recommendations should be considered:

a. Role models and mentors need to be made available to the students while they are in school. The schools will need to reach out to organisations like WISE so that they can assist them with showcasing, matching and pairing the students, especially the girls with positive role models and mentors.

b. The IT industry needs to get involved and highlight the attractive aspects of working in IT careers. This is not just a problem for the government or those in academia, but also the education system. Little interventions such as IT professionals (especially females) making themselves available to talk at career days at schools, could go a long way in encouraging more girls to get involved in future IT careers.

c. Careers advice is very important, especially what is said at school, and adequate career guidance is required. During my fieldwork activities, some of the students mentioned that career advice was practically non-existent at school. Schools need to review their budgets and get fully informed careers advisors (e.g. Connexions) who are able to assist the students with all careers, especially in light of the new NC core curriculum subjects which allow students access to a variety of careers.

d. Parents need to be made more aware of the opportunities available in IT as a career option for their children (both boys and girls). Schools need to brief parents on the current Computing NC by inviting them to talks and to discuss aspects of their children’s learning and career options for their future. This is important as the parental influences of careers may affect the students’ interest positively or negatively in IT careers.

e. IT as a career needs rebranding: in order to change deep-rooted perceptions, the industry has to be depicted differently. It has to be made more accessible to young people. For example media representations through posters, TV adverts or even TV programs need to send the message that 'cool', popular and socially connected people do work in IT.

f. Gender bias in IT is a problem that exists because not enough people actively dispel this 'image', something that preferably should be done in school during careers advice sessions. Unless this happens, it will be hard to break out of this vicious cycle, and consequently this will hinder a number of girls from even considering IT careers.

g. Schools need to actively find suitable work placements and apprenticeships for the students, especially the girls when they are still in the early phases of choosing future careers options. This way, students get first-hand experience of what IT careers are all about and will be more able to decide if such a career is worthy of consideration amongst other career options.

h. More needs to be done in schools to encourage students to consider careers on their merits rather than in the context of outmoded gender stereotypes, especially in co-ed environments where these views would seem to be more prevalent.

7.4.3 IT as a tool

Technology involves experimenting and having hands-on experience, something boys enjoy but girls may not to the same extent. According to de Lange (2013), girls are not encouraged to experiment with technology when they are young, which in turn decreases their chances of retaining an interest in IT as they grow up. Ultimately, this filters through to the reduced numbers of girls in technology careers. De Palma (2001) suggests that boys and young men are drawn to technology careers because they like to tinker: they enjoy taking things apart and putting them back together and they like kits, gadgets and screwdrivers. In a culture where technology is ‘cool’ for the boys but ‘weird’ for the girls, and computers are widely labelled as ‘boys’ toys’, it is vital to make technology engaging and available at early stages in school. Unless girls are taught at an early stage to appreciate technology in itself, it will be much harder for them to self-select a career that is seen as something ‘alien’ and for ‘weird kids’ (de Lange 2013).

Most of the findings from previous research with regard to girls’ and boys’ engagement with and uses of technology are now debatable in the light of the present day widespread and intense use of technology. When considering girls’ more limited involvement with computers, it has to be understood that this could have more to do with disenchantment than with anxiety or intellectual deficiency, especially as the findings in my study indicate that girls are actually confident and comfortable technology users, especially in the areas of technology they enjoy most, such as social networking and mobile-phone and gadget technology.

Due to the advanced and increasing use of technology by both teenage boys and girls, computers can no longer be seen just as ‘toys for boys’ as suggested by previous researchers of technology and gender. My study has confirmed that girls are indeed spending increasing amounts of time on computers when using the various social networking sites and technology for leisure. This point was further substantiated by Goldfein (2011), who confirmed that women (girls) and men (boys) are on Facebook in about the same numbers, but female (girl) users of Facebook have on average 20% more friends, spend a third more time on Facebook, play the most games and create the majority of content, including posts, photos, likes, dislikes, comments, and message, and that girls are responsible for most of the ‘poking’ done online.

Unfortunately, in spite of this new wave of girls and their engagement with and uses of technology, IT is still portrayed via male stereotypical images: computer use has been and still is associated with male geeks and techno-wizards - identity stereotypes that are unattractive to girls (Turkle 1988, Morritt 1997). Since girls and women are surrounded by consumerism, advertising, and popular culture, which advocate that they should be attractive to boys and males (Bartky 1990), very few girls and women desire to achieve ‘geek’ status (Turkle 1984, Woodfield 2000, Chandler-Olcott & Mahar 2003).

The advancement of technology and its social connectedness in everyday life was apparent from the views given by both the girls and boys who participated in my study. They were exposed to, had access to and used a wide variety of these newly available technologies and gadgets.

7.5 Concluding remarks on 14-year olds' perception of IT

The issue of women in IT and encouraging more girls to consider such careers for the future is a global problem in contemporary society. There does not seem to be a clear way to resolve it. Government initiatives such as '21st Century Women', a project aiming to attract more women into IT; Women's Online Business Centre (www.onlinewbc.org); CC4G – a computer club specifically for girls; Girls into Digital World and so on, do not seem to have made a difference, although the situation would have probably been worse without such initiatives. An evaluation of CC4G shows that initiatives that are relevant and full of activities of interest to girls in the way they engage with and use technology (such as social networking, music, fashion, online chat, and shopping) are likely to attract female participants. However, unless the content and processes go well beyond this orientation, the strategy is unlikely to transform female decision-making and patterns of participation in IT-related courses and careers and that many of the aspects of the IT curriculum that deter girls from pursuing further IT or computing courses and careers also deter boys (Fuller et al. 2013). A further factor thought to influence girls and IT is their social attitudes, therefore depending on the extent to which these attitudes are formed and fixed, it may be that intervention programmes such as CC4G have no effect.

There is need for more research on (gendered) learner identities, computing/digital technology and school-to-work transitions. Ongoing research in this area provides guidelines and suggestions and points to, amongst other things, teenagers' subject choices and their gendered perceptions of IT and IT work as being factors influencing low participation rates in IT careers for women. Further research to catch up with some of the students who participated in my study is required to see if any of my interventions had a long-lasting impact on them and their future career choice. Other interesting research areas for the future could include (1) professional women in diaspora and their perceptions of IT as a career option or (2) the complex relationship between ethnicity, diasporas (economic migrants) and single-sex education.

We might also need to determine whether the issues regarding IT career participation is more of a generational problem rather than just related to gendered perceptions because technology is woven into everything we do in our lives today. As such, adults as well as children – both boys and girls – have become heavy consumers of technology. Unfortunately, despite significant changes in IT usage gender gaps, it is still disconcerting that girls and women alike still need to be encouraged to consider IT careers. Gender gaps in terms of IT usage are closing but perceptions of IT as a subject and possible career are not. The low proportions of girls and women studying IT have not increased, suggesting that we still lack a solution to important elements of the learning and work-related gender gap.

This thesis has highlighted the fact that in order to get teenagers (especially girls) involved in IT careers for the future, more participatory research is required on students' perceptions of IT as a subject, and as a career, because this type of research will bring to the forefront the problems surrounding IT, as well as get more girls (and boys) actively involved in finding, discussing and providing reasons as to why they do not engage with IT careers and advanced study, especially in light of the new computing curriculum which commenced in September 2014. As my research study has shown, conducting research with young people and using that same platform to talk and advise them regarding IT careers impacts on the students, as it may encourage and support them to think more positively about IT careers.

Throughout my study, an important point that emerged was that there is no substantial difference in ICT knowledge, use and aptitudes between the boys and the girls in school. However, if more people, especially girls, are to be involved in IT careers for the future, then more needs to be done to encourage and advertise opportunities for IT careers through appropriate and informative careers advice sessions (such as Connexions) in schools so that young girls (and boys) can see IT as an option and be able to make the decision while considering alternative career options too. This means more extensive information and involvement must be provided from both the industry and the schools, which should involve more than just asking girls to attend CC4G. Similar facilities should be available outside of school in the form of camps or alternative clubs. More positive role models and mentors from the IT industry will be required; the discussion with the students during the research, as mentioned in Chapter Five, introduced a number of female role models and contributors to promoting women and IT. This is important for the teenagers, especially girls, as it may encourage interest in possible IT careers. As stated in the report by Pearl et al. (2002), while students and young adults can benefit and successfully learn from mentors of either gender, women and girls need to be exposed to female role models as this will help to dispel the negative stereotypes of IT workers.

Finally, to increase teenagers' interest in IT careers, more needs to be done in the form of positive publicity and media coverage of IT careers, scholarships to encourage more girls to train specifically for IT-related careers, internships, apprenticeships, and work placements, alongside more involvement from the schools and the IT industry at large. The students need better careers advice regarding the opportunities IT careers offer and they need to be provided with and be able to identify with inspirational role models and mentors. They need to be made aware that IT careers can be interesting, exciting, financially rewarding and essential for the enhancement of our society and growth of our economy. There needs to be better communication channels to talk about IT careers; teachers and career advisors need to explain clearly to the students what opportunities IT careers are able to offer and also encourage them to actively consider IT careers alongside other career options they may be interested in for the future.

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Appendices

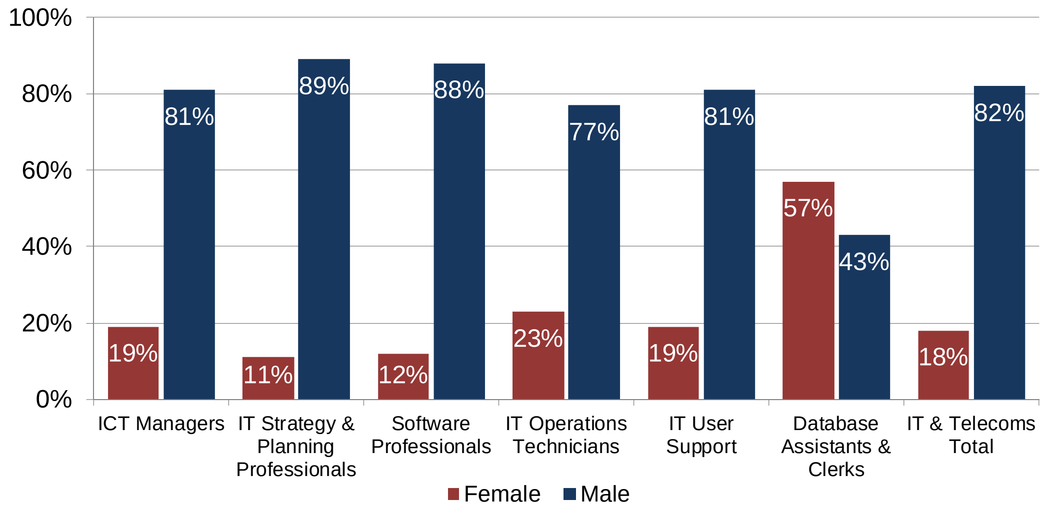
Appendix A - General research materials and documentation in Chapters One, Two and Three

Appendix B – Further research documentation from Chapter Four

Appendix A

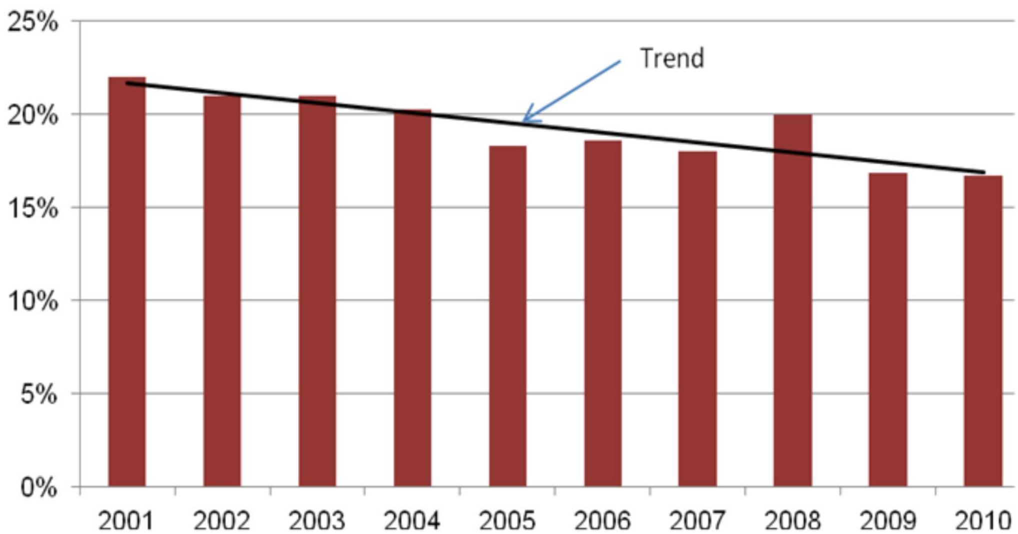
General Research materials and documentation in Chapter One:

Fig 1.0(1): IT occupations by gender



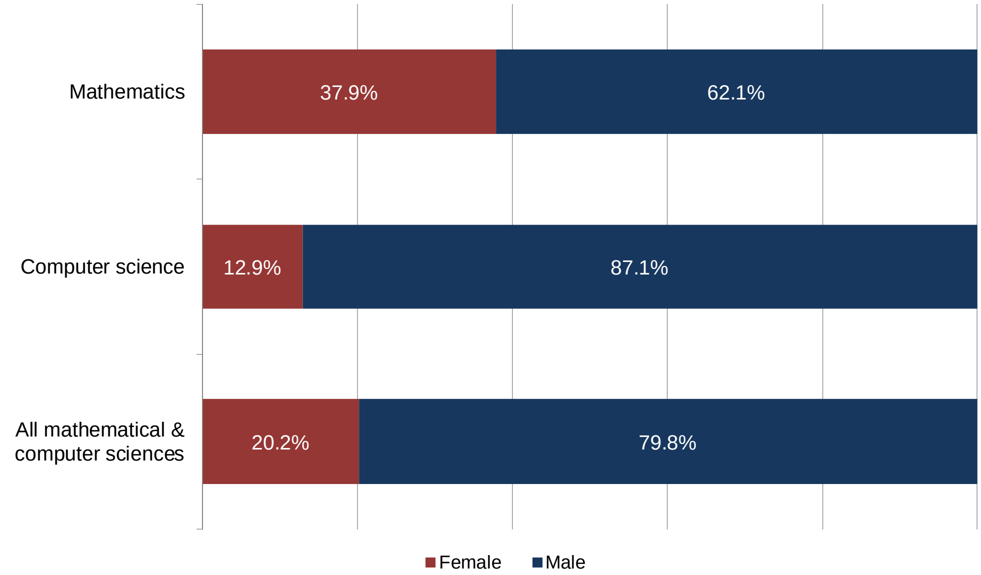
Source: e-skills analysis of data from ONS Labour Force Survey 2001 to 2010 (Q.4)

Fig 1.0(2): Women as a percentage of all IT occupations



Source: e-skills analysis of data from ONS Labour Force Survey 2001 to 2010 (Q.4)

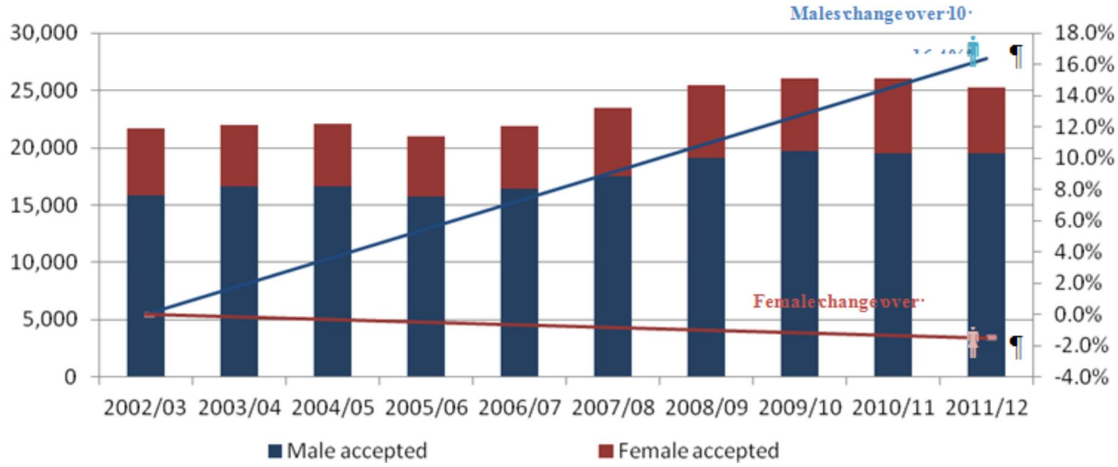
Fig 1.0(3): Percentage of women applicants in mathematical and Computer Science subjects (2001/02-2010/11)



Source: e-skills analysis of data from ONS Labour Force Survey 2001 to 2010 (Q.4)

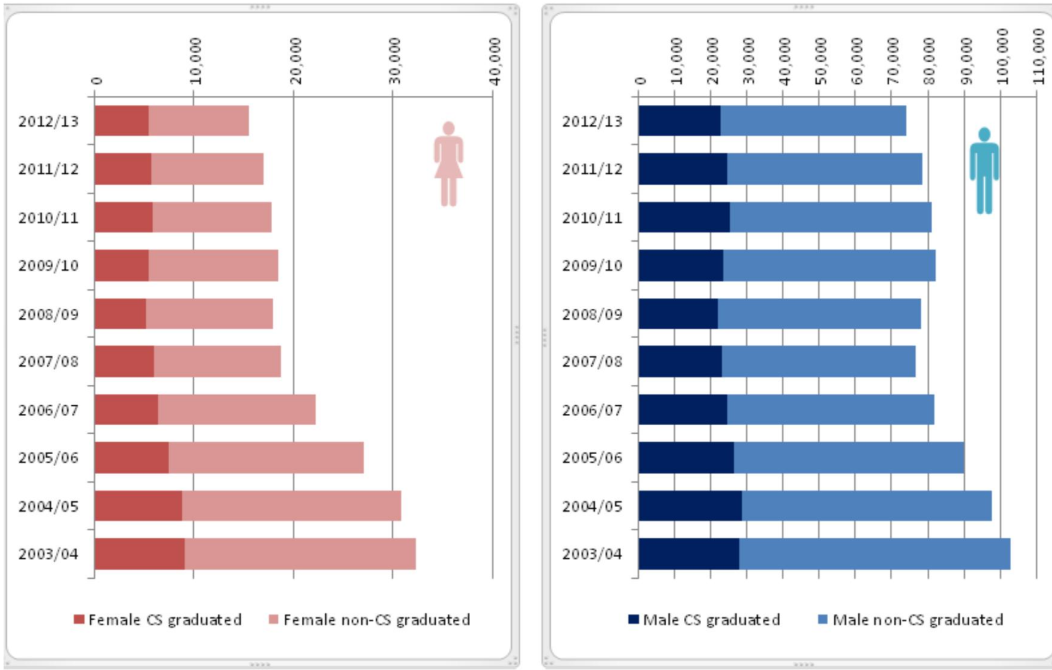
Note: Only one in five (20%) applicants to mathematical and Computer Science subjects is female. The lowest percentage of female applications is for Computer Science (13%). Mathematics is better represented, but women still account for only a third (38%) of applicants.

Fig 1.0(4): Number of women applicants accepted into mathematical and Computer Science subjects (2002/03-2011/12)



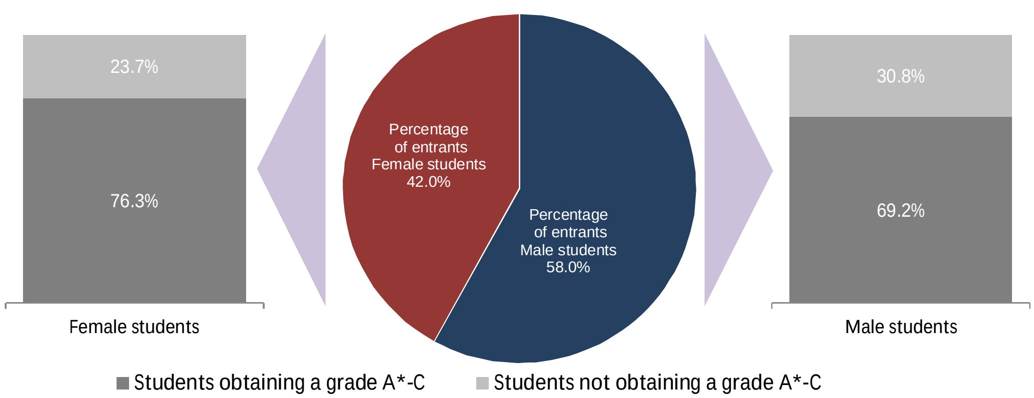
Source: Joint Council for Qualification (JCQ)

Fig 1.0(5): Students studying and graduates of those who studied Computer Science by gender (2003/04-2012/13)



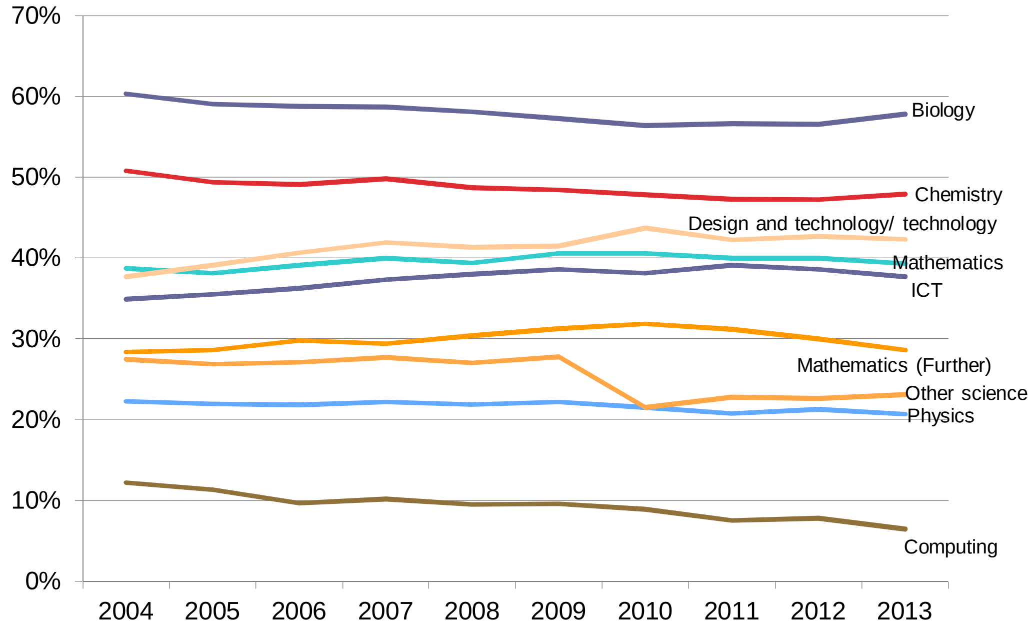
Source: Higher Education Statistics Agency (HESA)

Fig 1.0(6): All UK candidates GCSE ICT course entries (2004-2013) and GCSE ICT A*-C passes (2013) by gender



Source: Joint Council for Qualification (JCQ)

Fig 1.0(7): Percentage of all UK female (candidates) entrants for STEM GCSE A-level courses (2004 – 2013)



Source: Joint Council for Qualification (JCQ)

Fig 1.2(1): Key Stage 3 – Compulsory National Curriculum Subjects

Compulsory national curriculum subjects are:

- English
- maths
- science
- history
- geography
- modern foreign languages
- design and technology
- art and design
- music
- physical education
- citizenship
- information and communication technology (ICT)

Schools can develop their own ICT curricula or follow the programmes of study.

They must also provide religious education (RE) and sex education from key stage 3 but parents can ask for their children to be taken out of the whole lesson or part of it.

Source: GOV.UK - https://www.gov.uk/national-curriculum/key-stage-3-and-4

Fig 1.2(2): Key Stage 4 – National Curriculum Core and Foundation Subjects

During key stage 4 most pupils work towards national qualifications - usually GCSEs.

The compulsory national curriculum subjects are the 'core' and 'foundation' subjects.

Core subjects are:

- English
- maths
- science

Foundation subjects are:

- information and communication technology (ICT)
- physical education
- citizenship

Schools must also offer at least 1 subject from each of these areas:

- arts
- design and technology
- humanities
- modern foreign languages

They must also provide religious education (RE) and sex education at key stage 4. Pupils don't have to take exams in religious studies but schools must provide at least 1 course where pupils can get a recognised RE qualification at key stage 4 and above.

English Baccalaureate (EBacc)

In performance tables, the EBacc shows how many students got a GCSE grade C or above in English, maths, 2 sciences, a language, and history or geography.

Source: GOV.UK - https://www.gov.uk/national-curriculum/key-stage-3-and-4

<u>Paragraph 1.2a: The Scottish Education System</u>

Scotland has its own qualification framework that is separate from the one set for England, Wales and Northern Ireland. Scotland follows the Curriculum for Excellence (also known as the CfE) for nursery, primary and secondary schools.

In Scotland, children complete seven years of primary school, starting in P1 (the equivalent of Reception classes in England), up to P7 (the equivalent of Year 6 in England). After this, they do six years of secondary school from S1 to S6 (equivalent to Y7 to Y12 in England). Secondary schools in Scotland are also known as high schools or academies.

The CfE consists of three core subjects that schools must ensure are taught: health and wellbeing, literacy and numeracy. Other than that, they are free to introduce projects that use skills and knowledge from more than one subject, leading to joined-up learning; teach about people and places from their local area or ask pupils about areas they are interested in studying.

Between 2013 and 2016, three new qualifications are being introduced: Nationals, Highers and Advanced Highers. Most children will be around 15 when they take Nationals. They can opt to stay in secondary school for two more years to take exams for Higher qualifications – which they will need to apply for university – and Advanced Highers – equivalent to the first year of university and used for applying to enter the second year of university.

The new qualifications are being phased in between 2013 and 2015 - National 1, National 2, National 3, National 4 and National 5: August 2013; Higher: August 2014 and Advanced Higher: August 2015.

Scotland does not assess primary and secondary students in Key Stages (and there are no SATs). Assessments include a standardised exam given for each subject a child will study, set out by the 5-14 curriculum (within the CfE). It is up to the teacher to decide when the student will sit the exam, and assessments are not decided solely on exam results. The exams are used for teachers to confirm their own judgment of how a student is performing

There are five defined levels within the Scottish educational system. Each is reached based on the teacher's assessment of a student's abilities and readiness to progress, but general year guidelines are as follows:

Early (pre-school years and P1);
First (to the end of P4);
Second (to the end of P7);
Third and Fourth (S1 to S3);
Senior phase (S4 to S6, college, etc.).

Source: http://www.theschoolrun.com/overview-scottish-education-system

General Research materials and documentation in Chapter Two:

Paragraph 2.1a: Secondary School Education in England

State Maintained Schools

Within the state sector, most children transfer to secondary school at the age of 11 years. By the end of Year 6, the last year of compulsory primary education, parents/guardians are expected to have expressed a preference for a secondary school, and a place is offered to the pupil based on such preferences unless the school has more applicants than places, in which case, pupils are admitted into a particular school in accordance with a published admission agreements/policy, which tends to vary for the different local authorities and the different schools. The schools - whether grammar, comprehensive, voluntary-aided, free or academies - can be mixed (co-educational) or single-sex (boys or girls only).

a. Comprehensive schools take pupils of all backgrounds and abilities; they are not selective but can be part of a system in which selection occurs via a catchment area[100]. Comprehensives offer a full range of academic and vocational subjects. The local authority employs the schools' staff, owns the schools' lands and buildings, and has primary responsibility for admissions.

b. Grammar schools are selective and offer academically oriented general education. Grammar schools are run by the LEA or council, a foundation body or a trust[101]. Entrance is based on a test of ability, usually called the 11+ exam; only pupils who pass this entrance test are offered an opportunity to apply for these schools. The majority of grammar schools are single-sex, i.e., the pupils, based on their gender, go to either a boys' or a girls' grammar school. These grammar schools tend to attract and select the top 25% of the academically strongest students within the state sector.

c. Voluntary-aided schools are schools within the state sector that are mainly controlled by organisations; these can be faith schools, such as Church of England, Roman Catholic, or London Livery Companies[102]. The charitable foundation contributes toward the capital costs of the school and appoints the majority of the school governors; the governing body employs the staff and has responsibility for admissions.

d. Academies are a newer type of state maintained schools introduced into the English educational system by the government in 2000 to revive 'flagging and failing' schools. Some of these new academies are also known as Free schools[103].

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[100] Types of School. Citizens Advice Bureau. Advice Guide. http://www.adviceguide.org.uk/n6w/index/family_parent/education/types_of_school.htm

[101] Types of Schools in England: What different types of schools do you have in England? http://resorces.woodlands-junior.kent.sch.uk/customs/questions/education/schools.html

[102] Voluntary Aided Schools. Teachernet. Department for Children Schools and Families. Retrieved 10 February 2013.

[103] A Free School, introduced by the Conservative-Lib Dem coalition government in 2010, is a type of Academy, it is state funded, attendance is free, and it is not controlled by any LEA.

> While some of these schools are newly created, others are former comprehensives that have decided to close-down and re-open as academies[104]. These schools have been established with substantial capital investment from businesses or voluntary religious or private foundations; they are monitored directly by the DfE rather than the LEA, and the state also pays the running costs. Unlike the other LEA schools, they are not expected to follow the compulsory NC as they have a right to operate their own curriculum, and they also have the freedom to re-invent the school day and can pay their teachers more or less than LEA controlled schools.

All state-funded schools are regularly inspected by the Office for Standards in Education[105] (Ofsted). Ofsted publishes reports on the quality of education at a particular school on a regular basis, and schools judged by Ofsted to be providing an inadequate standard of education may be subject to special measures, which could include replacing the governing body and senior staff.

Independent Schools

Independent schools in England are generally called private schools with the exception of a number of older private schools, which are known as 'public' schools[106]. The public schools are those private schools that are members of the Headmasters' and Headmistresses' Conference (HMC); generally, they are the older, more expensive and more exclusive private schools[107]. Independent schools charge fees for pupils to attend and, as such, are not funded by the LEA or government. These schools do not have to follow a set curriculum; they set their own admission policies and criteria, and they select whomever they want whenever they want. They offer a range and variety of subjects depending on their students' needs, and although they are self-controlling and self-funding, they do have to follow a set of guidelines for the standards of education, which is set by the organisations that inspect them. Some of the independent schools are inspected by Ofsted, the Independent Schools Inspectorate, the Bridge Schools Inspectorate, or the School Inspection Service[108].

Traditionally, many private schools (especially the secondary provision) have been single-sex, but a growing number are now co-educational (mixed – boys and girls). Entrance to most of the independent schools is normally by a Common Entrance exam taken at the age of 11 years for the girls and some boys, but for the traditional public schools, 13 years is the age for boys as most of the preparatory schools for boys cater for their education from the ages of 7 to 13 years[109].

---

[104] What are Academies? Standards Site. Department for Children, Schools and Families. Retrieved 10 February 2013.

[105] Ofsted: Raising standards improving lives. Who we are and what we do. http://www.ofsted.gov.uk/about-us

[106] Education and Training Statistics for the United Kingdom: 2008. Department for Children, Schools and Families. Enrolment at independent schools.

[107] Vivian Ogilvie (1957). The English Public School. Batsford. p.1. Retrieved 10 February 2013.

[108] Types of School. https://www.gov.uk/types-of-school/private-schools.

[109] UK Private School: Entrance Examinations. http://www.ukprivateschools.com/entrance-exam.htm.

General Facts and Figures about Independent Schools in England

According to government statistics and the various independent school councils (2009):

a. 8% of children in England are educated at independent schools, that is, over 511,000 children nationwide are in independent schools.

b. The average annual fee for a child to attend an independent school is about £10,000, and it costs an average of £18,828 per year for a boarding independent school.

c. More than half of the students in independent schools come out with A* or A GCSEs in the traditional subjects such as biology, chemistry, physics, history, geography and maths.

d. About 38% of students getting three As or better at A-level are from independent schools (the core sciences and maths being the favourites at this level).

Source: BBC – Student Life online forum – Debate of the Week. State schools Vs Private Schools – Which is better? http://www.bbc.co.uk/schools/studentlife/debate/2008/42_state_vs_private_school.shtml

State Vs Independent Education

There are different views on the divide between state and independent education in areas such as performance, achievements, and opportunities. In the independent sector, the class sizes are generally smaller than in a state school. Smaller class sizes mean more individual attention and more student-focused learning, which in turn, can boost the qualifications students receive as well as their happiness in school. According to a study conducted by the London School of Economics (LSE) in 2008, the independent sector educates just over 7% of all pupils in England (8% according to government survey in 2009) but employs 14% of teachers; the apparent mismatch is because of the much smaller class sizes. The class size difference – as measured by pupil-teacher ratio - is 18:1 in the state sector compared with 9:1 in independent schools. The study goes on to confirm that schools in the independent sector, due to their financial advantage (payment of school fees), can recruit better-qualified and more experienced teachers, especially in the area of SET and maths, and that this shows in the achievements and performance of the students in these subjects (Green, Machin, Murphy and Zhu 2008).

According to the Good Schools Guide (2012), moving from the state school sector to private education at 11 is becoming increasingly widespread, and many day schools for boys as well as girls now have their largest intake at this age. Many of the independent schools, mindful of A-level league tables are increasingly keen to attract the brightest and the best students. Many parents have been swayed by the more successful (according to school league tables) exam results at GCSE and A-levels and by the fact that 91% of pupils from independent schools go on to study at university. Not only are results higher, with 18% of independent schools' A-level entries receiving A* in 2012 compared to the national average of 7.9%, but also, students are more likely to study the traditional subjects favoured by the Russell Group universities. Core subjects, such as maths and further maths, sciences, history and languages, are all viewed favourably by the country's top performing universities, and these subjects are studied by more pupils at independent schools than elsewhere. In 2012, GCSE results were equally strong – 31% of entries from private schools achieved an A* compared to a national average of 7.3% (Pozniak 2012).

General Research materials and documentation in chapter 3:

Questionnaire

Letter of Intent to conduct research

Research Brief

Profile of Schools use for Research

Creativity Session Format

Creativity Map output from the various schools/sessions

Consent form

Sample of SPSS code book

<u>**Fig 3.2.3: Questionnaire**</u>

Questionnaire: 14 Year Olds Subject Choices, Perceptions of IT/ICT as a subject and IT/ICT as a possible career:

My name is Elizabeth Ibegbulam, I am a doctoral student at the University of Sussex exploring what factors affect 14 year olds in their subject choices, and in particular, how they perceive IT as a subject choice and as a career.

Please note, personal data obtained from this questionnaire will be made anonymous and treated with confidentiality. The data will be used only for the purpose of this research.

Name: ____ Date: _______________

School: ____

Email Address (Optional): ____

Gender (Sex): ☐ Female ☐ Male

1. <u>Background - Ethnic Origin: (please tick only one):</u>

☐ White British	☐ Black African	☐ Asian Bangladeshi
☐ White European	☐ Black British	☐ Asian Chinese
☐ White Irish	☐ Black Caribbean	☐ Asian Indian
☐ White Other	☐ Black Other	☐ Asian Pakistani

☐ Other (Please State): ____

2. <u>Parent's Occupation</u>:

Does your Mother work? ☐ Yes ☐ No ☐ Don't Know

What is her occupation? ____

Does your Father work? ☐ Yes ☐ No ☐ Don't Know

What is his occupation? ____

3. Proposed subject choices for GCSE (please tick your subject choices):

i. Which subjects are **compulsory**? (Please tick all the compulsory subjects; please list other subjects if not displayed.)

	Subjects		**Subjects**		**Subjects**
	English Language		History		Islamic Studies
	English Literature		Geography		Arabic
	Mathematics		Spanish		Drama
	Single Science		Latin		Dance
	Double Science		French		
	Chemistry		German		
	Physics		Music		
	Biology		Citizenship		
	Design & Technology		PE		
	IT/ICT		Business Studies		
	Art & Design		RE		

ii. Are you allowed to make a choice of subjects you wish to study for GCSE?

☐ Yes ☐ No ☐ Not Sure

If no, please go to question 4, if yes, please answer question 3 iii below.

iii. What subject **choices** are you going to make? (Please list other subjects if not displayed).

	Subjects		**Subjects**		**Subjects**
	English Language		History		Islamic Studies
	English Literature		Geography		Arabic
	Mathematics		Spanish		Drama
	Single Science		Latin		Dance
	Double Science		French		
	Chemistry		German		
	Physics		Music		
	Biology		Citizenship		
	Design & Technology		PE		
	IT/ICT		Business Studies		
	Art & Design		RE		

4. Which job (career) would you like to do when you grow up? (4 possible choices for the future)

i. ______________________________ iii. ______________________________

ii. ______________________________ iv. ______________________________

5. Who has influenced your decision with regards to your job choices for the future? (please tick as many boxes that apply to you):

☐ Parents ☐ Family ☐ Media ☐ School/Teachers ☐ Self

☐ Peers/Friends ☐ Careers Adviser ☐ Others (who or what, please state)

____

6. Do you feel comfortable and confident using computers?

☐ Yes ☐ No ☐ Not Sure

7. Do you like ICT/IT as a subject?

☐ Yes ☐ No ☐ Not Sure

Why? (Please explain your answer):

____

____

____

8. Please respond to the following statements:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
IT/ICT is an easy subject					
IT/ICT is a fun subject					
I really enjoy IT/ICT					
IT/ICT is useful for my future job/career					
IT/ICT is important for adult life					
IT/ICT is useful for me now					
There is too much course work for IT/ICT					
We do too much IT/ICT					
I do not feel challenged in IT/ICT class					
I am really glad I am doing IT/ICT					
I have made good progress so far					

9. Would you consider working in the IT sector or working as an IT consultant in another industry as a possible career choice for the future?

☐ Yes ☐ No ☐ Not Sure

Please explain why: ____

____

____

Thank you for taking part in this project. Your answers will be very helpful to me.

Fig 3.2.4(2): Output/Interpretation of Creativity Map during the mixed session:

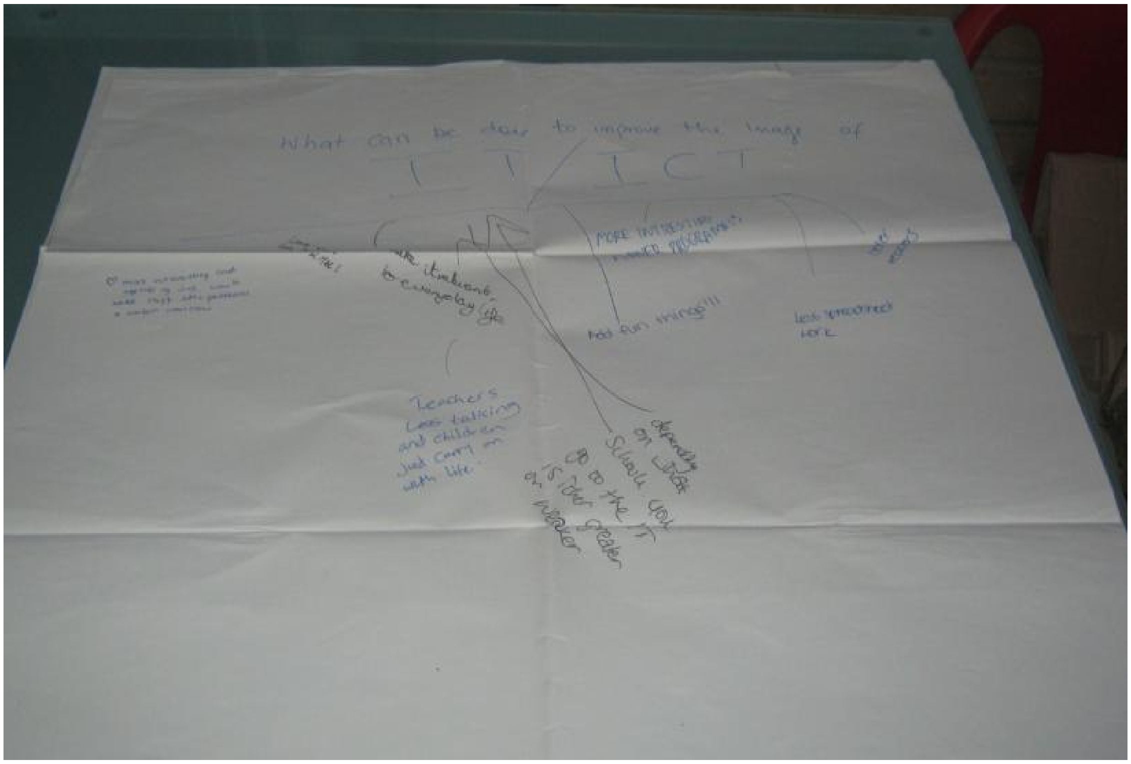

Fig 3.2.4(3): Output/Interpretation of Creativity Map during the mixed session:

Fig 3.2.4(4): Output/Interpretation of Creativity Map during Pine School session:

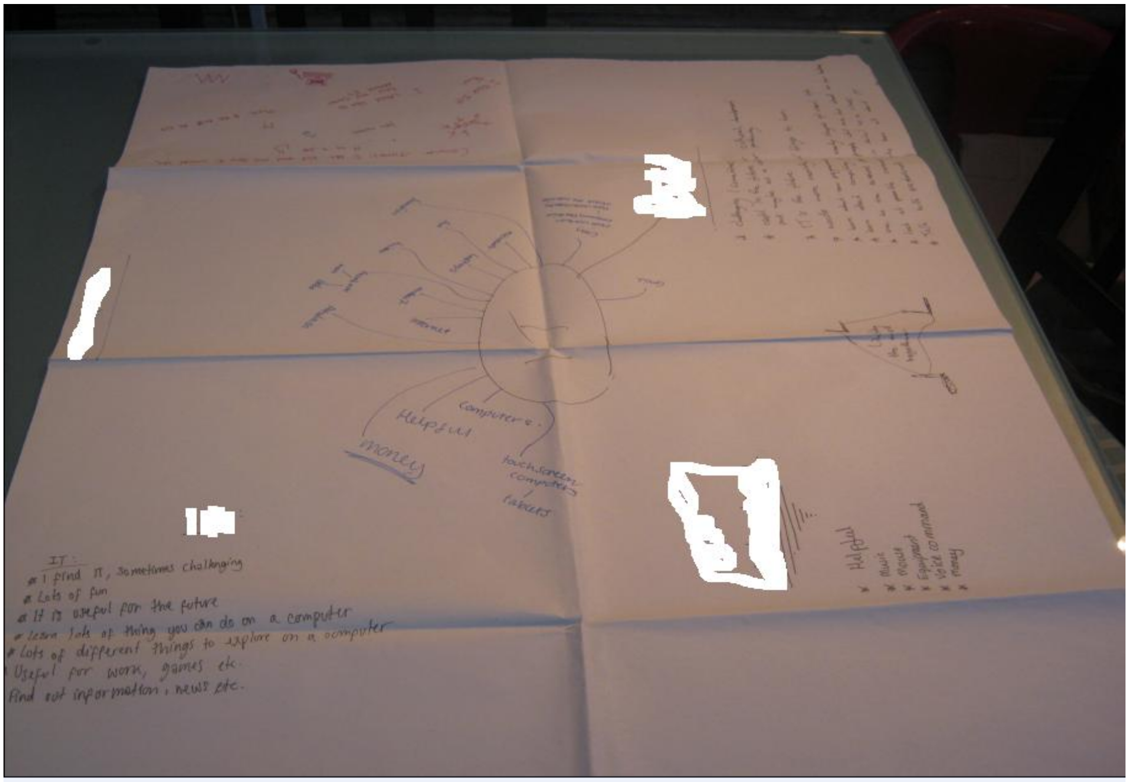

Fig 3.2.4(5): Output/Interpretation of Creativity Map during Pine School session:

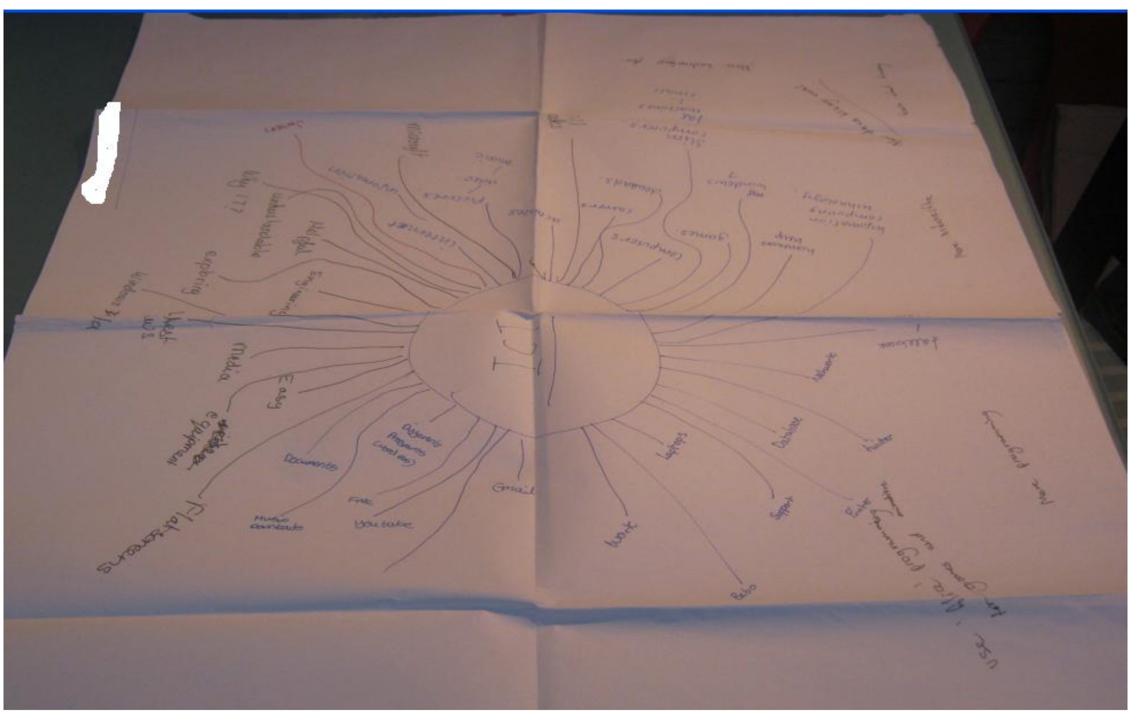

Fig 3.2.4(6): Output/Interpretation of Creativity Map during Oak School session:

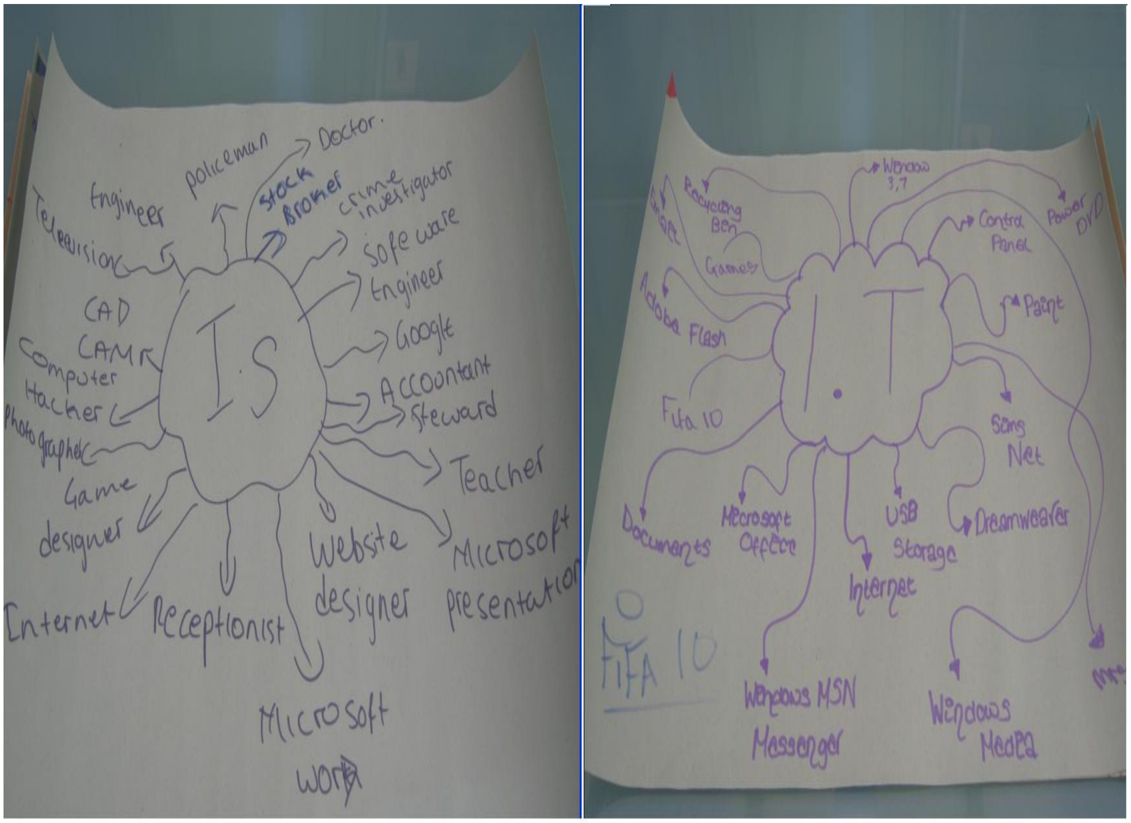

Fig 3.2.4(7): Output/Interpretation of Creativity Map during Oak School session:

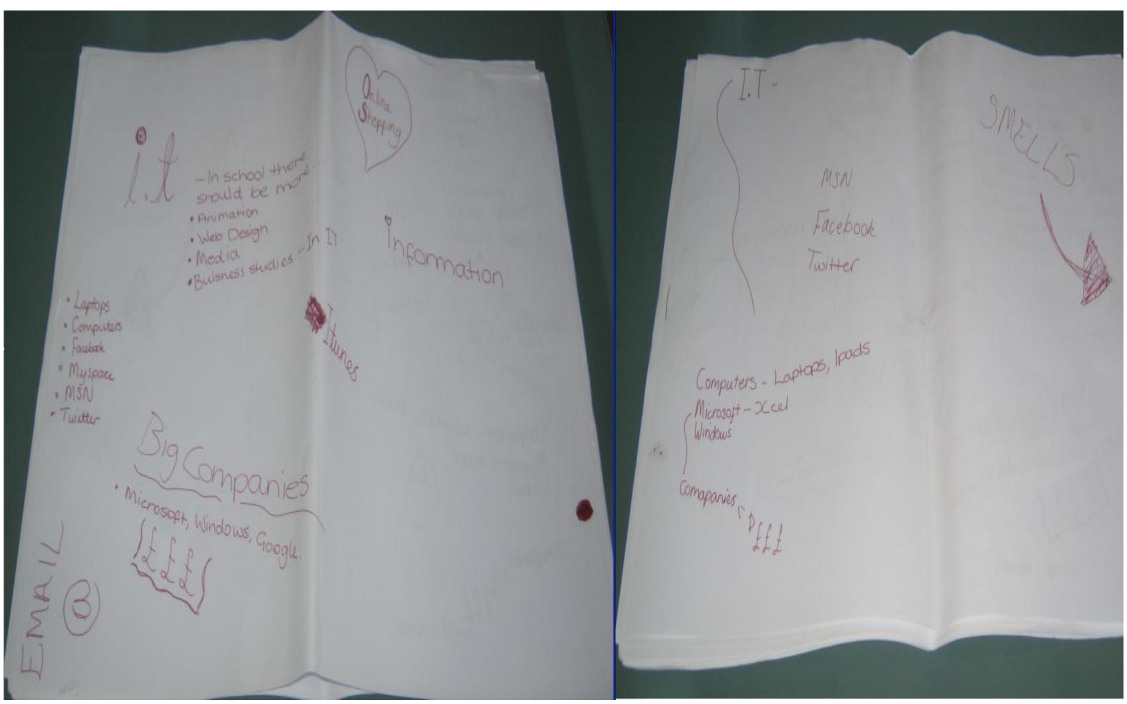

Fig 3.2.4(8): Output/Interpretation of Creativity Map during Oak School session:

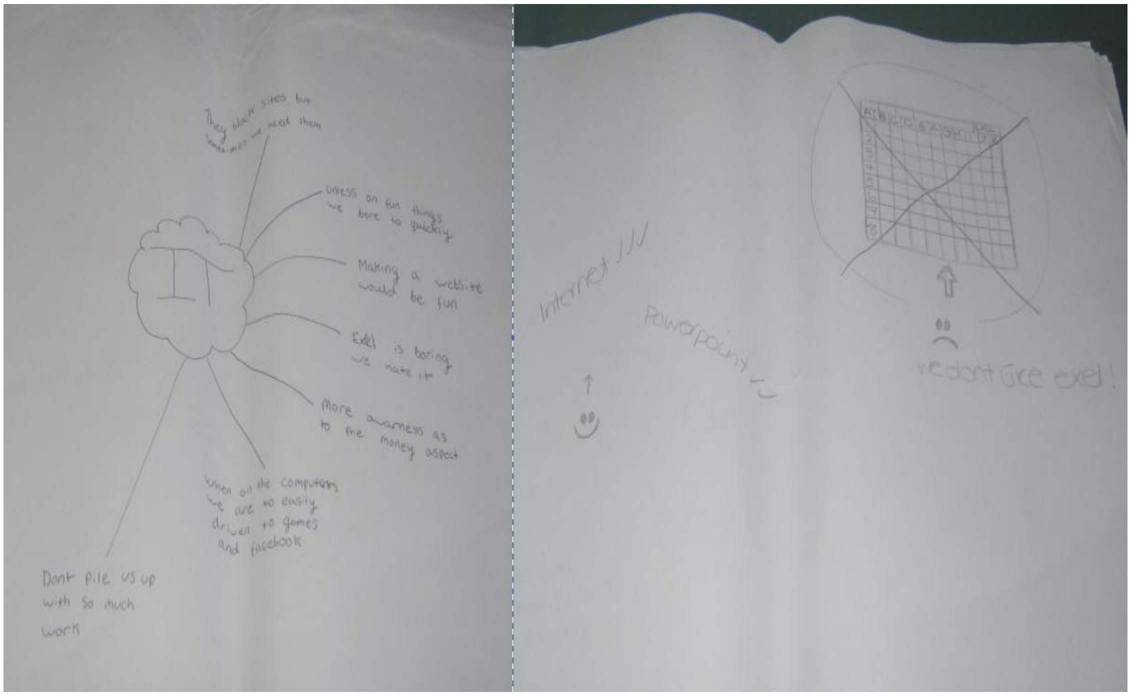

Fig 3.2.4(9): Output/Interpretation of Creativity Map during Ash School session:

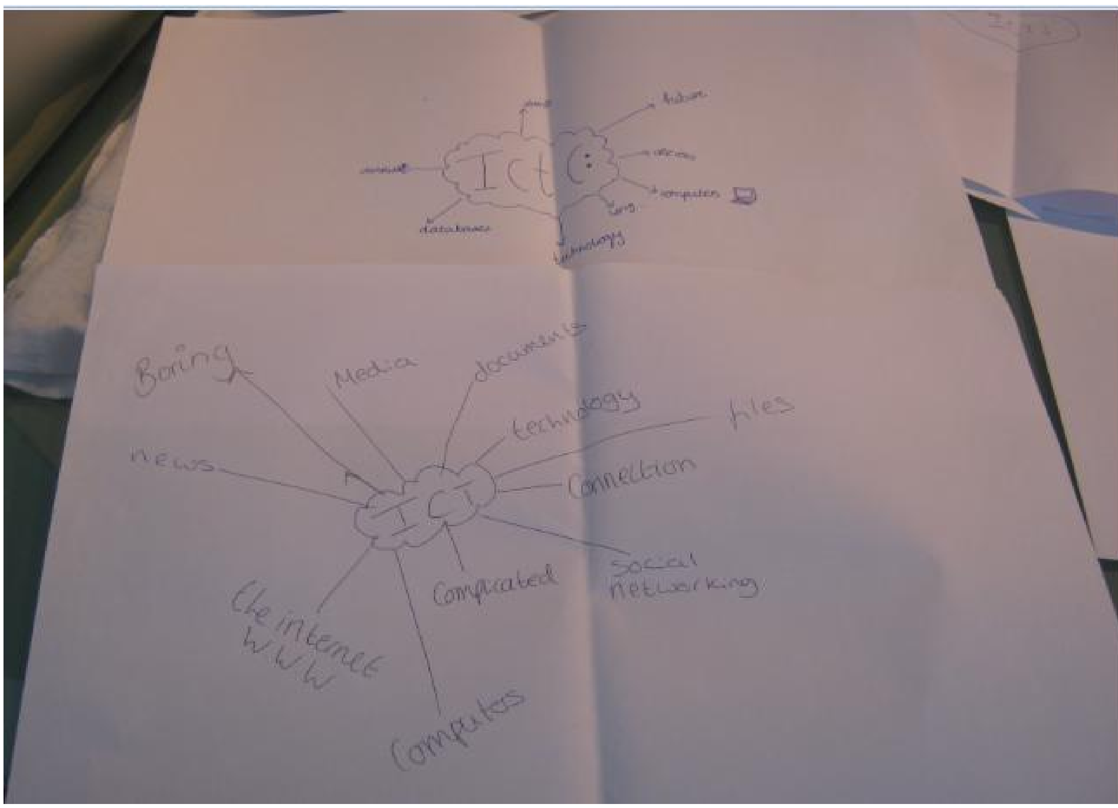

Fig 3.2.4(10): Output/Interpretation of Creativity Map during Ash School session:

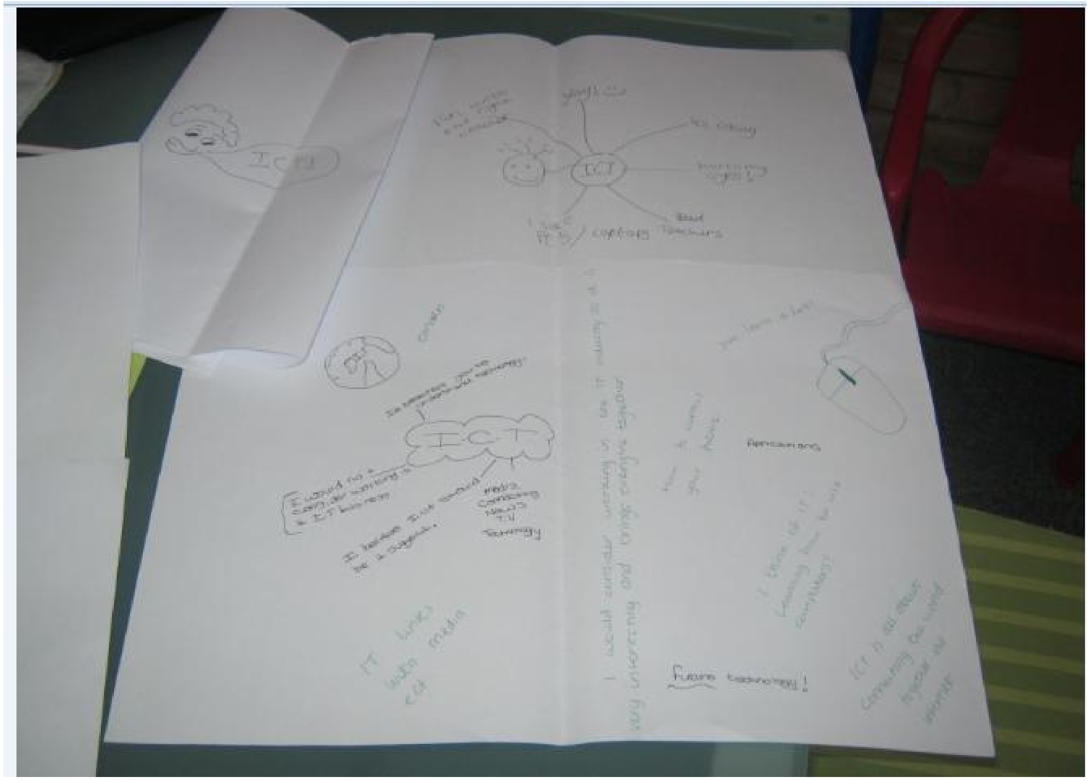

Fig 3.2.4(11): Output/Interpretation of Creativity Map during Willow School session:

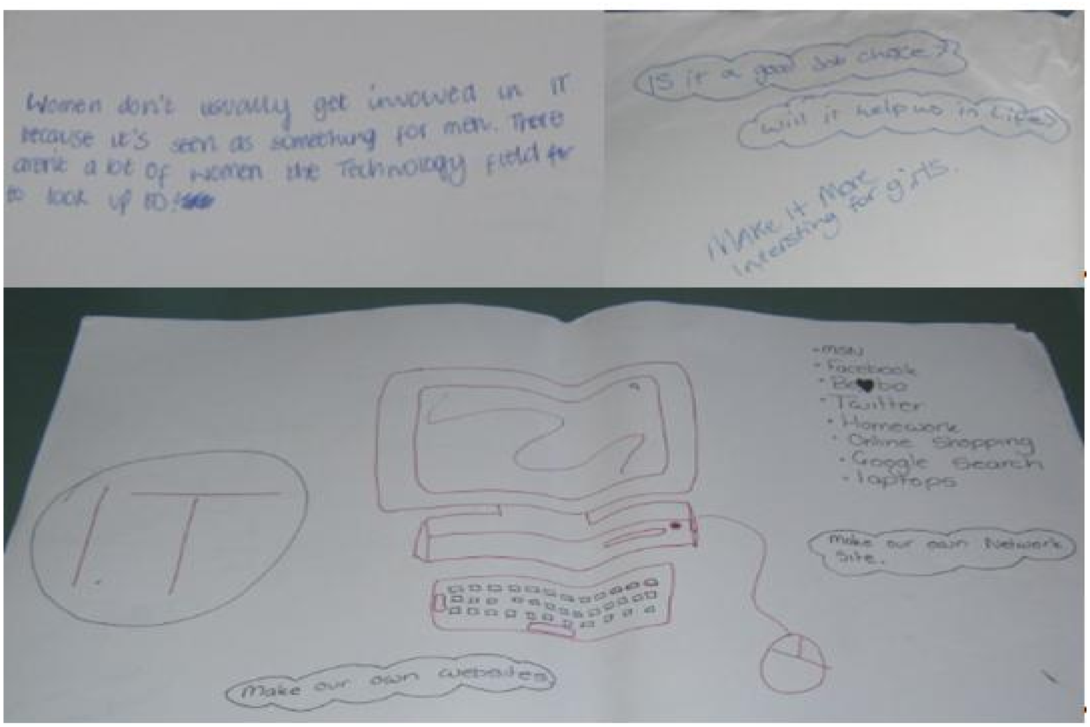

Fig 3.2.4(12): Output/Interpretation of Creativity Map during Willow School session:

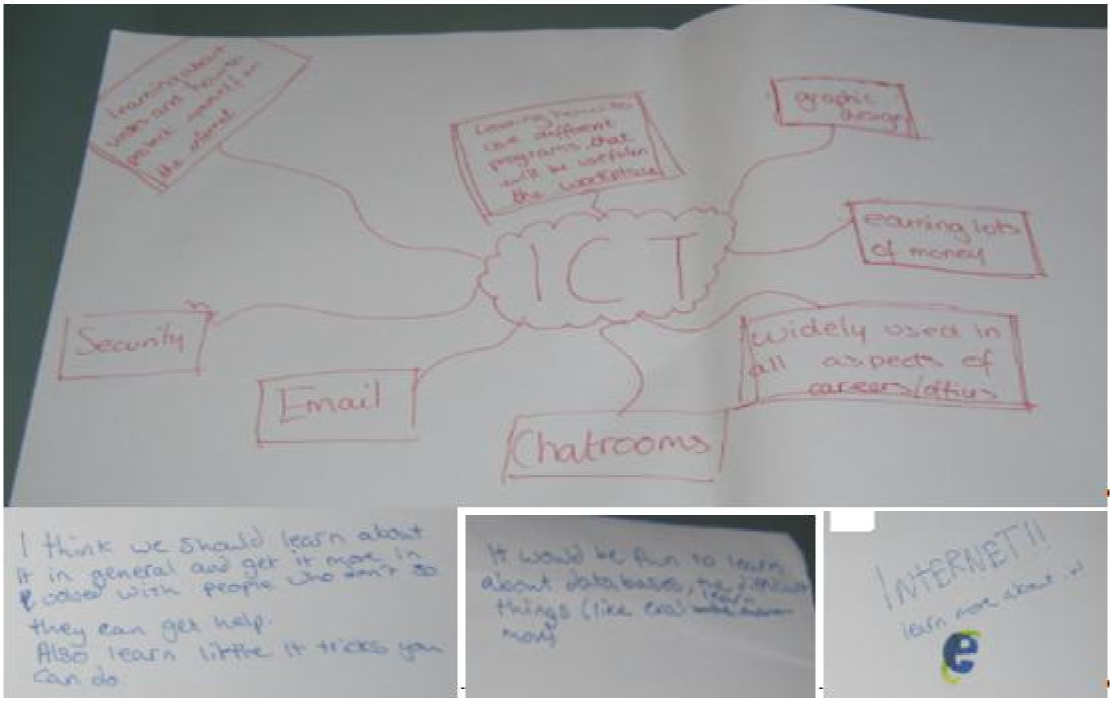

Fig 3.2.4(13): Output/Interpretation of Creativity Map during Willow School session:

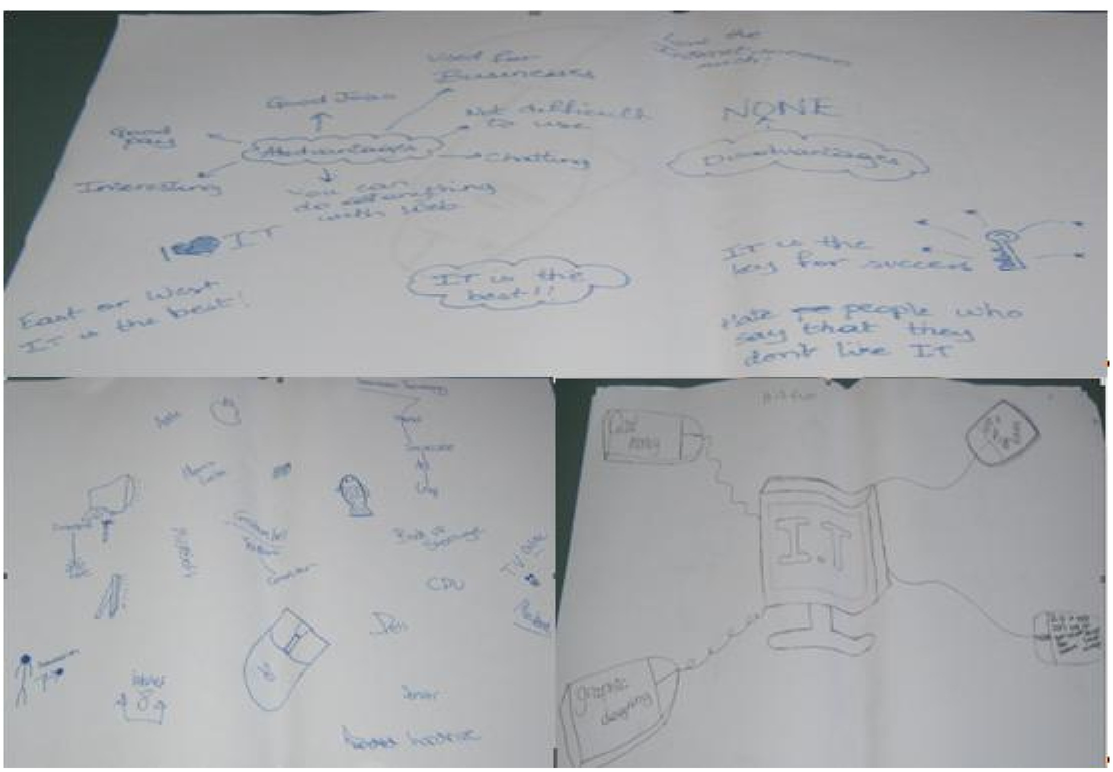

Fig 3.2.4(14): Output/Interpretation of Creativity Map during Maple School session:

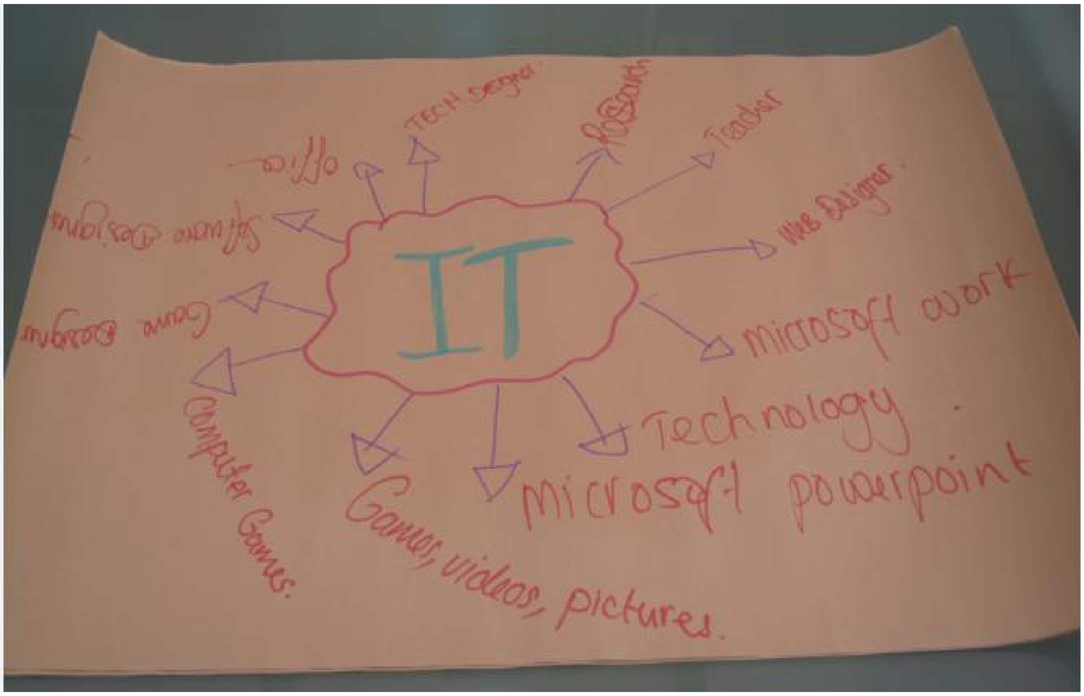

Fig 3.2.4(15): Output/Interpretation of Creativity Map during Maple School session:

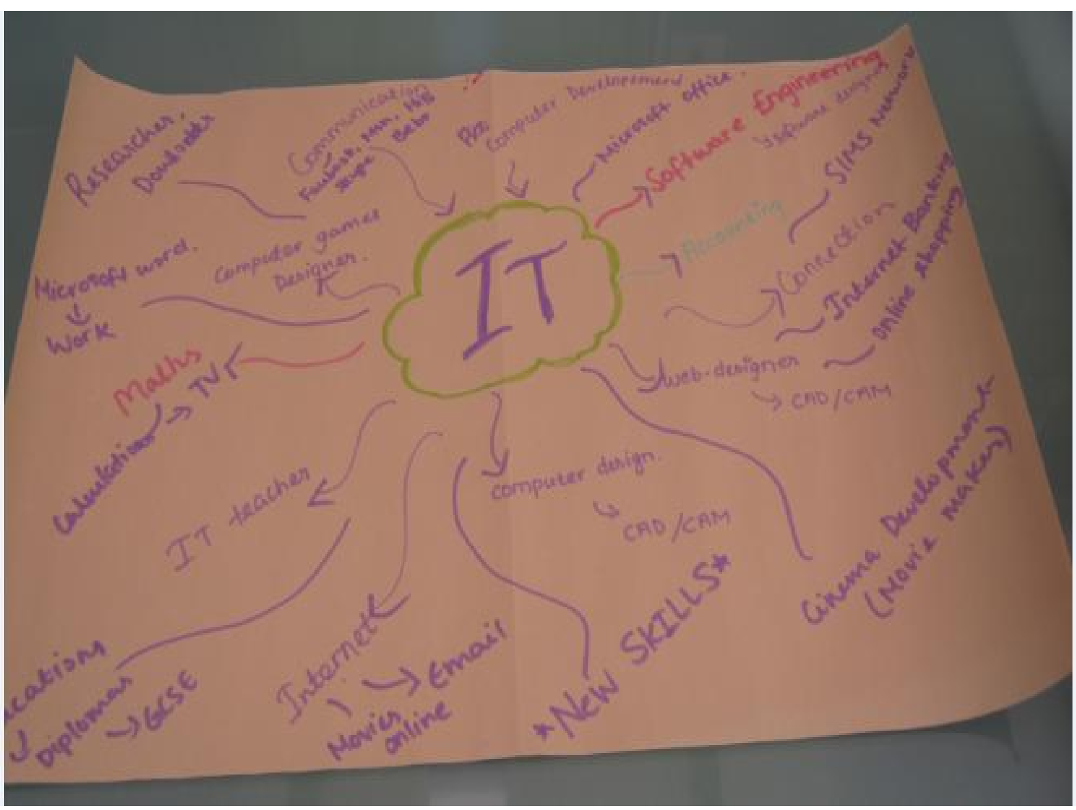

Fig: 3.2.5: Creativity Session Format.

1. Introduction to the rules for the day, get the students to sit down in groups, this is dependent on how many are at the session
2 min

2. Completing of the questionnaire
15 mins

3. With the assistance of the creativity map - Write or draw any thoughts connected to the theme Information Technology (IT) – (research participants will be looking at the drawing for ideas)
20 mins

4. Start preparing the students for the questioning session.
Questions to ask:

Do you like IT/ICT as a subject?
Would you consider IT as a possible career for the future?
Do you have any suggestions regarding the way IT is taught in school?
45mins

5. Question time, this will give the participants and opportunity to ask questions of their own if any
3 mins

6. Quick review of the session's activities, final summary for the day and closing remarks.
5 mins

End of session. (Total estimated time to take for activity is 90 mins more time may be used for larger groups)

7. Collect all documents and equipment.

Equipment:

Tape recorder and camera/video recorder
Classroom or meeting room
2 X packets of coloured felt tip pens.
2 X large sheets of paper A0 size
2 X A3 sheets of paper for presentation

Refreshments:

1 bottle of still water
1 bottle of fizzy water
1 carton of orange juice
1 carton of apple juice
1 tin of biscuit
1 tray of assorted fruits
Disposable cups and plates
Tissues
For the afternoon sessions - sandwiches.

Notes:

I will act as the facilitator for all groups.
I will invite the ICT teacher or any of the participant teachers to attend.

Aims: To stimulate creative thinking among the research participants.

Outcome: The participants to come up different ideas about IT as a subject and as a career.

The student's to present their work on the paper provided

Questions will be answered but nothing further will be discussed until the final session. During the final session, any mis-perceptions will be cleared.

Instructions for the Questionnaire and IT Map.

1. Students to fill in the questionnaire and answer all questions.
2. Students to have a look at the IT Map and write down anything that has not been written on the questionnaire, their thoughts about it and any suggestions that they fill might help me with my research to understand their perceptions of IT as a subject and as a career.
3. Any queries, please contact Elizabeth Ibegbulam 07939 236 493.

Fig 3.3(1): Letter of Intent to Conduct Research (Sample)

<<Name of Head Teacher>>
<<Name of School>>
<<1st Line of Address>><<2nd Line of Address>>
<<Location>> <<Postcode>>

Elizabeth E. Ibegbulam
Department of Sociology
University of Sussex

Contact Nos: 07939 236 493
020 8239 9565

Email: E.E.Ibegbulam@sussex.ac.uk
Date: <<dd/mm/yyyy>>

Dear <<Name of Head Teacher>>,

Letter of Intent to Conduct Research at <<Name of School>>

I am a doctoral student at the University of Sussex exploring what factors affect 14 year olds in their subject choices, and in particular, how they perceive IT as a subject choice. As part of the fieldwork activities required for my DPhil, I would like to invite <<Name of School>> to participate in the research. It will not require much time investment on behalf of the school or its members, but I hope that a final report that I will provide on my findings will contribute some very useful information for you. Nine schools in the Southeast London Borough area are being approached for inclusion.

Attached is a brief overview of the research project, and it is my intention to invite 16 Year 9 students to take part in one short group interview for 45 minutes and a brainstorming session/creativity map exercise for 45 minutes over the course of an academic year. I would also like to conduct the teacher interviews with the ICT teacher and the Head of year 9.

For the purpose of this research I would like to make contact with all the research participants during the beginning and end of the academic year in which their subject choices are considered and finalised.

I would really appreciate an opportunity to clarify any matters you feel concerned about. I will contact you in a week to do this and to talk about whether it will be possible to undertake this research in your school.

I am fully aware of the confidentiality, ethical and data protection guidelines associated with research and with interacting with children, as such, I have the necessary CRB clearance required for someone conducting research with minors, and also, have conducted all necessary ethical clearance and courses at the University of Sussex.

I look forward to speaking to you next week.

Thank you.

Elizabeth E. Ibegbulam
DPhil Student
University of Sussex.

<u>Fig 3.3(2): Research Brief (Sample attachment)</u>

<u>Project Title</u>:	A Participatory Research Approach Assessment of 14 Year Olds' Perceptions of IT/ICT as a Subject, as a future Career and IT in general
<u>Reason For Project</u>:	Field work associated with DPhil Studies.
<u>Project Start Date</u>:	1st September, 2009
<u>Project End Date</u>:	17th July, 2010
<u>Project Background</u>:	Literature review lays claim that boys and girls either attach to, or turn away from IT at very early ages due to its particular image, and their own different socialisation experiences, therefore, the shortages in IT, especially female shortages, can only be addressed if we focus on children as well as a range of institutional and societal obstacles preventing women's progression at later stages. In consideration of this, my DPhil research focuses on 14 Year Olds' Subject Choices, their Perceptions of IT and IT work.
<u>Project Objectives</u>:	To get a better understanding of how 14 year olds make their subject choices and how they perceive IT as a subject and as a possible career for the future.
<u>Methodology</u>:	A Participatory Research methodology will be used with a combination of Focus Groups, Participant Observation, Group interviews, creativity map exercises, brain storming exercises, etc. All activities will be conducted in the school, during school hours/at the appointed/agreed time not exceeding 90mins per session.
<u>Participants</u>:	7 Secondary Schools in Southeast London Borough. A mixture of single-sex/co-educational, private and state. 16 students from each school and 2 teachers. All participants will be rewarded for their time. (To be discussed with the individual schools).

The full research proposal is available if required, please email E.E.Ibegbulam@sussex.ac.uk
For more information please see http://www.sussex.ac.uk/sociology/profile200954.html

Table 3.4(2): Profile of Schools used for the Research and No of Participants

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
A1	Ash AC Co-Ed (8 girls and 8 boys)	Ash is a co-educational Academy set in the suburbs of Southeast London Borough. A Science, Technology and Enterprise specialist, Ash is run in partnership with the Local Educational Authority, an industry sponsor and personal investors. Information provided by the school states that its aims are to provide high quality education and training for students of all abilities and background, prepare young people for an ever-changing world that values self-confident, well-educated and enterprising people. Ash places great emphasis on traditional standards of uniform, good manners, discipline and respect whilst providing a very relevant and modern education which will enable students to succeed in the workplace and society of the twenty-first century. Ash School offers a wide range of very high quality academic and vocational courses. ICT/IT is compulsory at the Academy until the end of year 9 (KS3) at which students take the GCSE ICT exams. ICT in KS4 is optional.
B2	Beech LEA Girls (16 girls)	Beech is an all-girls Local Educational Authority school located in the outskirts of Southeast London Borough. Beech is a specialist Language, Arts & Design College with outstanding facilities which include two multimedia language centres, specialists teaching areas, practice rooms and studios. The school is also a lead trainer in the use of ICT for the teaching of Modern Foreign Languages. The cultural and ethnic diversity is a great strength of the school, student and staff learn from each other in a spirit of friendship and mutual respect. School literature states that Beech prides itself as a forward looking school for girls, providing a vibrant learning environment where each student can fulfil their potential. The dedicated teaching and support staff aim to raise aspirations, to challenge and inspire students, and provide the care and support they need to achieve their goals. The modern purpose-built facilities and the highest standard of pastoral care combine to provide a complete and inclusive education. Students leave school as confident, independent young women, fully equipped to meet the challenges of further education, training and the world of work. ICT at the school is compulsory through to the end of KS3 and then it becomes optional from KS4. At the end of KS4 the students sit for the GCSE ICT exams.
C3	Cherry AC Boys (1 boy)	Cherry School is an all-boys Academy with a specialism of Sports Science & Enterprise. Situated in Southeast London Borough, the school prides itself as an inspirational centre of enterprising learning where staff and students embrace the opportunities and challenges of learning, as well as continually striving to exceed their personal best and enjoy social, sporting, artistic and academic success. According to the schools' literature the aim and expectation is that every student who joins Cherry achieves his personal best in all aspects of Academy life. The Sport Science & Enterprise specialism fosters a 'can do' ethos, promoting self-confidence, initiative and creativity. The Academy offers a full broad and balanced range of subjects, modern ICT with interactive whiteboards in every classroom and fully equipped science laboratories. ICT at the Academy is compulsory. At the end of key stage 3 the students sit the OCR Nationals Level 2 Full Certificate for ICT. ICT in key stage 4 is also compulsory; the students take on additional/advanced ICT/IT & Business modules. In KS4 the students have

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
		the option to either sit for the OCR Nationals Level 3 Full Certificate or GCSE in Business & Communication Systems.
D4	Dagwood IND Girls (1 girl)	Dagwood School is an Independent fee-paying day school for girls. Located in Southeast London Borough, the school's aim is to provide a first class education for girls, recognising that they will each have individual pathways to success. The girls are prepared and developed intellectually, emotionally and socially throughout their school lives and success is measured not only by exam results but by the confident, compassionate and capable young women they end up becoming. According to information provided on the schools website "Education is not something we do to you, or for you, education is something we do with you", the school encourages the girls to take responsibility for themselves, their learning and makes sure that the girls develop the skills and self-awareness to be able to achieve this. All girls take study skills courses to develop disciplines and techniques such as note-taking, revision preparation, time management, use of the internet and essay writing. ICT at Dagwood is a key subject in terms of being used as a learning tool across the curriculum and as a subject in its own right. ICT is compulsory in KS3 and by the end of year 9 all students are entered for the GCSE ICT exams. ICT in KS4 is optional, but by the end of year 9 the girls are confident, competent users of technology across a wide range of applications.
E5	Elm GR Girls (1 girl)	Elm School is a selective Grammar school for girls' situated in the Westside of Southeast London Borough. Elm prides itself as a highly performing specialist school for Science and Languages, its aim is to provide a caring, happy and stimulating environment in which the girls attain the highest levels of academic and personal achievement. According to the literature provided by the school, the girls are taught a variety of subjects with emphasis placed on self-discipline and consideration for others. Artistic, dramatic, musical and sporting talents are fostered at Elm, and ICT is compulsory throughout KS3 and KS4. In KS4 all students have discrete ICT lessons taught by specialist teachers leading to a GCSE ICT qualification. The students can opt to take a full course or a short course GCSE. The short course is only worth half a GCSE so students make up the other half with Religious Studies.
F6	Fringe IND Co-ed (1 girl)	Fringe is a co-educational Independent fee-paying day and boarding school set in beautiful parklands with excellent learning first rate facilities in Southeast London Borough. Information provided states that the school exists to provide an education of the highest quality for boys and girls that encompass the academic, physical, social, cultural and spiritual requirements of the whole person. Each pupil is challenged to produce their best at all times within the vibrant community which draws upon the best traditions of boarding and day school education and the co-educational multicultural community provides a unique educational experience. ICT at Fringe is compulsory in KS3 and KS4. The curriculum in KS3 is based on cross-curricular themes, additional topics such as making movies with musical backing tracks has been incorporated. At the end of KS4 the students have the option of the Edexcel GCSE ICT or the OCR Nationals qualifications.

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
G7	Goldenrain AC Girls (1 girl)	Goldenrain is an all-girls Academy located in the Southeast London Borough with specialism in Humanities and Performing Arts. The Academy is a highly successful and oversubscribed school that is proud of its achievements. Literature provided by the school states that its aims are to develop the potential of all girls by creating a well ordered, calm and supportive environment, develop good relationships based on mutual respect and trust, provide excellent, high quality personalised education and prepare the girls to enter the world as independent confident young women ready to take on the challenges of the twenty-first century. ICT at Goldenrain is compulsory in KS3 and KS4. At the end of KS4 students take at least one of the Edexcel's suites of qualifications in Digital Applications (DIDA – Diploma in Digital Applications) which consolidates the ICT knowledge and capability gained in KS3. This program of study has no written examination, assessment is purely by coursework.
H8	Hawthorn IND Boys (2 boys)	Hawthorn is an Independent fee paying day school for boys situated in Southeast London Borough. Hawthorn prides itself as a dynamic, forward-looking school at the forefront of independent education with outstanding facilities and an extensive range of bursaries and scholarships, allowing boys from a wide variety of backgrounds to benefit from an education at the school. Literature provided by the school states that it's a caring and supportive environment which provides exceptional opportunities; the quality of teaching allows the boys to excel in many areas as they develop intellectual curiosity and independence of mind, concern and respect for others, a sense of compassion and high standards in a range of interests. The curriculum is designed to give each individual student a suitable breadth and depth of opportunity in each year of study and ICT is incorporated into all subjects and aspects of learning at the school. ICT at Hawthorn is compulsory until the end of year 8, and becomes optional from year 9. The students can opt to take the European Computer Driving Licence modules 1-7 tests, this is not compulsory. Students who wish to take a GCSE ICT course are also provided with the opportunity, this also is optional. As standard, ICT is not offered in KS4 at the school.
J9	Juneberry LEA Girls (2 girls)	Juneberry is an all girls Local Educational Authority school with a strong sense of tradition. Located in the heart of Southeast London Borough, Juneberry a specialist in Language, Sport and Technology is a welcoming and friendly school with a clear focus on high achievement and a broad balanced and relevant curriculum. Literature provided by the school states that Juneberry has excellent learning relationships and empowering pastoral curriculum. The huge range of enrichment opportunities and out of hours learning enables the students to become confident and creative individuals. ICT is compulsory at the school through KS3 and KS4. At then end of KS4 all students are entered in for the GCSE ICT exams.
K10	Krimsone LEA Girls	Krimsone is a Voluntary Aided Local Educational Authority Comprehensive school for girls. Located in the Southeast London Borough, the school has specialism in Performing Arts and Science as well as Music College Status. Krimsone school is a happy place of learning and achievement, everyone is expected to work hard and all are encouraged to

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
	(1 girl)	share their talents generously with the school community and beyond. Information provided by the school states that the curriculum is at the heart of the school's work, teaching and learning activities are planned to ensure that each pupil is challenged and stimulated according to their own learning needs to achieve their potential in a supportive and encouraging environment. ICT at the school is compulsory in KS3 and KS4. The girls follow a certified ICT course as well as using ICT in learning for other subjects. At the end of KS4 all students are entered for the GCSE ICT exams.
L11	Linden IND Girls (1 girl)	Linden is an Independent fee-paying day school for girls situated in the centre of Southeast London Borough. Linden prides itself as a unique school in an exceptional and inspiring setting steeped in history and a first class academic environment that promotes leadership, independence, integrity and ambition amongst its students. School literature states that Linden provides a safe, stimulating and caring environment where each individual is empowered to gain a strong sense of self-worth and purpose through recognition of their own talents and abilities as well as their contribution to the community. The curriculum is academic in nature and designed to stretch and challenge the most able. Students are highly motivated with determination to achieve in all aspects of their learning. ICT at Linden is not compulsory, in KS3 students study ICT like any other subject offered at the school and in KS4 make the decision to continue or discontinue the subject. Students can opt for the Full or Short GCSE ICT course in KS4 this is also optional.
M12	Maple IND Boys (16 boys)	Maple is an Independent fee-paying day school for boys in located in Southeast London Borough offering an all rounded education of the highest quality for secondary boys up to the age of 16. According to literature provided the schools aim is to achieve excellence in education for the students within a cultivating, caring and secure religious environment. The strong academic background provided by the school helps them to graduate and take their place in society as professionals who will not only serve as role models for generations of men to come, but also as intelligent and thoughtful citizens who will serve as ambassadors to their country. The curriculum at Maple is designed to give each individual boy a suitable breadth and depth of opportunity in each year of study. The range of subjects available is appropriate to the overall high academic standards of the pupils. In the early years emphasis is placed on acquiring skills in a wide variety of subjects. At GCSE the subjects available are designed to keep as many options open as possible in order to give each boy an opportunity to study a broad range of academic or vocational subjects at University. ICT at Maple school is compulsory for all boys in KS3 and KS4. At the end of KS4 all boys are entered in for the IGCSE ICT exams.
O13	Oak LEA Co-Ed	Oak is a co-educational Local Educational Authority Voluntary Aided school located in the heart of Southeast London Borough. Literature provided by the school states that it is a purposeful school where girls and boys have an outstanding range of opportunities; the school is

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
	(20 girls and 30 boys)	academically ambitious, but also academically sensitive. The school understands that each individual child has different needs and different aspirations, and all have skills to be nurtured to fruition. Oak provide an education of the highest quality for girls and boys which encompasses the academic, physical, social, cultural and spiritual requirements of the whole person. ICT is compulsory in KS3 and KS4. At the end of KS4 all students are entered in for the GCSE ICT exams.
P14	Pine LEA Co-Ed (8 girls and 8 boys)	Pine is a Voluntary Aided co-educational Local Educational Authority School located in the East-end of Southeast London Borough. A Maths and Computing Specialist, the goal of the school is to provide an all rounded education to ensure that all students who work hard achieve their full potential and teaching staff are committed to excellence for all. Literature provided by Pine states that the schools aim is to promote an educational culture that is technological, enterprising and vocational. To develop innovative practice in the delivery of the specialist and associated subjects which provide models of excellence both within the school and across the community. Pine School raises the post-16 participation rate in the specialist subject areas, and provides the students with the skills needed to progress into employment, further training or higher education according to their individual abilities, aptitudes and ambitions. ICT at the school is compulsory in KS3 and KS4. At the end of KS3 all students are entered in for the GCSE ICT exams. ICT in KS4 is optional; students are able to take on additional/advanced ICT modules.
R15	Rowan GR Girls (2 girls)	Rowan is an all-girls high performing, Engineering and Language specialist selective grammar school located in the greenbelt area of Southeast London Borough. Rowan portrays itself as a forward-thinking, exciting and happy school with excellent results. A school that students are proud to be part of which offers the opportunity to be challenged and extended, celebrates success in all aspects, recognises the needs of individuals, and where every student really does matter. The school teaches a variety of subjects and has undergone some curriculum changes in the past year, especially in the area of ICT. ICT is now compulsory in KS3 and KS4. In the past students were only able to study the Short GCSE ICT course, this has now been changed so students study the Full GCSE ICT course which comprises of two core modules: Living in the Digital World and Using Digital Tools.
S16	Snowbell IND Girls (1 girl)	Snowbell is an Independent fee-paying boarding and day school for girls located in Southeast London Borough. According to information provided on the website, Snowbell is vibrant and dynamic; the girls thrive on expert teaching, state-of-the-art facilities and a vast range of extra-curricular activities provided. ICT at Snowbell is compulsory in KS3. ICT is integrated into all subjects across the curriculum; latest technologies are used widely and skilfully throughout the school. Pupils regard ICT as an essential part of their work, treating computers as another tool for researching, writing, calculating, storing, retrieving, manipulating, drawing and presenting information. At the end of KS3 every girl takes a qualification in ICT. Snowbell is an accredited Microsoft Academy training centre.

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
		In KS4 ICT is optional but students who are interested in the subject are encouraged to study for an IGCSE ICT.
T17	Tulip IND Girls (1 girl)	Tulip is an Independent fee-paying day school for girls situated in Southeast London Borough. Information on the schools website promotes it as a school that is all about developing strong, compassionate young women who are well informed and able to express their opinions confidently without arrogance. Tulip enjoys an enviable reputation for providing girls with an exceptional range of learning opportunities, sporting achievements, extra-curricular activities, and is committed to encouraging every girl to discover her passion in life. Tulip stretches the girls' imagination and horizons. Tulip offers a wide range of subjects to the girls in KS3 and KS4, the curriculum is designed to promote excellence and encourage each girl to fulfil her potential in many different areas according to abilities, skills and interests. ICT is incorporated into all subjects and aspects of learning at the school and the girls attend a standalone ICT lesson once a fortnight. Students study ICT like any other subject at the school until the end of KS3 at which they can opt for a Full GCSE ICT course but this is not compulsory. At Tulip ICT is not offered or available in KS4 as a standalone subject, the syllabus is completed at the end of KS3, year 9. Students in KS4 interested in IT can request for further/advanced modules/study but this is purely by formal request.
U18	Unicorn LEA Girls (1 girl)	Unicorn is a Voluntary Aided Comprehensive Local Educational Authority school for girls located in Southeast London Borough. Literature provided at the school states that Unicorn has a tradition of academic excellence, addressing individual needs and service. With specialism in Business, Enterprise and Languages, the curriculum equips girls with skills for the twenty-first century and develops them as independent and critical learners and confident communicators. ICT is compulsory throughout the school in KS3 and KS4. At the end of year 9 the students gain a Microsoft Office Specialist Examination Certificate (KS3 Level) and a Developing Enterprise Capability Qualification (Level 2). As ICT is compulsory in KS4 at the school, students study a Full GCSE ICT course as well as take the Vocational ICT Certificate in i-Media (Level 2).
V19	Violet LEA Boys (1 boy)	Violet is a Local Educational Authority Foundation school located in the Southeast London Borough, with specialists' status for Maths, Science, Technology and ICT. According to literature provided on Violet's website, the aims of the school is to provide an excellent education with quality teaching that is innovative, also to encourage and reinforce traditional values and skills. The pupils have access to state-of-the-art technology which supports their learning across all areas of the curriculum. The curriculum at Violet is challenging, motivating, enjoyable and provides a wide range of enrichment opportunities. ICT is compulsory at the school in both KS3 and KS4. At the end of KS4 the students sit for GCSE ICT exams.

Sch Id	School Name /Type/Gender/No of Participants	School Profile (as per school literature and website information)
W20	Willow LEA Co-Ed (17 girls and 13 boys)	Willow is a Community Local Educational Authority co-educational Technology Specialist school situated in the green belt area of Southeast London Borough. The school is a comprehensive school it provides a rich educational experience for all the pupils, encourages high standards of work and behaviour and expect pupils to achieve their personal best in academic, cultural and sporting activities. According to information provided by the school, Willow provides plenty of opportunity for independent learning through their well equipped Learning Resource Centre, ICT suites and the well equipped library. ICT at Willow is compulsory until the end of KS3. At the end of year 9 the students are entered in for/sit the GCSE ICT exams. ICT in KS4 is optional; if students are interested in ICT then they can take further/advanced IT/ICT modules.
Y21	Yellowreed IND Girls (1 girl)	Yellowreed is an Independent fee-paying boarding and day school for girls located in the suburb of Southeast London Borough. Literature provided by the school promotes it as a school that ensures its students develop in an environment which suggests to them in everything they see around them that there is nothing a woman cannot achieve. The schools philosophy is "happiness at school is the key to success and enjoyment for each individual", this underpins everything done at the school. Yellowreed offers a wide variety of subjects in KS3 & KS4 and provide sound academic teaching, up-to-date facilities and a wide range of extra-curricular activities. IT/ICT at the school is compulsory in KS3 and KS4; all girls study IT throughout their time at Yellowreed. The course is designed to equip the girls for the world of work as well as further studies after they leave the school. At the end of KS4 the students sit for the IGCSE in ICT.

Key:
IND – Independent
AC – Academy
LEA – Local Educational Authority
GR – Grammar
KS3 – Key Stage 3
KS4 – Key Stage 4
All Academy and Grammar schools are also Local Educational Authority Schools
Note: The school profile has been generated using information provided from the school literature or school website.

Table 3.5: Reflections of fieldwork activities

On the allotted days of the research activities, I turned up at the school 15-30 minutes before the agreed time, made contact with the teacher representative and was advised of the number of student participants, prior to that I had no idea of which students will be part of the session. In all the sessions conducted apart from the very first session (pilot session), the questionnaires, creativity maps, pens, and paper were placed on a table setup to accommodate between four to eight students. Refreshments - water, biscuits, juices, sandwiches, fruit, tissues, disposable plates and cups were placed on a table in the far end corner of the room used for the session. Although three of the sessions were not recorded, the recording equipment was setup in preparation for each of the sessions, this was then turned on at the start of all four sessions that recording occurred. The student participants and the teachers came in at the agreed time; I guided the students to the various seats as they entered the room, in the co-ed schools, the students were mixed so as to have both sexes in each group.

Consent for recording was requested; this was either granted or rejected. Where recording was granted the video/tape recorder was switched on, and where recording was rejected the equipment was put away before continuing with the session. An explanation was given to the students regarding the activities of the day, their rights and compensation for their time. The students started off with completing of the questionnaires which took between 10-15 mins of the time, and then a brief explanation regarding the creativity map and the exercise required was made. The students started off with brain storming exercises, discussing with each other (mini focus groups/group discussions), I was moving around between the various groups/tables started the interviewing of the various students (individually and as a group), in-between the session participant observation occurred (observing the activities in the room and the students various group conversations). During the sessions, I started reading responses from some of the questionnaires, asked some of the students for further clarification of things they wrote, provided explanations to the teenagers and responded to their questions. All questionnaires were collected by me, and at the end of the session which lasted for about 30-50 mins in total, all the documentation provided by the teenagers was also collected by me. Students were also advised and encouraged to review their data and responses especially if they felt concerned, but they seemed fine and satisfied with their contribution.

The students were all rewarded for their contribution to the research – shopping vouchers were distributed to the student participants, they were also provided with my contact details (email address) for them to make contact if anything came to mind. The teachers who assisted during the sessions were very happy with the students for their well-behaved manner and maturity during the session and after. They were also pleased with the mode of delivery of the research activity and did ask if I would be willing and available to assist in a couple of career choice events that the schools put in place during the academic year. Although no firm commitment was made at this point, I did accept to assist subject to my DPhil activities calendar.

Research Successes – Things that worked well

Overall, the research fieldwork was a success and the planned activities worked well for the research. The research has benefited from the following:

- Emailing the Head teachers very earlier on in the research was very valuable as this meant that I was put in touch with the Heads of year 9, who in turn allocated the main contacts for the research. In most cases the main contact at the school co-ordinating the research activities ended up not being the head of year 9 as requested in the research brief. Also, organising for schools earlier on meant that I was able to select the schools that met the research criteria.

- Although it was not my intention for the students to be pre-selected by the school, this turned out to be valuable because the students who assisted in the research were very helpful, co-operative, well behaved, manageable and very willing to participate in the research activities. It was as if they were eager to have their voices heard, and it is possible that these students may have been selected from the top sets in their year group.

- Conducting research with minors/teenagers can be problematic, because bearing in mind that they are still children and getting responses from them can be very tricky. The questionnaires helped with some of the interviews as it provided an opportunity for students to talk more and provide more information regarding their perceptions of IT/ICT.

Reading the students responses from the questionnaire gave an insight as to their level of understanding and thinking; hence further questioning was tailored to their level/ability.

- Due to the well thought out planned structure of this research, there was enough time in-between the sessions with the different schools and as such valuable lessons were learnt and used to improve the subsequent sessions. Although the activities formats were all similar, the structure and mode of delivery was altered to suit the individual schools. For instance, in the very first session, the group of students were seated at two tables with myself as the only co-ordinator, for subsequent sessions, the students were split into manageable groups (depending on the size) of eight or more students per table, with one of the students nominated as the co-ordinator of that group. This worked very well and the students worked in harmony. It was also easy for management of the group especially in the sessions where there were over 20 students.

- Using a selection of high, middle, low or underperforming schools, meant that I was able to cover a wide range of students and different types of schools, which gave an insight into the differences and what effect class/background has on the students – their career choices and expectations for the future. This was very valuable as preliminary reading of the questionnaires seem to suggest that the student's background and educational preferences of their parents to an extent has an effect on some of the students, and this makes for interesting further exploratory work.

Problems encountered – Things that did not work so well

As much as I would love to attribute all successes to this research project there were a number of problems encountered which although did not affect the research activities adversely but are worth mentioning in this thesis:

- Trying to organise time with the schools to conduct the research exercises was very time consuming, although the head teachers authorised initial entry into the school, I was really at the mercy of the delegated teachers who were to assist with the research activities, the person was not particularly the head of year 9 or the ICT teacher so trying to work around the teacher and make contact in some cases was problematic due to their own personal commitments, which in turn meant that there was a long chain to get to the students.

- The two schools from the initial nine lined up that declined participation outright at the early stages of the research, was upsetting because those two schools were part of a carefully selected model devised to assist with the research, although there was a backup plan and the introduction of the mixed group provided an impromptu replacement, it did alter the pre-planned model which was to have a mirror of schools in both educational sectors.

- In three of the research sessions I was advised that video/tape recording was not permitted during the session. The most upsetting thing about this was that in the brief provided to the schools, there was mention about recording of the activities on the day, which the schools did not object to at the time this until in some cases the actual day of the research when I was onsite and about to start off the activities, and this was very unfortunate. Although I was able comply with the no recording rule, this did turn out to be problematic especially as notes had to be manually recorded while talking and interviewing the students. Also for these sessions, I had to rely on the students documenting as much as possible on paper.

- During some of the sessions the participant teachers voiced their concerns and perceptions regarding IT/ICT as a subject especially in relation to what is taught to the students, this would have been valuable/beneficial to the research if officially obtained, but because they did not provide their consent, even when I asked, their views have not been used for the purpose of this research. This is very unfortunate as the teachers did make valid contributions regarding the IT/ICT curriculum as it currently stands and why they are consistently failing to recruit student interests in the IT/ICT subject arena.

- I am unable to comment whether the pre-selection of students and having the teachers present during the session was a disadvantage to the research output. The first creativity session (pilot session) had no teacher or other adult during the session. Until a detailed analysis of the data and comparison of the responses by the students in the various sessions, I would not be able to draw any constructive conclusions as to whether the students were unable to communicate effectively, i.e. their real/true feelings/perceptions due to their teacher presence and/or pre-selection.

Personal Perceptions and Observations from my fieldnotes

Although it is too early to judge bearing in mind that a thorough examination, analysis, discussion and presentation of all data collected has been conducted in chapters four and five, my initial observations and perceptions are:

- The general consensus of the students seems to be that IT/ICT is a very boring subject, attempts have been made by the students and they have documented why they feel this way, although some still do not want to study IT/ICT for any particular reason.

- The IT/ICT teachers' seem to portray some negativity towards the students and the subject they teach. A number of students have confirmed that the teachers' lack of enthusiasm when teaching the subject seems to affect their ability to form an interest in the subject itself. As this point has not been substantiated. I am unable to comment further on this.

- There also is a general consensus that IT/ICT is not really worth embarking on as a subject as it is only half of a GCSE, which is a problem identified in some of the high performing school. This particular point has been explored further in the thesis to provide a better understanding of IT/ICT as a GCSE module.

- Finally, my personal observations are due to the lack of interest from the students, schools are cutting back on ICT/IT as a subject and incorporating the lessons into other subjects. Stand-a-lone IT/ICT lessons are taught about once every fortnight, with some schools not even offering the module at GCSE level which seems to be the case in some of the independent schools used in this research.

Fig 3.6(1): Consent Form: 14 Year Olds Subject Choices, Perceptions of IT/ICT as a Subject and IT/ICT as a possible Career.

Consent Form for Pupils (14 year olds')

Title: Research Approach Assessment of 14 Year Olds' Subject Choices, their Perception of IT and IT Work

Introduction: My name is Elizabeth Ibegbulam, I am a doctoral student at the University of Sussex exploring what factors affect 14 year olds in their subject choices, and in particular, how they perceive IT as a subject choice. As part of the fieldwork activities required for my DPhil, I would like to invite your son/daughter to participate in the research.

Procedures: All activities will be conducted during school hours within the school and will take no more than 90 minutes per session. There will be 2 sessions during year 9 and this will take place during the morning registration or afternoon allocated time and supervised by myself and a member of the teaching staff.

Session 1 – Completion of Questionnaire and Creativity map/Brainstorming Exercise. The activities will be as follows:

Introductory Questionnaire: An introductory questionnaire will be handed out to pupils

Creativity map/Brainstorming Exercise: The pupils will be doing a brainstorming exercise. They will look at an IT/ICT map (this will be provided), then write or draw any thoughts connected to the theme Information Technology

- IT/ICT as a general area
- IT/ICT as a subject choice and
- IT/ICT as a career choice

Session 2 – Group Discussion/Interviews and Presentation of High Street Shopping Vouchers.

Group Discussion/Interviews: At the start of this session, the pupils will be handed a sheet of paper to confirm their subject choices for GCSEs. They will complete this and hand back the sheets to me. I will then talk about IT as a career, answer any questions posed by the pupils, and attempt to explore their perceptions further by asking a few informal questions based on the information filled on the sheet of paper they handed back to me.

Presentation of High Street Shopping Vouchers: As a token of appreciation, all pupils that participate in the research will be rewarded with shopping vouchers, this will be handed over to a member of the teaching staff to distribute to the pupils.

Risks: As part of the legal requirements for conducting research with minors, I have undergone the necessary statutory CRB checks (certificate available on request). There are no obvious risks to the pupils as all activities will be held at the school during school hours, however if at any time the activities make them feel uncomfortable or they do not want to participate, they have the right to opt out of such activity or even withdraw from the entire research. At the end of each activity/session, they will be able to review the recorded information and decide whether they want this included or not.

Benefits: If you decide to participate in this research it will help to provide valuable information to my DPhil thesis and also contribute some useful information to you/your child especially in the area of IT as a subject choice and as a possible career for the future. You will also have the opportunity to learn more about IT as any misconceptions will be explored. All research participants will be offered a token of appreciation. However, if you choose not to/fully participate; there will be no penalty as participation is solely voluntary.

Confidentiality: If you agree to take part in this research, data obtained from the exercises will be made anonymous and treated with confidentiality. The data will be used only for the purpose of this research. For more information regarding this research, please go the following research page: http://www.sussex.ac.uk/sociology/profile200954.html

Would you like to participate in the research? If please indicate by completing the information required.

Yes: ☐ **No:** ☐ (Please tick the box)

Date: ___________________________________

Child's Name: ____

Parent's/Guardian's Name: ____

Parent's/Guardian's Signature: ____

Fig 3.6(2): Standards and Guidelines on Research Ethics - School of Law, Politics and Sociology

Research involving children

- Children (defined as those aged under 18) will need particularly careful consideration with respect to establishing and monitoring consent, the role of gatekeepers, the use and communication of findings and the potential disruption (emotionally or practically) caused by the research itself;
- Informed consent from young people should be actively and directly sought using communication methods that maximise their understanding of the research;
- Disclosure of information suggesting serious harm to the child or others should be addressed as indicated in the guidelines above on vulnerable people;
- Participation in the research should be made as rewarding and enjoyable as possible;
- Interviewing children should either be undertaken by two researchers or in areas where the researcher and child are not entirely alone to protect the researcher as well as the child;
- Consider the gender of interviewers where appropriate, for example in research involving children who have been sexually abused;

Feedback on the findings should be given in ways that are meaningful to the participants.

<u>Table 3.8.1: SPSS Code Book</u>

[DataSet1] C:\Users\Liz Ibegbulam\Desktop\Questionnaire information.sav

Notes

Output Created		26-JAN-2014 11:34:19
Comments		
Input	Data	C:\Users\Liz Ibegbulam\Desktop\Questionnaire information.sav
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	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	164
Syntax		CODEBOOK Name [n] SchoolName [n] SchoolTypeGender [n] TypeofSchool [n] Sex [n] PriStat [n] @1BackgroundEthnicOrigin [n] @2iDoesmotherwork [o] @2iiMothersOccupation [n] @2iiiDoesfatherwork [o] @2ivFathersOccupation [n] @3iEngLang [n] @3iEngLit [n] @3iMaths [n] @3iSingleScience [n] @3iDoubleScience [n] @3iTripleScience [n] @3iDesignTechnology [n] @3iITICT [n] @3iArtDesign [n] @3iHistory [n] @3iGeography [n] @3iSpanish [n] @3iLatin [n] @3iFrench [n] @3iGerman [n] @3iMusic [n] @3iCitizenship [n] @3iPE[n] @3iBusinessStudiesEnterprise [n] @3iRERS [n] @3iIslamicStudies [n] @3iArabic [n] @3iDrama [n] @3iDance [n] @3iiCantheymakeChoices [o] @3iiiEnglishLanguage [n] @3iiiEngLiterature [n] @3iiiMaths [n] @3iiiSingleScience [n] @3iiiDoubleScience [n] @3iiiTripleScience [n] @3iiiDesignTechnology [n] @3iiiITICT [n] @3iiiArtDesign [n] @3iiiHistory [n] @3iiiGeography [n] @3iiiSpanish [n] @3iiiLatin [n] @3iiiFrench [n] @3iiiGerman [n] @3iiiMusic [n] @3iiiCitizenship [n] @3iiiPE [n] @3iiiBusinessstudiesEnterprise [n] @3iiiRERS [n] @3iiiIslamicStudies [n] @3iiiArabic [n] @3iiiDrama [n] @3iiiDance [n] @3iiiLeisureandTourism [n] @3iiiHealthandSocialCare [n] @3iiiTherapyandPsychaiatry [n] @3iiiChilddevelopment [n] @3iiiResistantMaterials[n] @3iiiiMedia [n] @3iiiPhotography [n] @4iCareer1 [n] @4iiCareer2 [n] @4iiiCareer3 [n] @4ivCareer4 [n] @5iParents [n] @5iiFamily [n] @5iiiMedia [n] @5ivSchoolTeachers [n] @5vSelf [n] @5viPeersFriends [n] @5viiCareersAdvisor [n] @5viiiOthers [n] NameWhoWhat [n] @6Comfortableconfidentcomputeruser [o] @7iLikeITICTasasubject [o] @7iiExplainyouranswerfromquestion7i [n] @8iITICTisaneasysubject [o] @8iiITICTisafunsubject [o] @8iiiIreallyenjoyITICT [o] @8ivITICTisusefulformyfuturejobcareer [o] @8vITICTisimportantforadultlife [o] @8viITICTisusefulformenow [o] @8viiThereistoomuchcourseworkforITICT [o] @8viiiWedotoomuchITICT [o] @8ixIdonotfeelchallengedinITICTclass [o] @8xIamreallygladIamdoingITICT [o] @8xiIhavemadegoodprogresssofar [o] @9iConsiderworkinginIT [o] @9iiExplainingyouranswerforquestion9i [o] KS4EnglishLanguage [n] KS4EnglishLiterature [n] KS4Maths [n] KS4SingleScience [n] KS4DoubleScience [n] KS4TripleScience [n] KS4DesignTechnology [n] KS4ITICT [n] KS4ArtDesign [n] KS4History [n] KS4Geography [n] KS4Spanish [n] KS4Latin [n] KS4French [n] KS4German [n] KS4Music [n] KS4CitizenshipPSHE [n] KS4PE [n] KS4BusinessStudiesEnterprise [n] KS4RERS [n] KS4IslamicStudies [n] KS4Arabic [n] KS4Drama [n] KS4Dance [n] KS4LeisureandTourism [n] KS4HealthandSocialCare [n] KS4TherapyandPsychaiatry [n] KS4ChildDevelopment [n] KS4ResistantMaterials [n] KS4iMedia [n] KS4Photography [n] /VARINFO POSITION LABEL TYPE FORMAT MEASURE ROLE VALUELABELS MISSING ATTRIBUTES /OPTIONS VARORDER=VARLIST SORT=ASCENDING MAXCATS=200 /STATISTICS COUNT PERCENT MEAN STDDEV QUARTILES.
Resources	Processor Time	00:00:00.20
	Elapsed Time	00:00:00.25

Appendix B

Further research documentation from Chapter Four

<u>Table 4.1(3): Do you like IT/ICT as a subject: students' responses by their school private vs. state.</u>

	Boys (% (n))			Girls (% (n))		
	Private	State	Total	Private	State	Total
Yes	78 (14)	80 (49)	80 (63)	43 (3)	64 (50)	62 (53)
No	17 (3)	10 (6)	11 (9)	57 (4)	22 (17)	25 (21)
Not Sure	5 (1)	10 (6)	9 (7)	0 (0)	14 (11)	13 (11)
Total	100 (18)	100 (61)	100 (79)	100 (7)	100 (78)	100 (85)

<u>Explanation of Data in the Table:</u>

According to the data displayed in Table 4.1(3) above, a slightly higher percentage of the boys (80%) than the girls (64%) from state schools said that they liked IT/ICT as a subject, and a greater percentage of boys (78%) than girls (43%) from private schools said that they liked IT/ICT as a subject. A higher percentage of the girls (22%) than boys (10%) from state schools said that they did not like IT/ICT as a subject, and a similarly a higher percentage of girls (57%) and boys (17%) from private schools said that they did not like IT/ICT as a subject. A slightly higher percentage of the girls (14%) than of the boys (10%) in state schools said they were not sure they liked IT/ICT as a subject, and a greater percentage of the boys (5%) than of the girls (0%) in private schools said that they were not sure they liked IT/ICT as a subject.

Generally, a greater percentage of the students from the state sector schools (boys and girls) liked IT/ICT as a subject compared to the percentages of students (boys and girls) from the private schools. A greater percentage of the students (boys and girls) from the state schools disliked IT/ICT as a subject compared to the percentages of students (boys and girls) from the private schools, and a greater percentage of the students from the state schools were not sure they liked IT/ICT as a subject compared to the percentages of students (boys and girls) in the private schools. With such a small number of students from the private schools to report on (25 students in total, i.e., 18 boys and 7 girls), this study will no longer include the private vs. state school sector variable in further analysis.

Table 7.4.1(1): The new computing curriculum for Key Stage 3

Key stage 3 (Ages 11-14)
Pupils should be taught to: • design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems • understand several key algorithms that reflect computational thinking (for example, ones for sorting and searching); use logical reasoning to compare the utility of alternative algorithms for the same problem • use 2 or more programming languages, at least one of which is textual, to solve a variety of computational problems; make appropriate use of data structures (for example, lists, tables or arrays); design and develop modular programs that use procedures or functions • understand simple Boolean logic (for example, AND, OR and NOT) and some of its uses in circuits and programming; understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers (for example, binary addition, and conversion between binary and decimal) • understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems • understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits • undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users • create, reuse, revise and repurpose digital artefacts for a given audience, with attention to trustworthiness, design and usability • understand a range of ways to use technology safely, respectfully, responsibly and securely, including protecting their online identity and privacy; recognise inappropriate content, contact and conduct, and know how to report concerns **http://www.develop-online.net/news/uk-govt-outlines-computer-science-curriculum/0115853**

Table 7.4.2(2): The new computing curriculum for Key Stage 4

Key stage 4 (Ages 14-16)
All pupils must have the opportunity to study aspects of information technology and Computer Science at sufficient depth to allow them to progress to higher levels of study or to a professional career. **Pupils should be taught to:** • develop their capability, creativity and knowledge in Computer Science, digital media and information technology • develop and apply their analytic, problem-solving, design, and computational thinking skills • understand how changes in technology affect safety, including new ways to protect their online privacy and identity, and how to report a range of concerns **http://www.develop-online.net/news/uk-govt-outlines-computer-science-curriculum/0115853**