The ICT Gender imbalance in Schools and beyond: Missed Opportunities

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Abstract

'Pipeline shrinkage,' the steady attrition of women in the ICT industry despite their academic achievement, has been of great concern not only in the United Kingdom but also internationally for almost a quarter of a century. This study reviewed literature and prior research from both national and international perspectives, with a particular research focus on the experiences of students in three British secondary schools. The situation may have been exacerbated in British schools as government strategies have increasingly focussed on male students' apparent "underachievement" relative to female students during the past decade.

One aspect of focus has been the resurrection of interest in single-sex classes in state schools. The comparatively strong academic achievement of female students has led to little focussed research on why they fail to capitalise on their ICT ability and study the subject beyond school level. Their behavioural intentions have not been the focus of research.

This study tested the fit of The Theory of Planned Behaviour (TpB) as a theoretical framework to examine how behavioural, normative and control beliefs differed, both between male and female students in mixed and single gender schools and female students taught in mixed or single sex classroom contexts. Samples of 150 students were questioned from which 120 were useable; 40 from each of the three participating schools. In two cases 25 students were Key Stage 4 students and 15 were A' Level students. In addition, a series of semi-structured interviews were undertaken with a further sample of 30 Key Stage 4 ICT students. Results showed that data fitted the TpB model and explained female students' lack of intention to study ICT beyond their current level as beliefs were found to be related to that intention.

Recommendations were provided for changes in practice based on attitudinal responses to behavioural beliefs, learning styles and teaching strategies. The study suggested that these gains would be achieved only if initiatives for change are developed within gender-relational contexts, rather than situated within recuperative masculinity policies.

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1. Introduction

It is easier to put a man on the moon than to get more women to enter computer professions

(Wendy Hall, President of the British Computer Society, 2007)

1.1 What is the Problem?

Internationally women are a minority in most areas of the Information and Communication Technology (ICT) industry (Grid Talk, 2009, Truth, et al., 2003). Women in the United Kingdom (UK), however, are in a minority in all areas of the ICT industry (Panteli et al., 1999). Rather than enhance and empower the lives of women, there is a danger that ICT will further increase international gender divide (The European Commission, 2009, The World Bank, 2002, 2009). Women represent less than 25% of the ICT workforce in most countries, and less than 10% in Luxembourg, Switzerland, the Netherlands and Austria (Grid Talk, 2009). In the United States of America (US), the reported figure is as low as 20% (Ahuja, 2000). All indications are that the situation in Australia follows the same pattern, reflecting well-rehearsed ideas about the masculinity of technology and computing culture (Diamond & Whitehouse, 2005). Research from New Zealand presents a similar picture with women only constituting a minority sub-group on ICT graduate courses that once were attracting equal numbers of female and male undergraduates (Margolis & Fisher, 2002). The number of women studying and entering the ICT industry is actually declining in the major developed countries of the world (Grid Talk, 2009, Margolis & Fisher, 2002, Panteli et al., 1999).

The high point for women's participation in the ICT industry in the UK was in the late nineteen eighties but the trend has been a downward spiral ever since (Gras-Velazquez et al., 2009, Black et al., 2005). In 1999, approximately 16% of ICT workers in the UK were women, but, within a year, the figure dropped to 13%, placing the UK well below the US, Canada and Ireland. In fact, recent statistics show that the situation has since become worse. In 2001, the percentage of female ICT professionals in the UK fell again, and in software engineering fields, women account for just 8% of the workforce (Towner 2002). International research has found that women continue to have less computer experience and hold less favourable attitudes towards computers than males (Gras-Velazquez et al., 2009, Arnot, 2002, Taylor and Mounfield, 1994).

The under representation of women in the ICT industry is recognised internationally as an area of concern (Grid Talk, 2009, The European Commission, 2009, The World Bank, 2002, 2009). Gender issues, however, are routinely ignored in the study of ICT at undergraduate or graduate level. Research (Turner, 2005) has been undertaken on the experiences of female students studying ICT in Higher Education through the Women into Computing (WiC) mailing list and by examining university ICT departmental course modules. This research revealed that in 20 British universities only two undergraduate and two masters' modules included a lecture on gender. One newly validated Gender and ICT module according to Turner (ibid) was offered to students as an elective but would 'probably not run,' because of the low numbers of interested students. This lack of recognition at university level of female students' perceptions of ICT as a 'masculine' subject is important if this is the very issue that is perpetuating the attrition of women from the study of ICT and the ICT industry.

Multiple and diverse masculine organisational and social cultures and behaviour, alienate women from ICT by the attitudes and beliefs they hold about this culture, particularly an image of, 'nerdyness' (Webster, 2005). Female students have significantly more negative attitudes regarding ICT and less of a preference for the 'traditional,' methods of competitively working in front of a screen than their male peers. These attitudes may be attributed to experiences rather than gender itself. Similarly, the female students' stronger preference for social contact than male students (Proost & Lowyck, 1997) and a desire to help people in their work (Gras-Velazquez et al., 2009) could also be a function of their past experiences and nurture, leading to them making choices in careers other than ICT (Creamer et al., 2005).

There has certainly been a substantial increase in the opportunities for both female and male students to have access to computers in schools in recent years. The National Curriculum in England and Wales aims to expose all students to computing across the school curriculum and to develop students' knowledge and understanding of ICT. Female students achieve not only academic parity with males in ICT but achieve higher grades at General Certificate of Secondary Education (GCSE) level or General Certificate of Education Level – Advanced - (A') Level (Ofsted, 2009, The Telegraph, 2007 The Times, 2006). Despite their success in the subject, male students numerically supersede female at A' Level by 30% (Ali, 2001) and the numbers of women studying ICT at all levels from A' Level onwards is decreasing (Clegg, Trayhurn & Johnson, 2000). Women's negative perception of ICT as a subject and an industry is discussed at length in the Literature Review and it is well documented that they find the subject unappealing and the industry inflexible and male dominated (Adam et al., 2005). Yet little research has been undertaken within schools and the ICT industry to explore the attitudes and beliefs of female students and employees in order to address the continuing problems of gender imbalance with regard to the nature of ICT itself (Michaelson, 2005). Why female students hold beliefs that preclude them from its study post 16 and beyond has not been a research focus. Instead, research has focussed, on the effects of redistributive or affirmative action polices; measuring disadvantage and attempting to put in place policies and strategies that will rectify the situation (Pringle et al, 2000) rather than identifying the attitudes, beliefs and behaviours that lead female students to abandon ICT study.

As an ICT subject leader in a successful Academy, formerly a City Technology College (The Academy), I was aware as I carried out my research that post 16 students studying A' Level Computer Science showed a gender imbalance with a ratio of seven male students to one female student. Evidence gathered from a cohort of Year 11 GCSE students expounded the premise that female students are disinclined to study ICT beyond the compulsory GCSE level due to a number of attitudinal factors which this research study analyses. As a Senior Lecturer and Post Graduate Certificate in Education (PGCE) ICT course coordinator, I am conscious that the number of male PGCE ICT students outnumbered females by the ratio of two to one.

By the end of Key Stage 4, students have many attitudes and beliefs that have positioned them in option groups and lead to behaviours that ultimately move women away from the ICT industry. Our attitudes and beliefs, however, are not fixed in a set of socialised, non-transferable roles, but are constantly positioned and repositioned through discourse. Individuals both negotiate and are shaped by their subject positions within a range of different, and often conflicting, discourses. These vary according to historical, cultural or social context. The motor for this,

> is never localised here or there, never in anybody's hands, never appropriated as commodity or a piece of wealth. Power is exercised through a net-like organisation. Not only do individuals circulate between its threads but also they are in a position of simultaneously undergoing and exercising this

> power. They are not only its inert or consenting target, but also the elements of its articulation
>
> (Foucault, 1980:12).

Power in the ICT industry is currently largely 'exercised' by men and they are the 'elements of its articulation'. The gendering of the ICT industry is in part a consequence of women's economic, social and political inequality in the labour market. The consequent male dominance of the ICT industry internationally, in tandem with women's growing antipathy towards the subject, could lead to an imbalance of the power relationships in ICT to the detriment of not only an equal society but to the industry itself (The World Bank, 2009).

A recent large scale research project involving 115,000 participants , 'Women Matter-A Competitive Edge for the Future', commissioned by the international McKinsey corporation, found that 3 of the 4 key leadership behaviours required to drive the company forward competitively into the 21st Century were those more applicable to women: 'Inspiration', 'Participative Decision Making' and 'Expectations and Rewards'. The additional behaviour, 'Intellectual stimulation', was behaviour equally applicable to women and men, whereas the least important, 'Control and Corrective action' and 'Individual decision-making' were characteristically male behaviours. McKinsey & Company are drawing on the report results to encourage parity of gender leadership and work towards making the company less male gendered in its practices; an area they acknowledge as a weakness (Desvaux & Devillard, 2009).

Computers have revolutionised our world and continue to do so by the second – across continents, across all economies, classes and genders. The impetus of the

Space Race has been replaced by a jostling for technological supremacy that involves every village, every country and every nation. The face of society has not only changed but will continue to do so. Technologies we cannot imagine today will be the norm in a few short years – or even months. It is imperative that all children, of all nations, are ICT literate and skilled in embracing the powerful force of technology as it emerges. Technology that is ubiquitous and essential to us all - essential to manage the economy, essential as a means of transaction and storage and, above all, essential as a method of communication. Societies who neglect technological education limit their potential to operate as players in the global economy. A country's economic growth and prosperity relies on its efficiency and that efficiency relies on it technological expertise and capability (The World Bank, 2009). Young people without ICT skills and confidence will be limited in the contribution they can make to their nation's economy and limited in their own careers, development and life chances. Each generation must be able to stand with their international peers in a 'world class' of knowledge and development (Gras-Velazquez et al., 2009). No nation can afford to deny its children this opportunity as the costs are too high and the curriculum must keep pace with the skills students need to amass.

ICT is no longer a specialism and the stereotypical computer 'geek', working into the night on an incomprehensible programming problem should be an image consigned to history books. Any sense that ICT and its associated global industries are gendered must be jettisoned too for the benefit of the industry itself. The application of technology needs a multiplicity of skills and intelligences to be effective. Reflection coupled with reaction, the interpersonal with the independent, development along side deconstruction. The demands of the ICT industry require the diversity of a work force that represents the whole, not a part, of that potential work force (Desvaux & Devillard, 2009). It is an industry that demands its participants to be risk taking but highly ethical, problem solving through wide-scale collaboration and flexible in structures that need not be scaffolded by any gendered notion of what the industry needs to be.

Technology is not static and how the industry has been perceived cannot be static either. If the Western World is to keep pace with its developing competition then the issue of the attrition of women from the ICT industry must be addressed as to fail to do so has consequences that go beyond any classroom or any town and will impact upon the state of the world economy itself. The attrition and alienation of women from the ICT Industry is not only iniquitous and short sighted economically from a worldwide business point of view, but also morally. To deny women a stake in the entrepreneurship possibilities, career opportunities and high salaries offered by the ICT industry will serve to further perpetuate masculine domination, regressively economically marginalise women, widen gender pay differentials and deny half the population access to global capital (The European Commission, 2009, Gras-Velazquez et al., 2009).

In the short term, it is not feasible to expect a change in the dominance of a male culture gender imbalance in ICT. Investigating and reporting the beliefs, attitudes and intention to study ICT post 16 and beyond of female students, irrespective of their socio-economic backgrounds or ethnicity is, however, a positive move towards challenging the extent of this domination. If teachers are made aware of the beliefs, attitudes and intentions that potentially deter female students from the uptake of ICT post 16 and beyond, pragmatic strategies can be put into place to address the problem. Practical considerations including teacher gender, classroom organisation, teaching styles and learning preferences are addressed in this study. In addition, suggestions discussed regarding strategies teachers and schools can consider in order to attract female students in larger numbers into the ICT examination classroom and beyond.

As Post-structuralists contend, individuals – teachers, female students and male students – are not unitary 'subjects' uniquely positioned, but are produced as 'a nexus of contradictory subjectivities', (Walkerdine, 1990) intertwined in a complex web of power relations that are constantly shifting, rendering individuals at times powerful and at other times powerless. Female students have the potential to adopt multiple positions or multiple voices that interact with their conscious and unconscious desires, pleasures and tensions (Baxter, 2002). It is possible that female students could adopt these different positions and speak in different voices that would attract them to, and retain them in, the ICT industry. Teachers, however, need to be aware of the impact they potentially can have on the attitudes and beliefs held by female students whilst at the same time understanding the attitudes and beliefs that impact upon their intentions in relation to the further study of ICT.

The Theory of Planned Behaviour (TpB) provides a broad, psychological insight into the experiences of female students successfully studying ICT at either GCSE or A' Level and their option choices in the three participating schools in this study. It is a model of the psychological processes that mediate observed relations between attitudes and behaviour; processes composed of attitudinal, social influence and intention variables to predict behaviour. The Theory asserts that intention to perform behaviour is determined by the individual's attitude toward performing the behaviour and subjective norm held by the individual (Ajzen & Fishbein, 1980). Triangulated with a series of semi-structured interviews, The Theory of Planned Behaviour provides a comprehensive picture of the attitudes, beliefs and intentions of the participants in this study in order to make an original contribution to knowledge. No current research exists into the behavioural, normative and control beliefs of female students towards ICT. Only by understanding and acknowledging that female students hold beliefs regarding ICT that may lead them to under participate in post 16 ICT study can schools construct learning and teaching environments that begin to challenge and change those beliefs.

1.2 The Research Questions

The research uses a post positivist paradigm to examine the following question: Are there gender differences in Behavioural, Normative and Control Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

The four accompanying sub questions are:

- Are there gender differences in ICT students' attainment and what impact does this have on their intent to study ICT post 16 and beyond?
- How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).
- How do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?
- What impact does teacher gender have on the beliefs of students towards ICT in single and mixed gender schools?

2. The State of our Nations: Issues in female participation in the ICT Industry

There is no female science waiting in a cupboard to be discovered.

We have to make it happen

(Nicole Dewandre, 2003)

2.1 Pipeline Shrinkage: The Attrition of Women from the ICT Industry

Across Europe, Australia and the United States, structures and systems reflect the dominant masculinity of the ICT industry (Kramer & Kramarae, 1997). Recent decades have witnessed major changes in education enrolment across the European Union (EU) and women now outnumber men in upper secondary and university education in most European Union countries, representing 58% of graduates in the EU as a whole. Women are also closing the gender gap at the highest academic level, making up 41% of PhD graduates. Nevertheless, the different areas of study still show traditional gender patterns across not only the European Union, but across the Western world. Men continue to dominate the Sciences, Mathematics and ICT (Lagesen et al., 2005, Sanz, 2005, Vehviläinen & Brunila, 2005).

In Europe, women's increased qualifications have had a positive effect on their employment rate, pay levels and promotion to managerial position, yet imbalances in subject choices in education still feed through to gender segregation in the labour market (Gender in Technology, 2001). The share of women among computing professionals has either decreased or stagnated between 1998 and 2004. Women hold far less decision-making and managerial positions and there appears to be a metaphorical glass ceiling with regard to their career prospects. Women represent only 30% of managers in European enterprises; Denmark (23%), Malta (14%) and Cyprus (14%) having the lowest percentages of women managers (Grid Talk, 2009).

The fundamental principle of equal treatment between women and men has been a part of the Treaty of Rome since 1957. Crucially, article 119 was included in the Treaty giving women and men all over Europe not only the legal basis for asserting equal pay for work, but also a fairer future.

Reducing the pay gap was one of the objectives of the European Strategy for Growth and Jobs, yet a pay gap between men and women continues to exist, 53 years after the signing of the Treaty of Rome, in spite of the action taken and resources spent on trying to reduce it. According to the indicator of the (unadjusted) gross hourly pay gap between women and men, women were earning on average 15% less than men in the European Union were in 2005. Since the Equal Pay Act was introduced nearly 40 years ago, there has been a significant increase in the numbers of women in employment. In 1971, the employment rate for women was 56 per cent, compared with 69.6 per cent for the three months to March 2009 and the UK has one of the highest employment rates for women in Europe. Yet in the UK, women are still paid, on average, 22.6 per cent less per hour than men and within some contexts, the pay differential is actually widening. The full-time gender pay gap was 12.5 per cent in 2007 but in 2009 is 12.8 per cent. The pay divide is further differentiated for part-time workers (39.9 per cent). This is significant, as 41 per cent of women work part time compared with just 12 per cent of men. Moreover, women make up more than three-quarters of the part-time workforce (The Women and Work Commission, 2009). Women are paid less than men are in all ICT sectors and in all EU countries.

This difference is particularly marked in Belgium, Denmark, France, Germany and Luxembourg (Grid Talk, 2009).

This research addresses an under researched area, that potential gender differences in beliefs, attitudes and behaviour towards ICT are exemplified not only by national examples but also by international trends in women's under participation in the ICT industry. Generally, these gender differences are not attributable to objective criteria (for instance male ICT staff are not better qualified), which is a sign of the inequalities still experienced by women in the labour market. Women achieve a higher pass-rate at school than men do in all the European Union Member States and account for the majority of graduates. Yet, once they leave the education system, they find themselves in a labour market in which they enjoy less favourable conditions than men. Women are frequently employed in gender typical areas, in which their productive potential is not fully exploited (Desvaux & Devillard, 2009, Gras-Velazquez et al. 2009, The European Commission, 2009, The European Commission, 2007, Steitz, 2006).

The term 'Pipeline shrinkage', sometimes known as 'leaky pipeline', specifically describes a well-known phenomenon regarding women in the sciences including computer science (Gras-Velazquez et al., 2009, Grid Talk, 2009, Steitz, 2006, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990). It refers to the steady attrition of female students and women throughout the formal science, technology and computing educational system from primary education through to positions of power and influence in industry (Derbyshire, 2003). The American Association of University Women (AAUW) data suggests as few as 17% of high school students take the advanced placement tests in computer science, ultimately making up only 20% of technology professionals in the United States (Gurian, 2002).

In the UK, approximately 20 million people use ICT in their workplace. The ICT workforce is predicted to grow between 1.5% and 2.3% per annum throughout the next decade with an estimated additional 179,000 ICT professionals to join the workforce over the next ten years (e-skills, 2004). Studies have shown that in 2008, there were estimated to be over 1.3 million new technology workers and it is predicted that by 2010, 65% of the economy will be based on technology (Mitchell, 2005). There is a predicted shortfall of 300,000 skilled ICT workers by 2010 (Grid Talk, 2009). If employment rates amongst women remain at current levels, Europe can expect to see a further shortfall of 24 million people in the active workforce by 2040. If women's employment rates equal men's, then the projected shortfall drops to 3 million (Gras-Velazquez et al., 2009).

Trauth et al. (2004) suggest that women remain severely under-represented in the ICT industry in the UK. This industry encompasses all areas of technology used to handle information and aid communication. It covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. These products include personal computers, digital television, email and robots. Importantly, the industry is also concerned with the way these different products can work with each other. These fields include telephony, broadcast media and all types of audio and video processing and transmission of information. Information Technology (IT), in contrast to ICT, is the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware. IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and securely retrieve information.

A survey of ICT professionals found that in 2003 the number of women in ICT had fallen from 232,900 to 207,213 - a drop of 3% despite an overall growth in the ICT workforce in the same period (The Deparment of Trade and Industry (DTI), 2004). Thus, only 1 in 5 of the ICT workforce is female (e-skills, 2004) despite that, since the 1990s, gender equality policy has been characterised by affirmative redistributive principles relating to women's position in the economy. Governments promote wide-range affirmative strategies to encourage industry to improve its record on employing women, reduce sex discrimination at work and encourage women into the knowledge economy. There have been proactive attempts to create for women the educational and social advantages that have benefitted men, employing gender essentialisms to do so rather than always expecting women to work in ways that are inherently preferable to men (Arnot, 2002). Yet less than 20% of the 15% of women in the UK, who work in the ICT industry, hold a computing degree (Webster, 2005). This is despite the data that evidences that female students outperform male students in ICT academically at A' Level.

In 2007 out of 13,360 A' Level ICT students, 63% were male students, 2.3% of the total cohort and 37% female, only 1.1% of the total A' Level cohort. The female students, however, achieved a higher percentage of A-C grades at 59.2 % whilst male students only achieved 49.3% A-C grades (Ofsted, 2009). The statistics for A' Level Computing are disparate. This is the A' Level taken up by the least number of female students at 0.1% (the same percentage of male students who take A' Level Expressive Arts – primarily Dance!) whilst 1.4% of male students take this A' Level subject. Yet, again, female students perform better with 63.7% A-C grades, the male students achieving a lesser percentage of A-C grades at 58.1% (The Daily Telegraph, 2007). Compared to 2004, in 2007 there was a 45% decline in female students opting to study A-level Computer Studies and an all time low in the numbers of female students opting to study ICT Post 16 in British schools since records began (Ofsted, 2009).

At GCSE, where participation is more equitable, female achievement again superseded their male peers in 2006 at a ratio of 7.1%: 4.9% achieving A* grade, 16.2%: 12.4% achieving A grade and 19.7%: 17.4% achieving B grade (The Times, 2006). Such excellent prior attainment suggests that there should be a steady increase in female students studying ICT at A' Level and beyond into Higher Education, but in the UK there was a 20% decrease – from 37% to 17% - in women entering all computer science courses from 1979 to 1999 (Clegg et al., 2000, Ali, 2001).

The issue of female students' lack of participation in the study of ICT Post 16 is reflected in many European countries (The European Commission, 2009). Despite Norway's state feminism and proactive attempts to recruit women to study ICT at graduate level, the percentage of female students opting to do so has dropped from 38% in 1997 to below 10% in 2004. A strongly gendered segregated labour market, however, exists and government polices actually sustain gender differences related to choices of education and occupation in the emphasis placed on reducing rather than eliminating the consequences of these differences in terms of income and welfare (Lagesen, Levold & Sørensen, 2005). Finland, similarly, has not achieved gender equality in the ICT industry. Women's numbers in both ICT education and work grew in the 1970s and 80s, in parity to women's extensive full time participation in the labour market, up to an internationally high percentage. The numbers then dropped significantly, as across the EU, in the 1990s, whilst the numbers in ICT professions generally multiplied and became male dominated, mirroring student gender populace in the technical universities. After this decline in female participation, not even an increasing number of equality projects were able to influence the tendencies of the 1990s (Vehviläinen & Brunila, 2005).

As surprisingly, in Sweden, for so long sheltered from social problems that affected other parts of Europe, an ideological vacuum has developed amidst a loss of faith in traditional ideologies. During the late 20th Century, ICT was deemed the panacea to fill the gap, creating a 'knowledge society' (Riis, 2000). The National Commission on IT in 1994 produced the evangelically named report: 'Information Technology. Wings to Human Ability,' that outlined the creativity that ICT would generate for all Swedish children, without stipulating how the ICT would be utilised to do so. This was followed by 'The Tools for Learning Programme' and approximately 5 Billion SEK spent; the largest financial investment made in Swedish education in a 100 years.

From 1995, the number of schooboards/administrative bodies who reported that they had an ICT strategy or action program had increased substantially. Computers in themselves, however, are not a guarantee that ICT is used in the teaching process and that educationalists acknowledged the pedagogical benefits for students within the classroom. Moreover, a decentralisation of education into self-managing municipalities, despite a centralised national curriculum, also removed cohesion and unity (Riis, 2000, Astrom, 1998).

The representation of undergraduate female students in Spain attending the School of Computer Science in the Technical University of Madrid University has also mirrored the pattern of decline across Europe. In 1994-95 there were 740 female undergraduates (26 per cent of the total), but the cohort had reduced to only 595 female undergraduates in 1997-98 (22 per cent of the total). Across the European Union and the West, many PhD granting departments have very small numbers of female professors and consequently there are few same gender role models for the female students within Higher Education institutions (Michaelson, 2005, Leverson, 1990). In the School of Computer Science at The Technical University of Madrid University in 2003, female teaching staff represented only 15% of senior faculty members, whilst, over a 15-year period, the number of male Full Professors and Tenure Professors, increased 133 per cent faster than females did. With regard to Assistant Professors, the number of women at this level remained stable at seven in 1989 and eight in 1999 although the number of male Assistant Professors decreased from thirty to fourteen in the same period as they gained tenure to become Associate Professors. Moreover, the number of female PhD students also decreased and represented only 10% of the graduate research ICT students in 1999 (Sanz, 2004). This is in contrast to the increasing, or at least constant, ratio of female to male professors and PhD students in other departments.

A possible rationale for this decline in participation can be given as one of semantics and association. In 1993, the Computer Science degree in three major Technical Universities in Spain (Technical University of Madrid, Technical University of Catalunya and Technical University of Valencia) was renamed from 'Bachelor in Computer Science' to 'Bachelor in Computer Engineering'. There is an implication that the negative attitudes the female students associated with the term, ‘engineer’, led to the decrease in participation in the courses (Sanz, 2004).

2.2 The Masculinisation of the ICT Industry

Research points to even professional women in the ICT industry believing that ICT competence is linked to interest and thus men will inevitably be both more competent and more interested (Sefyrin, 2005). There is a male-dominated, male students’ own clubhouse discipline (Margolis & Fisher, 2002, Strok, 1992) complete with its own locker room humour (Webster, 2005). This is an ethical as well as a practical issue (Desvaux & Devillard, 2009). Listening to women’s voices is essential to understand their needs in the work place.

The European Social Fund (ESF) funded project - Women in IT (WINIT) ran for two years from February 2004 to February 2006 (Adam et al., 2005). It involved a programme of research concentrating on women’s experiences of the ICT industry in England: whether they be moving into the industry (career choice, recruitment), moving up in the industry (pay and progression) or moving on (retention, returnees) from the industry. WINIT aimed to explore in-depth the experiences of these women and to this end a series of semi-structured interviews were undertaken to explore the ‘situated knowledges’ that structure life in the ICT workplace and provide the opportunity to explore the nuanced links between women’s domestic situations and their working lives. There was also a need for quantitative data to generate representative and valid data to be used in arguments to encourage more women into ICT (Adam et al., 2005).

The majority of women in the sample were aged between 30-34 years of age (20%) whilst the second largest age group (16%) were aged between 25-29 years of age. This reflects the predominance of young people within the industry (Platman and Taylor, The World Bank, 2009, 2004). In terms of ethnicity, the majority (91%) were 'White: British, Irish, Other white' with 'Chinese or other ethnic group' being the second largest at 4%. Five percent of respondents considered themselves to be 'currently disabled'. In terms of living arrangements, 59% were living in a couple which incorporated being married, remarried and co-habiting. In terms of personal income, drawing on 92 responses, 21% were in the £31,000 to £35,000 bracket, with 12% in the £36,000-£40,000 bracket. Five percent fell into the lowest income bracket (£0-£9,000); whist 7% placed themselves in the £60,000+ personal income bracket (Griffiths et al., 2005). These figures demonstrate the wide range of income levels possible within the ICT industry but a range that also demonstrates the gender disparity in managerial and senior roles (Grid Talk, 2009, The World Bank, 2009).

In Australia, The Association of Professional Engineers, Scientists and Managers Australia (APESMA) found that more than 25 per cent of professional women reported a pay disparity with their male counterparts. For women with business qualifications and those in senior management positions, the figure was much higher at over 40 percent (Rossi, 2007). Available data indicates that women are conspicuously absent from decision making structures in both developed and developing countries (The European Commission, 2009). These structures include boards and senior management of ICT companies, senior management and advisors of policy and regulatory organisations, organisations setting technical standards, industry and professional organisations such as the Internet society, national policy and regulatory organisations, line ministries responsible for the ICT sector and international development organisations and agencies (The World Bank, 2007, The World Bank, 2009). There are still 22 companies in the FTSE 100 that have all-male boards (The Women and Work Commission, 2009).

For Chinese women the work profile appears more positive at first glance, exposed as they are to more opportunities for professional and personal development than ever before and in terms of career choices for female university/college graduates, ICT ranks as the most popular career choice compared with other industries. Chinese students of both sexes have more positive behavioural attitudes towards ICT than British students, coupled with more use of the internet (Graff et al., 2002). The ICT related jobs in which Chinese women predominate: Public Relations, marketing, sales and administration, however, are 'preferred' by them to manufacturing, development and research. Despite this disparity of gendered roles within the ICT industry, the average income of women is 5 – 15% higher than their peers' income in non-ICT related jobs. There remain barriers, however, to women's career development in the ICT industry that have strong similarities to their European counterparts. Chinese women constantly have to juggle work and family commitments. In addition to looking after their precious 'only' child, husband and elderly parents, they also need to compete with their male peers at work. Long working hours present problems to their wellbeing and family lives (Desvaux & Devillard, 2009). Family responsibilities often prevent them from business travel and consequently affect their job roles and career advancement. For these reasons, the number of single women in the ICT industry is increasing (Black et al., 2005).

Similarly, 81% of the women questioned in the WINIT project were either no longer or not caring for children at home. There clearly existed some level of frustration with the lack of a range of options available to working mothers, with 'flexibility' sometimes offering little more than added pressure as women continue to disproportionately undertake the 'burden' of care (Adam et al., 2005). In Europe, more than 40% of women who do not work outside of the home aged 25-54 do not do so due to family responsibilities, compared with less than 4% of inactive men. In contrast, there is no gender disparity between women and men who do not work due to sickness/disability, education or retirement (Grid Talk, 2009).

In addition, those women that work part-time, a relatively rare option within the UK ICT industry, can suffer from diminished career progression prospects and a possible deterioration in the respect they receive from fellow full-time, usually male, workers (DTI, 2004). Women who completed the WINIT questionnaire were keen to comment on their experience of working in the ICT indudsty. A respondent suggested:

> It's all about confidence, especailly around men, sometimes I tend to take a back seat espeically in my environment you have to see yourself (sic), I think you almost have to have more arrogance. That doesn't come naturally to me
>
> (Adam et al., 2005: 289).

WINIT results indicate that 73% of the participants had a male line manager, reiterating that there is a gender imbalance occurring at some stage of the progression process, few role models and a top-heavy male 'club' membership (Adam et al., 2005). Occupational segregation remains the norm (The Women and Work Commission, 2009). These differences in roles, power and pay both are a product of and perpetuate 'pipeline shrinkage'. Women in male dominated industries are expected to perpetuate the model of masculinity in the workplace (Desvaux & Devillard, 2009, Atwater et al., 2004).

Without listening to these female voices, gendered occupational cultures will still flourish with a belief that belonging to the workplace and being, for instance, a ‘real’ ICT engineer, systems analyst or manager entails the enduring symbolic association of masculinity and technology with prevailing images of masculinity and power (Faulkner, 2005). There remains a progressive, rather than declining, tendency for ICT environments, as computer science has become strategic for economic development, to become more mathematically and “tough” sciences oriented. This trend further exacerbates the guilt and inadequacies that affect women’s attitudes due to their perceived incapability in technical fields, without considering the cultural disadvantages and the male-orientation of technologies (Black et al., 2005). Attitudes to working in the ICT industry have as much to do with the low relative numbers of women in ICT than with the symbolic association of ICT and masculinity. Measures which directly increase the relative numbers of women in ICT to achieve a ‘critical mass’, could change attitudes but the relative isolation of those women who do work in ICT means they experience the sector as a ‘chilly culture’, and this contributes to the ‘leaky pipe’ problem of poor retention. Ironically if the emphasis is only on redistributive research, demonstrating the under-representation of women statistically, rather than on recognition research that exposes the gendered nature of ICT, then the problem of the attrition of women from the ICT Industry will be enduring (Desvaux & Devillard, 2009, Gracia-Luque & Stein, 2005).

Networking and role models are important ways of empowering women in ICT occupations; but corporate measures, such as more employee-centred flexible working arrangements, are also needed (Desvaux & Devillard, 2009, SIGIS, 2004). Students at the University of Bergen, in Norway, were found to actively report a change of attitude to computing, repudiating their belief that it was 'masculine' as a 'lie'. This was due to the majority students on the course being female and the female role models presented by the lecturers (Corneliussen, 2005).

The work place profile of participants in the ICT industry, however, continues to be not only typically male, but also young, in their mid-twenties, and without domestic responsibilities. Contracts are predominantly full time and permanent with an ethos of 'total availability'. A European research project – Widening Women's Work in Information and Communication Technologies (WWW-ICT) found that even in countries with controlled working hours, ICT companies tended to be an aberration with working patterns that exceeded the norm and with pay frequently linked to performance (Webster, 2005).

> Certainly, in the company there would be an expectation that when you reach the senior level that you are available all the time
>
> Senior engineer in Irish ICT Company (Webster, 2005:11).

Moreover, managers frequently determine career development by an additional workload beyond the working day (Desvaux & Devillard, 2009, Webster, 2005). In the US, networking is an ingrained aspect of the ICT business culture with both promotion and client acquisition reliant on its power. Women are able to do so successfully yet research indicates that women do not benefit from networking as much as their male counter parts, with additional professional activities having a negative effect for the careers of women but a positive effect for men (Desvaux & Devillard, 2009, Grodzinsky & Gumbus, 2005). In the private sector organisations, a lot of project-based work can include potentially lengthy periods at customer sites, as well as long days and weekend work. As Australian employees noted:

> When we were delivering...the whole group was here every weekend till midnight... they'd be lining up for overtime once they hit 40 [hours]...that's the environment we work in... there are key people ... that work [long hours] constantly because they're delivering to the client... they work around the clock if they need to
>
> (Diamond & Whitehouse, 2005: 5).

There is an inevitability that that this pattern of work and promotion will affect the attitude of female workers (and some male) who need to be more flexible in their working hours and who will be disadvantaged by long working hours. Flexible working arrangements boost productivity; enhance employee satisfaction and employer's reputation. The fact that far more women than men make use of such arrangements, however, creates a gender imbalance, which has a negative impact on women's position in the workplace and their economic independence (Desvaux & Devillard, 2009, The European Commission, 2006, Diamond & Whitehouse, 2005). The most common change in working practices due to childcare is a shift to part-time work, a move to a different company or a move to a different role.

Behind these changes in working practices lie nuanced gendered experiences and gendered patterns of work and care. The continued low status of 'flexible' (but ultimately 'feminised') part-time work and the curtailing of female part-timers' career progression associated with this problem of perceived low status is one example of this phenomenon (Griffiths, 2005). Moreover, work such as services or caring work within the industry itself is unseen. It does not produce a tangible product or because the work is in some way non-standard or non-routine and as such is not visible to the 'club'. There is evidence of the segregation of men and women in information systems and strong gendering of certain areas of information systems work. Women's achievements are not recognised and the power structures within the occupation keep them alienated (Turner 2001). Yet the lack of women in all aspects of the ICT Industry, including Programming and Software development and as interface testers, affects the productivity and creativity of the industry (Desvaux & Devillard, 2009, Turner 2005).

Academics describe even the internet itself as conceptualising masculinity in its reliance on anarchy, the frontier, democracy and community in its most liberal, unaccountable form that is on absolute masculine terms (Kramer & Kramarae, 1997). This masculinity, however, relates generally to its design features rather than its actual use. Throughout the developing world access projects (Derbyshire, 2003) have found that the internet gives previously unimagined freedom to female students, both socially and academically, liberating them from the restrictions imposed by cultural norms. By evaluating, questioning and interrogating how ICT is used in order to establish new conventions and ways of working, an ethic of openness could be established in both ICT teaching and the ICT industry, bringing the whole notion of male dominance into the study of, and debate on, ICT (Grundy, 2005). This will enable women to discuss openly their attitudes to ICT and its limitations for women. The lack of pluralism inherent in the internet is evident in that ethics plays little part in most academic ICT study. Computer dissertations usually do not require students to include ethical issues in any depth and almost certainly do not require them to provide any gender analysis. Often an extended computer program is sufficient for a dissertation, with no theoretical social and ethical analysis of the environment for which the program is written (Turner, 2005).

There is some consensus that the future for ICT development should be shaped by human values rather than be only driven by the technology itself. Along with class and race, ICT must include gender equality and the empowerment of women (Desvaux & Devillard, 2009, Marcelle, 2002). That this is the case in developing countries has been contentious. It has been argued that development should deal with the basic needs of all the people first before looking at the gender divide in ICT. International Development agencies, however, do perceive ICT as a key element in meeting women's basic needs and should provide the access to resources to lead women out of poverty (The European Commission, 2009, Gras-Velazquez et al., 2009, The Women and Work Commission, 2009, Hafkin & Taggart, 2001).

Ironically, in the Western world, the computer industry emerged in a parallel time period to the rise of the women's movement, yet women have lost ground in the world of computing (Clegg, Trayhurn and Johnson, 2000, Leverson, 1990). Only in the field of Artificial Intelligence (AI) have women made a significant research input on par with men. Female students with strong mathematical and linguistic backgrounds find an environment with associations that differ from the stereotypical world of computer science or engineering offering challenging roles for women, with less 'baggage'. Furthermore, AI has connections with cognitive psychology, perhaps, according to Strok (1992) tuning in to women's capacity for introspection and verbal dexterity. The combination of analytical and creative work attracts women to the computer industry, coupled with the potential to work with clients to transform their needs into a technological outcome (Webster, 2005). The ability to succeed in computer related programmes is not inherent to the male gender, yet qualified women are not attracted and retained in all levels and in all fields of the ICT industry (Grid Talk, 2009, The World Bank, 2009).

2. 3 Gendered Beliefs and Attitudes to ICT

Female university students are often loathe to enter into what they see as a world not only male dominated but a world dominated by a 'hacker' subculture, in which joy, play, fun and love – life itself- are wrapped up in an intense, singular focus on computing and the computer itself (Margolis et al., 2000). It is a culture that alienates women and those who do enter, leave more often than their male counterparts (Fisher et al., 1997) leave. Women perceive working in ICT as an environment marked by 'smelly anorak,' (Turner, 2005a) sociopathic behaviour involving programmers working frenetically late into the night, experimenting with systems, treating computing problems as leisure pursuits and displaying disdain for end users (Webster, 2005). Traditional gender constructions where men are positioned as being rational and logical, women as concrete and contextual, prevail (Ali, 2001). The result is a significant gender gap in this growing technological field (The European Commission, 2009, DeClue, 1997, Deboer, 1984).

Research carried out over the last decade continues to suggest that gender based attitudinal bias towards ICT develops before the notion of the subject ICT exists for children. The gender distinctions found in post war textbooks, that 'male students make things and female students use things that male students make,' appear to remain 'uncomfortably' true forty years later (Margolis & Fisher, 2002). The female Director of a Czech Republic ICT still held the archaic view that the gendered representation of women on her workforce was unproblematic as boys, 'take alarm clocks to bits,' whilst girls, 'comb doll's hair' (Turner, 2005a). Research has found that by the time they begin infant school at four or five years old, male students tend to like technology for its own sake and enjoy playing games or tinkering with computers for fun (Singh, 1997). Their experience is socially framed in a gender discourse: male game playing is working with computers, whereas women's typing is 'old' technology (Clegg and Trayhurn, 1999). These are not beliefs that necessarily will remain fixed for students but that can only be addressed by teachers if they recognise that they still exist.

Female students' beliefs and attitudes towards ICT and computers, that ultimately leads them away from studying ICT post 16, begin in early childhood in the home, rather than the schoolroom (Archer, 2004). Parental attitudes themselves would appear to affect attitude in not only the toys and gadgets they buy for their children and the role models they provide, but in the speech they use in discussion of 'scientific' issues with their children (Tenenbaum & Leaper 2003). Children's stereotypical play, the girl playing teacher, the boy playing builder, is unlikely to be challenged by parents but has significant implications for children's career choices and future earnings. Challenging these stereotypes regarding 'jobs for the girls' is key to breaking down gender segregation in the workplace and changing our gender culture (The Women and Work Commission, 2009).

US research indicates, prior to the fourth grade that the eight year old female students are as interested in technology as males but are discouraged by the adults in their lives and are constantly challenged by their male peers in class. This leaves them questioning their attitudes to ICT. Adolescent female students are thus intensely pressured to be "cute" instead of "smart," which leads to the current conflict for young women interested in sciences and ICT as Tech "geeks" are rarely considered cute or attractive (Mitchell, 2005).

In the 1990s, when designing software intended for both genders, both male and female designers tended to design using characteristics typical of software designed for males (Huff, Fleming & Cooper, 1992). Whether focusing on characterisation, layout or design, games catered for the preferences of male students with emphasis on control, choice and fast navigation, irrelevant of theme. Australian research (Singh, 1997) into gender difference amongst kindergarten students regarding their preferences to varying designs of multimedia learning interfaces was based on the assumption that a friendly and clear interface helps users to access the information efficiently and assists with motivation to use the multimedia program. A sample of 90 students (44 female and 46 male) were given a range of multimedia products with a range of interfaces to work through. They were then asked to fill in a simple questionnaire using the poll meter ruler for easier responses. Singh's findings revealed that male students were more attracted to movement whereas female were more attracted to visual aspects. For example, male students preferred a faster pace, a variety of choices on the screen and square and arrow type of buttons. Female students emphasised writing, colour, drawings, help and a calm-moderate game –not the formats of games used in their schools. Female students were marginalised not only by the content of the games but by their physical layout and construction.

With more women leading educational software companies, however, research (Koch, 1994) suggested that educational software companies were making efforts to eliminate gender stereotypes to ensure that their material was relevant and appealing to both female and male students in its 'purposeful' approach to learning. This has proved not to be the case and there remains a contention that most computer games are created for male audiences with an emphasis on the action and violence they are attracted to. The software industry continues to cater for the needs of a predominantly male audience who gain an entry point into the computing world via games and software, later taking up careers in the computing industry (Lal, 2002, Kelly, 2000).

When 37 educational software programmes in the US (19 recommended to schools and parents by the National Association for Supervision and Curriculum Development and 18 best selling titles from the 1998-99 publishers' list), were examined for visibility of male and female characters and for gender patterns in salient personality traits, higher gendered roles were still dominant. A larger proportion (47%) of the recommended titles, rather than the best selling titles (26%), had an androgynous central character and 37% of the remaining recommended titles had a male central character in comparison with 63% of the best selling titles. Although no obvious gender stereotyping was evident in terms of personality traits and roles in either set of software, two character traits were portrayed significantly differently for the two sexes: camaraderie with same sex friends was more common amongst male characters and engaging in non-traditional roles more frequent for women and female students. For instance female characters were portrayed as villains, rather than victims, hunters rather than hunted. New gendered stereotypes were perpetuated; men work better in teams but do not deviate from their 'traditional' roles as frequently as women do (Drees & Phye, 2001).

As we interact and rely more on software, it becomes all the more important that the software systems themselves reflect the ideals of interactional rules that society rests upon; a society free from class, cultural, race and gender bias. Yet given that, the prime impetus for software development has come from the US and the Far East and that their dominant cultural norms of construction are white and male/ conformist and male it will follow, therefore, that a mass of cultural and gendered stereotypes will integrate into all forms of the media and media education (Greysen, 2005).

There are two issues: firstly, the extent to which educational software exhibits gender biased stereotypes and secondly the extent to which popular software has been specifically designed to appeal to male interests. Only a glance at Lara Croft, in her leotard and shorts, demonstrates that she certainly was not designed to be a strong, female role model. Lara perpetuates the traditional male fantasy figure and is an example of how male students grow up to take positions in power relations in which they acquire the ability to define women (Weeks, 1986). She has remained the dominant female game character since her first appearance in the mid 1990s and although theoretically, designed to 'confound all the sexist clichés' she has an 'unbelievable figure', which her designer, Toby Gard, contributes ironically to the 'slip of a mouse' (Gard, 1997). A Literature Review summarising research on computer games commissioned by Futurelab (2004) points out, whether her very existence is a positive role model for young girls and women or a depressing reminder for female games players that they can never live up to her physical ideal remains contentious (Kirriemuir & McFarlane, 2004).

Female software designers when asked to design female 'agents' to lead cyber space adventures based on self portraits took only their own general features, knocked off a decade in age, sharpened features, added makeup even if they did not wear it themselves and 'homogenized' skin colour. Whether the designer was black or white, they ended up creating an agent not dissimilar from agent Lara Croft herself (Greyson, 2005). Role-playing games have also made littlie impact in challenging stereotypes as male gamers are as likely to take stereotypical female roles to play behind as male, rather than girls and women playing at all (Kirriemuir & McFarlane, 2004).

In order to encourage positive attitudes from female students toward software, there is a need to develop a model of learning interfaces to reach a gender-free learning environment (Passing and Levin, 2000). Despite the efforts of software designers to make computer games less male gender specific the female role models games encounter still include stereotypical representations of women but to counteract this there have been attempts to 'feminise' (indeed 'soften') hardware by manufacturing pink consoles, sparkling consoles to attract girls to their outward appearance at least (Kirriemuir & McFarlane, 2004).

A survey undertaken for Futurelab (Kirriemuir & McFarlane, 2004) found that although games are clearly not only exclusively played by 'intense' games players, who are more likely to be boys than girls, girls tend to lose interest sooner, using computers for a variety of reasons whilst their male peers continue to use theirs primarily to play games. However, games are packaged, girls display the same enthusiasm for the capacity of ICT to enhance presentation as male students have for games (Clegg and Trayhurn, 1999) and use the Internet as a tool for communication and specific activities rather than play or to master technology (Christie 2002, Francis, 2000, Singh, 1997). Groups of male students engage in general chat about computers and games, female students use computers to chat electronically.

The Strategies of Inclusion: Gender and the Information Society (SIGIS) (2004) project, researches into and promotes initiatives that include women in both the ICT industry and beyond the workplace. It found that female participants in The

Gathering, a computer party for ICT enthusiasts in Norway, saw their contribution to the event as differing from their male peers. Every Easter holiday 4500 computer interested young people, mostly from the age group of 14 to 24, bring their computers and get together in a large indoor sports hall called the Viking ship. For five days and nights, they play on their computers and socialise. The Gathering is most of all a social event; even though the computer is an important element, the participants most of all come there to meet up with friends and make new friends. In 2004, the ratio of female to male participants had been a constant 15%: 85% and the organisers' attempts to recruit more young women had not been successful. The SIGIS research found differences in perceptions held by female and male students themselves. When the female students described their behaviours, their attitudes led to stereotypical descriptions although their actual practices were far less gender differentiated. The female participants described themselves and are described by the male participants as 'just users' or 'chatterers', whereas the male participants are described, and described themselves as, 'programmers' and 'games players'. Yet they were all skilful and enthusiastic users and all 'used', 'chatted', programmed and played games. (SIGIS, 2004).

Ironically, the failure to emphasise ICT as a communication tool in an attempt to attract more female participation can be described as confirmation that women are not interested in ICT for the enjoyment they can find in technology (Corneliussen, 2005). This dichotomy fails to recognise the aptitude women have for using ICT as a successful tool of communication. A US 2002 study looked at the differing perceptions that middle school female students and male students hold with regard to computers. Female students overwhelmingly perceived the computer as a means of communicating to 'connect' whereas male students used it to 'compete'. In open-ended questioning, the female students described male usage in negative terms, describing their male peers as 'anti-social couch potatoes' who were poor communicators due to their preoccupation with playing computer games (Christie, 2002).

A previous study of lower secondary education in the US also showed that electronic discussions had a favourable effect on the participation of female students in classroom discussion. They liked the fact that they could personally determine the tempo of discussion, that there were opportunities for reflection and that dominant classmates could not intervene (Singh, 1997). Recent research that involved questioning and interviewing 3000 UK male and female students found that female students were more likely to own and use a webcam and to record video in order to share recordings with their friends, whereas male students were more likely to own a Wii or PSP/DS and play more games. Gaming is more popular with boys than girls, with 72 per cent of boys and 47 per cent of girls having played online multiplayer games. There was no significant difference between boys and girls with respect to access to MP3 players, mobile phones or PDAs but social networking and communication activity is more common amongst girls (Luckin et al., 2008).

Schools can aim to gain 'Digital capital' (Bourdieu, 1977), from Web 2.0 technologies, the second generation of Web development and web design that facilitates communication, information sharing, interoperability and collaboration on the World Wide Web. This technology could enable female students to mirror their enthusiasm for, and dexterity with, social networking sites in the classroom, building networks of increasingly complex on-line learning that are constructed through collaboration rather than hierarchical and masculine power structures and contexts

(Luckin et al., 2008). Their learning can take place in an atmosphere in which they can determine its pace and tempo (Schmitz & Messmer, 2005), in an environment far removed from the competitive culture that permeates the traditional ICT classroom (Gipps, 2009, Sanders, 2006, Barnes & Todd, 1995, Edwards & Furlong, 1978, Edwards & Mercer, 1987, Edwards & Westgate, 1994, Moses, 1995, Howell & Avolio,1993). Web 2.0 technology can bridge the established informal contexts which teenagers are familiar with and the formal classroom learning context, in order to create a 'third space' that fosters the team and confidence building attributes that would enhance female students' self efficacy and contribute to more positive attitudes towards ICT (Luckin et al.,2008).

Female students' preference for the use of the internet and collaboration should be acknowledged, not deemed as 'chattering' in favour of the male students' more competitive and individualistic favoured learning styles. The use of the internet in public A' Level examinations is being piloted in 13 Danish High schools with the intent to examine their ability to not only use information to answer questions but also to encourage students to sift through information efficiently and enhance research skills. Papers are submitted electronically and randomly checked for plagiarism. The pilot is proving popular with little 'cheating' and may become fully integrated into the examination structure in Denmark after 2011 (Foundation Metamorphosis, 2009).

Students' perception (rather than the teacher's) of their ability in ICT is important; their perceived anxiety while working with the computer on assignments, perceived difficulty of understanding concepts delivered in class (such as unfamiliarity with football statistics as discussed below) and perceived understanding of ICT concepts in comparison to peers (Bernstein, 1991). Christie (2002) suggests male students have a fascination for the computer as a machine in itself which female students find not only alienating but also that undermines their confidence in the classroom. Luckin et al. (2008) report that although there were no significant gender differences with respect to shared laptop access, male students were significantly more likely than female to have sole access to a desktop computer. A male student is more likely to think of the computer as 'his' and a machine that belongs to him alone, whilst their female peers have use of a portable, shared laptop with none of the connotations of ownership.

The affect of language used in computing which uses violent, masculine words to describe systems and processes, such as 'crash', 'abort', 'bull-zip', 'manual', 'defender', 'flash' and 'hardware', serves, according to Margolis & Fisher (2002) to distance female students from the subject in the mood and associations it creates. In order to create, for female students, a revolving, rather than closed, door to studying ICT (Michaelson, 2005), it is essential to differentiate not only between the disparate learning style preferences of students but also between how female and male students prefer to learn and what teachers need to do to facilitate the learning of all students.

The Edexcel Applied GCSE Exam, June 2003, contained a question, which dealt with football [statistics]. A group of 16 year olds at The Academy sat this paper in January 2004 in their ICT mock examination and the results analysis was revealing. Whereas 72% of the male students got over 50% in this particular question, only 31% of the female students got over 50%, yet the overall percentage pass rate for the female students was 59%, which compared favourably to the male 63% pass rate. This stimulus – the use of football statistics – is a territory very familiar to most male students as part of the entrenched male culture (Polley, 1998, Holt & Mason, 2000). This topic is likely to appeal more to male students than most female students and therefore is likely to alienate and depress female achievement. Subtle gender bias continues to affect female students' sense of self, such as the seemingly biased EDEXEL question illustrated above. Computer-related learning will only be more effective if gender differences in computer-related interests and learning styles are taken into account in teaching arrangements and materials.

2.4 Comfort Levels in the Classroom

Female students' intentions, attitudes and behaviours are influenced by comfort level; a measure of how much anxiety one has in the ICT environment as shown by a number of pertinent factors.

In a comprehensive review of studies assessing female students' comfort levels, anxiety and self-efficacy internationally, over a twenty year period, Sanders (2006) found that a high level of consistency. Female students' 'confidence level [was] significantly lower than that of males even when females were more successful than the males in the class,' (Sanders, 2006:11). Researchers suggest that the context in which ICT is delivered – the ambiance, ethos and atmosphere of the classroom - directly affects how students learn (Margolis & Fisher, 2002). The ambiance created in the classroom has a direct relationship to comfort levels and this in turn will enhance student achievement and attitudes (Wilson, 2008). Dimensions of the environment, which students identify as unsatisfactory, may be of interest to teachers who wish to improve the learning experiences of their students. The students' ability to communicate - both question and respond to questions - is key to their comfort level, which in turn influences their approach to learning, whether in class or after school.

Little attention has been paid to the difficult and fundamental issue of how best to design effective learning experiences, which integrate ICT successfully into classrooms in ways that engage both male and female students. The British Government has invested large sums of money in its Curriculum Online initiative (DfES, 2001), which aims to bring high quality online materials into every classroom from Key Stage 1 to Key Stage 4. However, the issue is how to use them to maximum advantage to enhance learning for all students taking the learner and learning styles as its focus. They can be used as tools to facilitate learning, promote rapid dissemination and subsequent discussion but its successful implementation is in the hands of the teacher (Goodison, 2003).

Significantly, for schools, 318 UK female students questioned over a two-year period on their attitudes to ICT and careers in ICT were found to have little interest in the subject. Those students who were interested were attracted to the nature of working with computers, felt it would be satisfying to use computers to solve problems, were supported by their parents and, crucially, felt comfortable about working in what they believed was as a male-dominated field. Their attitudes were positive about ICT work and the workers themselves, describing them in terms such as, 'interesting, hard-working, smart and creative'. An important finding affecting both female students who were interested in ICT as a career and those who were not , however, was the lack of information easily on offer regarding ICT as a career. Unfamiliarity with the field, the failure actively to pursue information about a range of career options and dependence on the opinions of parents are key reasons why female students express their intention to avoid ICT as a career choice (Creamer et al., 2005).

This 'unfamiliarity' is not experienced by male students who feel confident to dominate a classroom environment, even when sitting at desks, 'sprawling' to take up more space (Francis et al., 2006). Participant observation in Australian primary schools showed very young female students angered by what they perceive as a constructed male technocratic mastery, reinforced and perpetuated by the male classroom teacher, initially based on a confidence with software (Singh, 1997). In 70% of Finnish schools, textile work and technical work directs primary school students towards the gender divide in 70 percent of schools. In these schools almost all students working in textiles are female and in technical work, male (Vehviläinen & Brunila, 2005). Costa Rican research studied how female and male students think about and use computers in primary school across grades K, 2, 4, and 6. The research methods used included observation of classes, semi-structured interviews with teachers and students and attitude-based questionnaires. Key findings were that: students generally have a positive attitude towards computers although female students both like computers less and are less confident of their ability to use them than their male peers and tend to be more anxious about the ICT environment. Teachers, parents and students behave towards male students in ways that encourage them in computer use. Thus, the ICT classroom is a microcosm of Costa Rican society in that gender roles and expectations of the wider society are reinforced in the school computer labs (Huber & Scholfield, 1998).

Female and male students bring attitudes and beliefs to their ICT classrooms that can be further entrenched by their learning preferences and the teaching styles delivered in those lessons. These attitudes and beliefs are examined in detail in the Chapter 4.

2.5 Learning Styles and Pedagogy

That differing learning styles are appropriate for some students and not for others has influenced pedagogy for over 30 years and has been a subject of some contention. Polarised opinion exists within the teaching profession with regard to learning styles. One extreme enthusiastically perceives planning to use a variety of learning styles within a lesson as an exciting educational 'fix', the other deems them a 'fad' to use as an excuse to retain teacher centred teaching styles, rejecting the models as the consequence of flimsy qualitative research (Coffield et al., 2004).

A number of categories of learning style models have been devised, some in parallel. Coffield (2004) groups them into five categories: constitutionally based models, cognitive structures, personality type, learning preferences and learning approaches or strategies.

Constitutionally based models rely on the premise that we have inherent personality characteristics that determine how we learn. These characteristics, according to these models, are as genetically predisposed as the characteristic of being either right or left handed. The constitutional theorists maintain that these characteristics are generally fixed and therefore teachers should match students' learning style preference to a range of teaching styles (Coffield et al., 2004). Learning style theorists who base their models in cognitive structures focus on the interaction between cognitive controls and cognitive processes (Riding & Rayner, 2005). Like constitutional theorists, cognitive theorists see learning styles as generally fixed and at the root of most human behaviour and ability. Personality type theorists perceive learning style as a factor of personality and that personality types themselves can be grouped together. Learning preference theorists differ in that they do not perceive learning styles as a fixed trait but, at times, more fluid, changing, slowly, from context to context and influenced by culture and experience. Finally, learning approaches or strategies are propounded as holistic theories of learning, rather than as styles of learning that, again, may vary, but in this model according to task, rather than a wider context (Coffield et al., 2004).

These differing models all share a limitation in that they tend to be reliant on students self-reporting their preferences for a particular learning style and their consequent measurement, rather than on observation of students in actual learning environments. Learning style theories that do pragmatically begin to look at actual classroom organisation, however, are those based on instructional preference (Riding & Rayner, 2005). These include Dunn and Dunn's (1974) Learning Style Inventory (LSI), a constitutional theory and Reichmann and Grasha's (1974) three bipolar Learning Style dimensions, a learning approach (Coffield et al., 2004).

In a number of papers published from 1974 onwards, Dunn and Dunn proposed that learning styles are the way in which students' biological and developmental personal characteristics mean they prefer to learn in different ways and in differing environments. Their sources, however, are diverse and their learning preference theories are rooted in sociology and neuropsychology rather than the classroom itself (Coffield et al., 2004). They developed a Learning Style Inventory (LSI) that identified a range of elements that affect individual learners in order to maximise their learning by matching a personal preference to their stimuli. The elements identified in the LSI are: environmental (light, temperature, design); emotional (structure, persistence, motivation, responsibility); sociological (pairs, peers, adults, self, group, varied); physical or modality (auditory, visual, tactile, kinaesthetic perceptions) and psychological (impulse, reflection, analysis). Dunn and Dunn developed the LSI through the analysis of 104 item self-reporting questionnaire with a three part Likert scale completed by American students between the ages of 9 and 18 (Riding & Rayner, 2005). Subsequent research, following the development of the LSI, acknowledged the fluctuation of students' emotional response but claim that teachers matching students' learning to their contextual stimuli produced enhanced academic results (Coffield et al., 2004). Research studies using the LSI consistently conclude that there are differences in learning preferences between groups of learners and although few LSI studies have focussed on gender differences those that have done so have found differences do occur (Hlawaty, 2008, De Paula & Hlawaty, 2002).

Although many researchers have utilised the LSI model, strengthening its reliability and validity, there has not been a wholly independent verification of either Dunn and Dunn's theory or any of the preceding, and often complimentary theories that have developed, often in tandem (Riding & Rayner, 2005). Specifically there has been little comprehensive validity for the physical or modality theory of learning styles-students' preference for auditory, visual, tactile or kinaesthetic learning and the relationship between those learning styles and academic achievement, rather than students' perceived understanding of topics when they are working in a particular way in class (Coffield et al., 2004).

Parallel to Dunn and Dunn's LSI, Reichmann and Grasha (1974) identified three bipolar dimensions in a model that describes a student's approach to their learning context. These dimension can be described as: participant-avoidant – the variance between learners' engagement and disinterest in the classroom; collaborative-competitive – the differing attitudes students hold towards working either cooperatively or competitively and independent-dependent – the differing relationships students hold towards their work and its independent completion or reliance on teacher support and scaffolding throughout their learning. Again, the theory was tested using a self-reporting questionnaire but the 6-part sub-scale led to some ambiguity in the findings (Riding & Rayner, 2005).

Despite the lack of coherent validation of learning theories based on instructional preference, the acknowledgement that some learners do have preferred ways of learning, as reiterated in this research study in the students' response to both The TpB Questionnaire and during semi-structured interviews, has led to implications for pedagogy. The stronger the learning preference, the more important it is for teachers to evaluate their own teaching so as to maximise all their students' potential. This is something that is possible for all teachers to incorporate into their teaching and a positive affirmation that all students have the potential to learn (Coffield et al., 2004). This research study goes beyond identifying the perceived learning preferences that specifically relate to preferred learning in ICT lessons, to assess, through The TpB Questionnaire and semi-structured interviews, students' attitudes towards their learning, specifically the study of ICT. It suggests for teachers what the link between learning style preference and post 16 destinations may be through a quantitative analysis that goes beyond the students self-reporting their preferences.

2.6 Learning and Teaching in our ICT Classrooms

Female students' ability to succeed academically in ICT has been confirmed by published data from The Department for Children Schools and Families (Ofsted, 2009, The DCSF, 2007, The Telegraph, 2007, Gras-Velazquez et al., 2009). Their lack of engagement in the subject and their attitudes to ICT that result in the behaviours leading to pipeline shrinkage is not, however, mirrored by their academic success. Despite their actual ability in the subject, nationally gaining GCSE and A' Level results that supersede male students (Ofsted, 2009, The Telegraph, 2007) female students have lower self-efficacy and therefore their self-esteem, self-confidence and perceived ICT knowledge is weaker than their male peers'. The Theory of Cognitive Behaviour (Beck, 1976) begins to explore this superficial contradiction. According to Beck, female students' lack of confidence in ICT may have arisen because of how they have interpreted their experiences prior to, and during, their study of ICT at an unconscious level. No one is fully aware of the significance and influence of their current cognitions, emotions and behaviours. Therefore, the influence of these unconscious control beliefs may lead to the under representation of female students in the study of ICT post 16 and beyond into the ICT Industry.

Although their lack of engagement with ICT as a subject may be rooted in beliefs and attitudes derived from a wide range of influences and experiences, female students are still able to adopt a problem focussed response to their ICT study (Watson & Hubbard, 1996). Regardless of the subject focus, many female students score more highly on measures of conscientiousness than their male peers. They may display, therefore, far greater characteristics of organisation, care, dependability, self-discipline and achievement orientation (McCrae & John, 1992). They strive to achieve academically regardless of their intention not to study ICT post 16 and do not use escape-avoidance strategies (O'Brien & Delongis, 1996) to fail to complete course work or revise for examinations; ironically strategies that their male peers who achieve less well academically but are more positive regarding ICT, may be adept in.

It is important, therefore, that teachers work towards female students being able to reinterpret their experiences during their study of ICT by utilising a range of learning styles and teaching methods to create varied and interesting lessons. This should entail engaging all learners, irrespective of ability, prior experiences or gender rather than rely on a limited number of teaching or learning styles (Gipps, 2009, Sanders, 2006, Arnot & Gubb, 2001, Barnes & Todd, 1995, Galton, 1995, Galton & Williamson, 1992). This has not been the case with regard to the delivery of ICT in that female students persistently fail to engage with the subject and make gendered GCSE option choices that lead to the attrition of women and men from particular industries including women from the ICT Industry. The 20th Century gap between gender and power balance in British industry is not only perpetuated but also new inequalities are evolving (Gras-Velazquez et al., 2009, Grid Talk, 2009, Volman and Eck, 2002).

Concerns regarding the competitive, 'club house', environment of the ICT classroom that female students find alienating has long been a documented cause for concern. Her Majesties Inspectorate, (HMI, 1980), reported that in single gender female students' schools, students were performing better than the national average in computer science but in mixed schools they worried about appearing 'stupid' in front of the male students. The report concluded that, 'it is obvious that preparation for technical confidence and competence for Female Students must begin as early as possible.

Decades later, there remains a general research consensus that female students often find the ICT environment to be hostile, preferring auditory and observational learning activities where social interaction is encouraged, rather than kinaesthetic and tactile learning styles that male students prefer and that tend to dominate ICT classrooms (Christie, 2002). In most ICT classrooms competitive, 'independent' learning in front of the computer screen, with little interaction or collaboration has long been the norm (Barnes & Todd, 1995, Edwards & Westgate, 1994, Howell & Avolio, 1993, Moses, 1995, Edwards & Mercer, 1987, Edwards & Furlong, 1978). In work with many schools across a number of Education Authorities, the author has observed that most ICT lessons are constructed around students working alone, in front of their computer screen, punctuated with teacher centred instruction and some rapid closed questioning. This way of working cognitively suits male students as the fast pace of competition and limited processing time allows them to offer short, quick answers. This gives a superficial impression that male students, therefore, process information more effectively; however, the evidence is that female students usually process a more rigorous, thorough response (Riding & Rayner, 2005).

Female students' preferred learning style has been repeatedly found to be that of communication, discussion and collaboration to create new dialogues and ways of thinking (Schmitz & Messmer, 2005, Christie, 2002, Lally & Barrett, 1999, Lacey et al., 1998) ICT, being itself not intrinsically gendered, is an ideal focus for effective collaborative group work (Gracia-Luque & Stein, 2005, Loveless, 2003, Wegerif & Scrimshaw, 1997).

Collaborative work encompasses both teaching or learning method and can incorporate all forms of student centred learning (Westwood, 2006) regardless of gender. Student centred collaboration allows for a wide range of classroom practice that focuses not only on the situational context of the lesson but also the emotional experience of learning that is a shared, encouraging experience for all students, regardless of gender (Hori & Ohashi, 2005). Consequently, stereotypical roles, responsibilities, attitudes and salient beliefs with regard to the subject, can begin to be changed (Cruddas & Haddock, 2003, Bennett & Dunne, 1992, Galton & Williamson, 1992). Key to all learning and teaching styles, however, are the scaffolding and structures provided by the teacher. This will ensure that learning does not perpetuate stereotypes but allows students to learn in ways that are specifically relevant for them (Westwood, 2006, Dolmans et al., 2001) rather than determined by, in ICT, a male dominated pedagogy. Teachers must ensure that solutions and conclusions are not drawn too quickly and that pairs or groups are constructed to best support turn taking and equitable discussion. Roles need to be assigned with care in order to avoid replicating a learning environment that is dominated by the machismo of male students (Davies, 2003, Nayak and Kehily, 1996).

Students need to understand not only what is demanded of the Learning Outcomes but also the process required to achieve those outcomes (Westwood, 2006). The student centred learning styles that include Discovery Learning, Resource Based Learning, Problem Based Learning and Project Based Learning have specific features and individual advantages, but all entail students seeking solutions to problems that are intrinsically more motivating to individual learners and can lend themselves to collaboration and discussion if that learning method suits the participants (Westwood, 2006). Both Problem Based Learning and Project Based Learning can entail tasks that are, to varying degrees, open-ended, process-based and related to realistic situations. If planned and modelled effectively by the teacher, students' motivation will be high and many forms of communication, collaboration and representation undertaken at different points in the learning. Learning, therefore, is not traditionally (and usually in the ICT classroom male) teacher led (Dolmans et al., 2001) but transmitted through a deeper understanding achieved through choice and decision making (Westwood, 2006). Problem Based Learning, or issues based learning, has the added benefit of introducing students to more realistic, exciting 'case study' approaches to ICT and may begin to establish female students' associations with the subject area and industry that are removed from their perceptions that it is populated by 'smelly anoraks' (Turner, 2005a) and 'geeks' (Mitchell, 2005).

Female students who are immersed in Problem Based Learning; generating ideas, identifying information, establishing short term goals, allocating tasks and making recommendations (Westwood, 2006) are constructing their own learning cultures that are far removed from that of the traditional hacker culture and 'locker room' atmosphere of the ICT environment (Webster, 2005). Task Based Learning similarly allows female students to create their own scenarios in the classroom that re contextualises ICT, removing its masculine connotations for female students and giving them more autonomy and confidence in an area where they perceive male students to have an intellectual dominance (Black et al., 2005).

Task Based Learning can create a learning environment that is both comprehensive and inclusive (Westwood, 2006) in order to support all learners regardless of their ability or, importantly in this study, perceived ability. The Cognitive Learning Strategy or Task Based Learning can also be used effectively by teachers to circumvent the competitive environment of the ICT classroom as it allows learners to approach systematically their own learning, whether independently, in pairs or in groups, in a planned and strategic way. Female students, working either alone or together, can monitor or regulate their own learning in order to identify and plan for that learning. This gives individual, or groups of, students contextualised control and eliminates any perception of other, usually male, students being more capable (Westwood, 2006).

Students working towards a common goal promote self-confidence and autonomy that, in turn, benefits the group as a whole (Hori & Ohashi, 2005). The challenging Cognitive apprenticeship teaching style combines mentor or peer coaching in the classroom. Like Task Based Learning, Cognitive apprenticeships have the benefit of creating controlled and realistic scenarios in the classroom that again allow female students to experience ICT positively, negotiating meanings without threat or competition (Edwards & Mercer, 1987). This is a personalised learning style that has learning benefits for both student and coach but is teacher demanding in that it requires the teacher to think very deeply themselves regarding the cognitive and metacognitive demands of the task (Westwood, 2006). In doing so teachers can challenge their own attitudes and beliefs, discussing individual learning with students and mentors and assessing female students' achievements in isolation from the whole class competitive arena that can create the perception, for both teacher and student, that male students dominate (Li, 1999).

Collaborative learning benefits not only female students in subject areas labelled as stereotypically male but also male students who have expectations of their own gender norms and roles in the classroom. Embedding a culture of discussion and collaboration in the classroom can serve to break down the perception that elaboration and exemplification in classroom discussion is feminine and to be derided by casual quasi homophobia that impedes the learning of both genders (Davies, 2003, Nayak and Kehily, 1996). An organisational fusion of both teacher and student centred teaching and learning styles will produce the most effective lessons for all learners (Westwood, 2006, Stevens & Slavin, 1995, Pollard et al, 1994 Hembree, 1992, Johnson & Johnson, 1990, Croll & Moses, 1988, Peterson, 1988).

To retain the narrow perception of what ICT often constitutes- a log on/log off format with independent, competitive, fast paced learning, the 'traditional' approach to learning in ICT (Arnot et al., 1998) - will only seek to further disengage most female, and some male, students. The belief will be perpetuated that the culture of the ICT classroom is 'obsessive' (Francis et al, 2006, Myhill & Jones, 2006). Collaborative and student centred learning that incorporates peer coaching and modelling can also work towards circumventing the lack of female role models in ICT classrooms. Although male teachers predominate in the subject area (Clegg & McNulty 2001) students have no preference for either teacher gender in any subject area (Ashley, 2002). The importance of strong female models in ICT has been stressed as has the impetus both nationally and internationally to increase the participation of female students in the post 16 study of ICT and beyond (Donaldson,2009, Gras-Velazquez et al., 2009,Ofsted, 2009, Reding 2009, The Women and Work Commission, 2009). The TDA has however, actively promoted the recruitment of more male Trainee Teachers at Key Stage 2 (Ashley, 2002, The TDA, 2002). This encourages the idea that male students will benefit from more male role models (Buren, 2001, Ball, 1994) and ignores the importance of female role models for both male and female students (Myhill & Jones, 2006).

2.7 Single-Sex Schools: An Answer to 'Pipeline Shrinkage'?

Gender dualism was built into the framework of post-war English education and for many years went unchallenged. In the 1970s and 1980s, equal opportunity and antidiscrimination policies tackled economic forms of sex discrimination. Affirmative recognition, however, focused on the shifting of attitudes rather than structures, reinforced through pedagogic/curricular projects aiming to create 'girl friendly schooling' (Arnot et al., 1999) and, for over thirty years, there has been debate regarding gender grouping in schools.

Whilst the under participation of female students in ICT post 16 and beyond is a concern, their academic attainment up to the end of Key Stage 4 is not. This was not always the case. In the mid 1970s the concerns regarding the under performance of female students led to single sex classes in mixed schools and girl-only positive action programmes, especially in vocational and academic courses in sciences and technology, to address the anxieties and 'special needs' of female students as a group. Female students had been marginalised in the education system. Their every day experiences, in the mixed gender classroom and playground, impacted negatively on their self-esteem and experiences. Schools challenged male sexist language, behaviour and values, encouraging students and staff to value female students' achievements (Francis & Skelton, 2005). The use of gender categories within radical feminist pedagogic initiatives, which explored women's ways of knowing, their knowledge, reasoning and values, reinforced the need to focus positive action on improving female as distinct from male students' chances. Following key studies of classroom discourse in the 1980s identifying the dominance of male students in the classroom (Spender, 1982, Stanworth, 1981), teachers were encouraged to primarily consider gender in designing anti-sexist projects to value and affirm female experiences and standpoints.

There were, however, contradictions in the anti-sexist work that went on in schools during the 1980s and early 1990s. Projects such as those reported by Arnot (2006) and Arnot et al. (1999) may have actively sought to promote female students' voices, particularly white, middle class voices, in the classroom, eliminate overt sexist language and images in teaching materials and texts and recognise overt stereotyping but the existence of a dominant male school culture was not actually challenged or addressed.

Transformative gender equality strategies were rooted in feminist sociology, rather than in the classroom. The contradictions between equality and difference, consequently, were recognised but remained in classrooms and the perception was that as long as female students were given the same opportunities, attention and time as male students they would flourish. Female students were the problem and their education was the solution (Arnot, 2006).

In the 1990s the increased impetus of league tables and target setting led to the statistical exposure of gender difference in examination results and the transparent evidence of male students' underachievement and, 'the failing boy' (Epstein et al., 1998). Gender educational policy and research took a 'boy turn' (Weaver-Hightower, 2003b). The affirmative recognition remedies used to encourage Female students in the early 1980s were colonised, inverting them in the name of male students in response to the caricatures of the 'successful' female pupil and the 'failing' male student, with the wide range of other learning behaviours being ignored (James and Myhill, 2004).

Due to affirmative recognition with remedies that are 'boy-focused', researchers have noted pedagogic and curriculum shifts in the UK. There is a greater structuring of learning as exemplified by competitive target setting, the removal of free revision periods and study breaks and increased mentoring, monitoring and surveillance (Arnot and Gubb, 2001). Ironically, however, this increased masculinisation of schooling with its tighter surveillance potentially increases male anxieties in a competitive context in which gender identities are based on being successful (Skelton, 2001). Attention is now refocusing on the classroom gender dynamics and the continuing conflict between teachers and lower-achieving working-class male students, which not only affects male students' confidence to learn but also damages female students' chances of gaining help, attention and self-esteem (Arnot and Reay, 2006). This is a classroom culture that alienates both female and male students who do not conform to the 'laddish' stereotype as not only female students (Francis & Skelton, 2005) but also some male students defer to the dominant male environment and culture (Younger & Warrington, 2006, Ball & Gewirtz, 1997). Teachers further perpetuate this environment by failing to challenge attitudes and behaviours that reflect the casual sexism, homophobia and racism of the dominant male students (Younger & Warrington, 2006, Kenway & Willis, 1998).

In schools and classrooms, 'new' affirmative recognition remedies reinforce masculine cultures at a time when hegemonic masculinity as a gender form has been revealed to be one of the major features of male resistance to academic achievement (Weaver-Hightower, 2003). Traditional masculinity is frequently seen as negative and perpetuating bullying, 'laddishness' and stereotypes based on machismo, male bonding and bravado (Frank et al., 2003, Frosh et al., 2002, Martino & Pallotta-Chiarolli, 2003). If left unchallenged by liberal affirmative politics, as in the previous decades, this 'laddishness' is a device that male students have used to cope with, in their perception, the increasingly oppressive competitive curriculum. Alongside the degeneration of traditional working-class communities, their attitudes to the curriculum contributed to the underachievement of white working class male students. Rather than deconstruct this masculinity, teachers work these preconceived social and/or biological discourses around gender difference. These are fed less by observations about what is essentially 'female' but more by what is essentially 'male' (i.e. not female), including male preferred learning and assessment styles. Male biological vulnerabilities merge with psychological insecurities and immaturity, and both feed, and are fed, into observed impressions about male learning difficulties, motivations and disaffection (Arnot, 2006).

The 'problem' with male students as dislocated from society is situated strongly within recuperative masculinity politics rather than within gender-relational debates. The development of boy-oriented curriculum materials, the tendency to exemplify issues through cross-curricular technology, sport, bravado, competition and the development of "boy-friendly" teaching approaches all sit centrally within this agenda (Martino & Meyenn, 2002). Promoting technology to engage male students across the curriculum is premised on the assumption that male students are "naturally" inclined to enjoy technology-based activities. This "common sense" notion, however, ignores the ways 'masculine' contexts like sporting fields, mathematics classrooms or technology labs tend to legitimise a particular form of masculinity. Consequently, technology is immersed in gendered practices that perpetuate narrowly defined masculine norms to the exclusion of females and multiple expressions of masculinity. Thus, schools may actually be perpetuating inequity at the same time that they are attempting to redress it (Wallace, 2006).These concerns have been contextualized in recuperative masculinity agendas. Within school contexts curriculum, pedagogy, and organisation from male students' perspectives have been prioritised and the fundamental nature of female and male students have been generalised without regard to sexuality, ethnicity, class or acknowledging the very real needs of particular female students currently being failed by the school system.

The academic achievements of female students have erroneously perpetuated the myth that the teaching and learning methods that benefit male students will necessarily also benefit their academically more successful female peers (Francis & Skelton, 2005). Their disengagement and dissatisfaction is 'hidden' (particularly that of working class female students) and the situations and influence that lead to female students' attitudes and choices ignored (Plummer, 2000, Younger & Warrington, 2006). Many of the initiatives surrounding single sex classes for male students are thus rooted in this agenda of male disadvantage and repair amid the general moral 'panic'(Ashley, 2002) about their achievement levels, their apparent disaffection and disengagement from schooling.

The National Foundation for Education Research (NFER,) commissioned research (Spielhofer et al., 2002) that established that single sex schooling may have an impact on GCSE results for both female and male students. This analysis of the impact of single sex education on student performance indicated that, even after controlling for prior attainment and other background factors, female students in single sex comprehensive schools achieved better results than their peers in mixed schools for all the outcomes measured, except the number of GCSEs taken. Female students in single sex schools could be expected to achieve over a third of a grade better than similar students in mixed schools.

No overall differences were found between the performance of male students in single sex and mixed comprehensive schools. A more detailed investigation, however, revealed that male students with lower prior attainment achieved better average GCSE scores in single sex schools and male students with higher prior attainment took slightly more science GCSEs and achieved higher total GCSE science scores in single sex schools. It was also found that male students attending single sex grammar schools achieved better results than those in mixed grammar schools for many of the outcomes measured (Spielhofer et al., 2002).

A survey of 2,300 13-14 year-olds in 13 single sex and mixed comprehensive schools found that there were statistically significant differences between the school types in attitudes towards the sciences. Male students in single sex schools were more likely to say they liked biology and female students in single sex schools were more likely to say they liked physics and chemistry. The differences between female students and male students, however, far outweighed the differences between single sex and co-educational schools. Moreover, it was the male students, in this study, who were more likely to be influenced by co-education rather than the female students (Stables, 1990). Gender rather than school type has been found to account for the observed differences in attainment between students (Colley et al, 1994).

Attitudes to option choices in traditionally gendered subject areas are not always, however, straightforward or predicable. Female students in single sex schools have been found to have more traditional, stereotyped attitudes to their learning and option choices than either their female peers in mixed schools or male peers in single gender schools, (Kenway & Willis, 1998, Lee and Lockheed, 1998). If teachers fail to challenge these attitudes (Sukhnandan et al., 2000) then single gender schools can further perpetuate attitudes and beliefs that ultimately lead to pipeline shrinkage.

Teachers' own attitudes to ICT may have an effect on the attitudes of their students. Sanders (2005) and Cox (2003) acknowledge that student teachers receive insufficient effective training to be able to engage female students effectively and that some female teachers perpetuate their own negative attitudes and perceptions regarding the subject

Previous research presents no easy answers as to how all students can be engaged best, and in what school setting. Whether or not single gender school or grouping can benefit female students remains ambiguous and lacking consensus (Sanders, 2006, Kruse, 1996). Following an international literature review of twenty years of research, from the mid 1980s to 2006, Sanders concludes:

> Much of the research on this topic is problematic. Girls (or girls' parents) who voluntarily choose single-sex schools or classes may well have other characteristics, such as academic orientation, that might account more strongly for any differences found.

> Randomization would control for this but no studies have as yet done so… In short, the hotly debated topic of single-sex education shows no signs of being clarified any time soon
>
> (Sanders, 2006).

What is clear, however, is that, in the current educational climate, any organisational structure that does not overtly support the achievement of male students is unlikely to be adopted as best practice. Yet it matters at every level of the ICT industry if the creators of computer technology are mostly male as computing salaries are comparatively high, jobs are relatively plentiful and entrepreneurship opportunities unbounded. Furthermore, a command of ICT is a crucial asset in many contexts outside of the field itself, and the lack of women represented in the field is a 'frightening' discrepancy (Gurian, 2002).

2.8 Redistributive Strategies to address Pipeline Shrinkage

ICT itself is not gendered. It is a subject and an industry that benefits the whole of society and women should be equal beneficiaries to the advantages offered by the industry and its products and processes (Nath, 2002). Gender equality and women's empowerment require structural change to uneven power relations. Women and men both need the benefits of ICT for the same reasons: for information, for business, to source materials, to communicate with business, family and community. It gives them a connection with the wider world and the digital landscape. Without special attention to gender, however, men and women will not have equal opportunities to enter the information age. The importance of gender in policy, programs, and projects must be acknowledged. Without doing so, it is unlikely that the results of redistributive projects will have a significant impact on women (The World Bank, 2009).

In response to the international concern regarding pipeline shrinkage (Gras-Velazquez et al., 2009, Grid Talk, 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990) a number of redistributive strategies, policies and initiatives have been developed in order to not only attract women to the ICT Industry but to support and encourage industry to do so.

The World Bank's microfinance program, Consultative Group Assist the Poorest (CGAP), which involves over 1000 international businesses, was set up in 1995. It responds to the demand from low-income business groups, 75% of whom are women, for access to loans. The total disbursements in 2002 was US$11.5 billion but to reach just 10 percent of international low-income entrepreneurs by 2025 will require lending capital of about US$12.5 billion. Approximately 10.4 million women have been given loans by the project since it began (The World Bank, 2009). A typical example is Tortas Peru established in 1996. It is a women owned business that uses ICT to reach and service a wide market to sell cakes and desserts. A network of housewives takes Internet orders for their cakes and also uses the Internet to provide baking tips in Spanish and English. The company covers the major cities of Peru but also targets over 2 million Peruvians who live outside the country. Through their website, Peruvian women all over the world can send gifts through a company that is run by women in Peru who are responsible for all aspects of the business including delivery. The company is ICT dependent and all new employees have instruction on how to use ICT but there is no presumption women will have computers in their own homes – only access in libraries or the country's highly efficient chain of public computer booths (Tortas Peru, 2009).

Both the European Union, in its gender mainstreaming Framework Programme, currently on its 7th cycle from 2007 – 2013, and the United Nations Division for the Advancement of Women (DAW) work towards complimenting and supporting the legal right women have to equal treatment with men. This is in order to not only address some of the disadvantages women face, but also to attempt to integrate gender equality into policy, participation, institutions and practices (Michaelson, 2005). **B**uying in, **I**mplementation and **G**rowth and reinforcement is a three phase conceptual framework (B.I.G.) that requires commitment and investment at every stage with clear measurable (in pay differentials, roles in the ICT industry and educational uptake internationally) targets and goals (Marcelle, 2002).

The equally ambitious International Millennia 2015 Project has similar goals in its aims to empower women across The United Nations in a multiplicity of ways including politics, education, social development and health with a focus on ICT and the traditionally male dominated areas of science, mathematics and new technologies (Delahaut, 2009). This is in line with a major initiative taken by The European Commission. In an effort to help solve the issue of international female recruitment and retention to the ICT Industry, The European Commission has evolved a Code of Practice, released in March 2009, with Signatory European and International stakeholders. Although not in anyway binding, it seeks to develop national and corporate initiatives to encourage greater participation of women in all areas of the sector (The European Commission, 2009). In tandem with the European Commission's commitment to reducing the gender gap, The Enabling Grids for E-sciencE (EGEE) project launched in 2004 also promotes best practice and raises awareness. It works alongside local communities across Europe to support women working in the ICT sector with the support of 150 ICT businesses in the scientific workplace (Grid Talk, 2009).

Yet some EU countries pay only notional attention to equality projects, United Nations directions or Framework Programmes. ICT policies often predominately focus on competition and investment policy, technology regulation and rural access with little attention to gender issues in ICT policy (The World Bank, 2009). In the Czech Republic, female staff make up less than 11% of the workforce in the technical universities and there is no tradition of female research students within these universities. Although led by a female Director, one of the largest Czech ICT companies has only a 26% female workforce and male managers outnumber female by a ratio of 63: 12 (Turner, 2005a). If the advantages of ICT are not acknowledged then equitable access to ICT is a non-issue; not all developed countries equally value entitlement to an ICT Curriculum and parity of participation. What is not valued is consequently not aspirational.

In developing countries, affirmative action programmes have had some positive outcomes of significance for female students and young women that supersede the outcomes of redistributive programmes in the Western world. The World Links' gender evaluation in Africa is a non-profit organisation providing e-learning opportunities to school students and teachers. The project found that whilst female African students shared many of the attitudes regarding ICT of female students in developed countries (sometimes in an even more exaggerated form due to the financial constraints determining much of African education) there was a positive impact of the increasing use of ICT. This had a particular impact on female students' self-esteem. Seventy percent of the female students interviewed in the World Links gender evaluation said that being able to use the internet provides freedom to them as young women and 95% correlated their increase in confidence and self-esteem to participation in World Links. The Internet offers a discrete form of communication to female students raised to be reticent and non-confrontational.

In contrast, 70% of male students felt the programme had no impact on their self-esteem perhaps reflecting a wider society where males have more advantages, exposure to the outside world and freedom of movement with consequently higher self-esteem and confidence about life in general.

The World Links evaluation also concluded that the impact of computer technologies introduced into schools in Senegal, Uganda, Mauritania and Ghana has been greater for female than for male students. This is because of a more academic focus in their use of the internet rather than surfing for rap music and sports results (Derbyshire, 2003). Equally positive is female students participation in computer training despite there being fewer female than male students' participating in Computer Science degrees at Ugandan Universities. In the Development Services Development Centre, based in the Kamuli District in Eastern Uganda, the total number of students trained in various computer courses in 2002 was 80 - 48 of them female. Positive recruitment initiatives such as a CD-ROM, 'Rural Women in Africa: Ideas for Earning Money', do have an impact (Epodoi, 2003), despite infrastructure iniquities and cultural barriers that are more overtly challenging than in Europe (The World Bank, 2009).

To enhance gender equality internationally, more needs to be achieved than workforce redistribution. Engendering policy as a precondition to addressing key gender issues should be seen in the specific context of a country, the degree of development of the ICT sector and the targeted concerns (The World Bank, 2009). Female students will not opt to study ICT Post 16 and go on to have careers in the ICT Industry simply because more jobs are being positively marketed. The concept of gender equality is not only creating job opportunities but also the understanding that women's social and economic status in relation to men's must improve on terms that are themselves not representative of masculine values and dominance. The ICT Industry must take into account equitable development methods as well as cultural, traditional and gender stereotyping.

If female students have negative attitudes and beliefs regarding ICT they will not be attracted to the ICT Industry despite international redistributive regendering policies and practices. This study seeks to identify female students' attitudes and beliefs comparative to their male peers and within differing school contexts, in order to propose classroom and school based strategies that educationalists can put in place to begin to change female students' salient beliefs that will lead to more positive attitudes to ICT. Female students must want to participate in the industry and aspire towards careers in ICT with clearly articulated and focussed goals.

The importance of goals is very significant in undertaking positive behaviour (in the case of this research the study of ICT post 16 and beyond). If female students leave Key Stage 4 study without aspirational goals towards the subject, it is highly unlikely they will join the ICT industry. For everyone goals jostle for priority and contextualise attitudes (Sideridis & Padeliadu, 2001). They illustrate the intrinsic value and interest in future behaviour (Pintrich & De Groot, 1990). The notion of goal importance has implications for goal setting. The positive effect that challenging goals have on task performance may increase depending on the degree of importance attributed to the specific goals (Hollenbeck & Williams, 1987). For the purposes of this study, the goal is that of studying ICT post 16 – or not. Female students leave school with academic qualifications in ICT that exceed those of their male peers (Ofsted, 2009). Academic achievement has been, therefore, a priority goal. They, however, do not see the goal of the further study of ICT or working in the ICT industry as being of any importance.

2.9 An Ideal

The growing need for computer professionals and the continuing decrease in participation by female students is an acknowledged cause for concern:

> ICT is the major driver of growth in productivity in the European Union. The ICT sector not only drives innovation, but fuels competitiveness in the global economy. Jobs in ICT are therefore key sources of growth and crucial for the growth of the economy. However, the EU's competitiveness depends on attracting and keeping skilled workers, especially in the high-tech sector, including women. However, while a shortage of around 300,000 qualified engineers is expected in the EU by 2010, fewer than 1 in 5 computer scientists are women. In short, Europe needs more "cyberellas" – women equipped with the e-Skills needed for the future. These skills are key to ensuring Europe retains a major role in the ICT sector of tomorrow. To tap this vast pool of talent, special attention must be paid to raising the participation of women in this field
>
> Viviane Reding
>
> European Commissioner for Information Society and Media, (2009).

Questions need to be asked regarding the reasons why this discipline appears unattractive to females and why this is a particular issue in Western and Eastern Europe, Australia, the US and the UK. Feminist research acknowedges the difference between the experiences of women, and that culture, class, nationality and religion impact upon their experiences (Letherby, 2003). The disparity of gender roles in the

ICT industry, for example, is often not so evident in many developing countries where between 30 and 50% of students studying ICT in Further and Higher Education are female (Hafkin & Taggard, 2001). In Malaysia, in the University of Malaya, Faculty of Computer Science and Information Technology Department, a significant proportion of the teaching staff and 39% of PhD students, 42% of MSc students and 66% of undergraduate students are female. This gender balance has been similar for two decades. ICT is not perceived as a particularly 'male' area and parity of achievement and participation is viewed from primary school as the expectation and the norm (Lagesen et al, 2005). Consequently, Malaysian women are, consequently, well represented at all levels in the ICT industry (Hafkin & Taggard, 2001).

Despite increased development in the analytical frameworks of gender studies programmes at university level and the sharper understanding of the daily school and classroom microprocesses in the conformation of gender identities and ideologies, little of these conceptual advances have manifested in worldwide national educational policies and curriculum reforms. At present, there is scant consciousness among teachers and administrators of either gender discrimination in educational settings or the need to face these problems (Stromquist, 2007). To answer those questions teachers need to listen hard, whatever the gender context of their classrooms, to recognise that a competitive, combative culture rather than collaborative working relationships will alienate female students (Letherby, 2003).

This study, principally, aims to explore the beliefs and contributing factors that impede female students from studying ICT post 16 and beyond in order to inform classroom practice with strategies that seek to increase their participation. ICT takes on personal meanings for female students as constructed by society and that meaning currently holds negative connotations for them that divert them from careers in the ICT Industry (Christie, 2002). To address this issue educationalists must accept the challenge to conceptualise women's ICT skills as real computing and ask what is 'wrong' with computing rather than what is 'wrong' with women (Clegg and Trayhurn, 1999).

3.0 Theoretical Framework: The Theory of Planned Behaviour and The Transtheoretical Model of Change

As every student of psychology knows, explaining human behaviour in all its complexity is a difficult task.

(Icek Ajzen, 1991)

The overarching question this study addresses, from a post positivist paradigm, is: Are there gender differences in Behavioural, Normative and Control Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)? Additionally, how far does teacher gender, learning styles, past behaviour and prior attainment influence the behaviour of female ICT students?

In psychology, The TpB explores the link between attitudes and behaviour. It has been applied to studies of the relationships among beliefs, attitudes, behavioural intentions and behaviours in various fields such as advertising, public relations, campaigns, healthcare, and, over the last decade, education.

A number of international research studies (Chedzoy & Burden, 2007, Gatfield & Chen, 2006, Chen & Craig, 2006 & Shevlin & Millar, 2006) have recently used The Theory of Planned Behaviour that aim to explain and explore students' attitudes and intentions in a range of educational contexts. They share similarities with this study, although less comprehensively in scope. With regard to the possibility of changing salient beliefs that impact on intentions, Chedzoy & Burden (2007) used

The TpB to assess UK Post Graduate Certificate of Education (PGCE) Primary Education student teachers' strength of intention to teach dance. They completed a TpB questionnaire both before and after an intensive eight-hour module prior to beginning their school-based practice. They then completed a questionnaire designed to measure their behavioural beliefs, their normative beliefs and their control beliefs in accordance with Ajzen's Theory of Planned Behaviour. There was found to be a statistically significant difference in the intention of the Primary PGCE students to teach dance after completing the module. Additionally, the study found that the self-efficacy of the PGCE students was enhanced. As a result of this study, changes to the PGCE PE programme were proposed to address the negative attitudes some students held towards teaching dance.

The educational area of research where The TpB has been most utilised, is in the destination intentions of a wide and varied number of students. Gatfield & Chen (2006), Chen & Craig (2006) and Shevlin & Millar (2006) all used The TpB to analyse the attitudinal factors influencing students intentions – whether Taiwanese students intend to study in overseas universities (Gatfield & Chen, 2006, Chen & Craig, 2006) and what factors led UK secondary school students to take careers advice or not (Shevlin & Millar, 2006). The studies all concluded that multiple factors affect attitudes and therefore intentions and that students with superficially shared experiences have very different intentions towards intended behaviour.

Most pertinent in its similarity to this research study, however, is the work of Fusilier & Subhash (2005) who undertook to explore internet technology acceptance and use in India, a developing country that can potentially benefit economically from greater participation in the ICT industries. They used The TpB to explore the link between university students' prior experience and their intention to participate specifically in web-based industries. In line with the conclusions presented in this study, Fusilier & Subhash found that the links between intention and experience were complex, with students' intentions affected by factors other than their prior experience with using the internet itself.

3.1 The Theory of Reasoned Action

The Theory of Planned Behaviour (TpB) originated in 1980 in Icek Ajzen's article 'From Intentions to Actions: A Theory of Planned Behaviour'. The theory was developed from The Theory of Reasoned Action, which was proposed by Martin Fishbein together with Icek Ajzen in 1975.

The Theory of Reasoned Action suggests that behaviour is determined by intention to perform the behaviour and that this intention is, in turn, a function of attitude toward the behaviour and subjective norm, as shown in Figure 1. The best predictor of behaviour is therefore, according to The Theory of Reasoned Action, intention - the cognitive representation of a person's readiness to perform a given behaviour and the immediate antecedent of behaviour.

Firstly, the intention and behaviour measures correspond in specificity of action, target, context and timeframe. If this is the case then a female student who indicates she intends to study ICT beyond GCSE or A' Level will do so with no dislocation of action, target, context or timeframe – nothing will occur to impede her intention. Secondly, intention and behaviour do not change in the interval between assessment of intention and assessment of behaviour. The notional ICT student cited above would not change her mind with regard to further study of ICT. Finally, the behaviour in question is under the individual's control; for instance, the student can decide at will whether she will perform or not perform the behaviour independent of other factors (Ajzen and Fishbein 1980). Intention is therefore the main predictor of the behaviour of female students in this case.

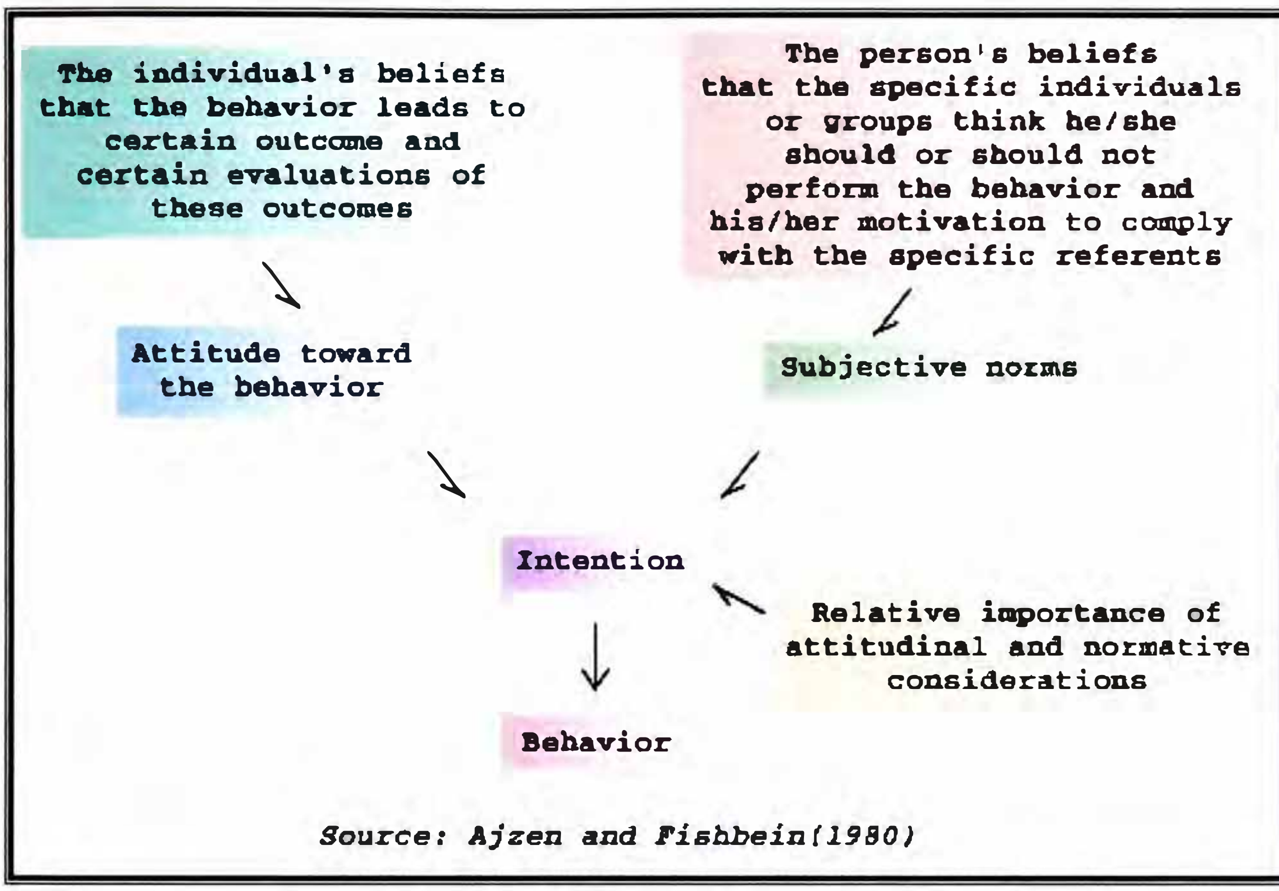

Figure 1: The Theory of Reasoned Action

Variables not explicitly included in The Theory of Reasoned Action (e.g., beliefs, demographic variables, attitudes toward targets and personality traits), however, can affect intention and behaviour as they influence the attitudinal or normative considerations or their relative weights (Fishbein & Ajzen 1980, 1975). For instance, a female student's academic prior attainment in ICT may initially affect intention but not directly affect actual future behaviour. Thus, intention does not always result in the intended behaviour and an intention to study ICT beyond GCSE or A' Level may not lead to the study actually taking place.

The validity of The Theory of Reasoned Action is extensive within specific conditions but under circumstances where internal and external factors might hinder the volitional control of the behaviour, it is a relatively poor predictor of behaviour. For instance, the intent to behave is measured by the likelihood that the behaviour intended will actually occur - a female student may say she does not intend to attend after school catch up ICT lessons but does so – or vice versa. The intention can only be measured by a procedure, which places the subject along a subjective-probability dimension involving a relation between the student and some action (Fishbein & Ajzen, 1975). The Theory of Planned Behaviour is, therefore, an ideal methodology to analyse the intent of female students to study ICT post 16 and beyond as it takes into account the variables that affect intention and behaviour (Fishbein & Ajzen 1980, 1975).

3.2 The Theory of Planned Behaviour

The Theory of Planned Behaviour, an extension of The Theory of Reasoned Action Figure 1, was developed by Fishbein & Ajzen, in 1975, to incorporate behavioural control factors in predicting behaviour as demonstrated in Figure 2.

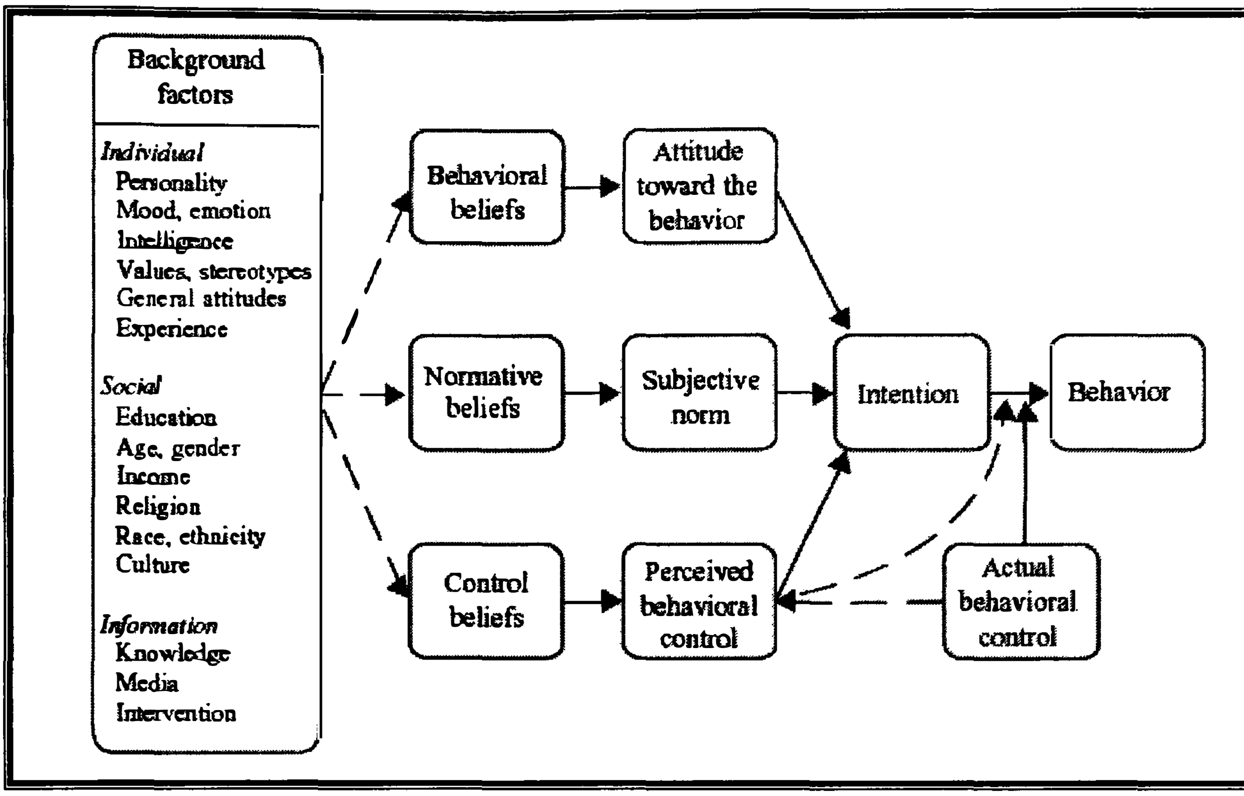

Figure 2: The Theories of Reasoned Action and Planned Behaviour (Ajzen, 1991)

The Theory of Planned Behaviour proposes that most intended behaviours are subject to some uncertainty and that the success in performing a behaviour depends not only on intention but also on factors that may interfere with behaviour control. A female student may intend to opt to study ICT post 16 but her beliefs may impede her behaviour to do so.

The considerations that determine behaviour include attitudes and beliefs about the likely consequences of success and failure, the perceived probabilities of success and failure, normative beliefs regarding important referents and motivations to comply with these referents (See Figure 2). As demonstrated by this research, female students will behave in a way according to the likely success or failure that she believes will be consequent of her behaviour. This success, however, will be complicit with her beliefs with regard to that success or failure not necessarily the objective outcome (a successful ICT degree or job). The outcome is therefore subjective, a behaviour responding to an emotional attitude (Ajzen, 1985). That attitudes are a consequence of experiential learning has become a sociological given (Fishbein & Ajzen, 1975) yet within that acceptance there will be areas of complexity. As represented in Figures 1 & 2, The Theory of Planned Behaviour allows for a more detailed analysis of behaviour than its predecessor, The Theory of Reasoned Action, in its focus on the importance of beliefs and their impact on the intentions and attitudes that culminate in behaviour.

3.2.1 *Beliefs*

In order to account for the formation of attitudes and intentions there is a need to understand how beliefs are formed. Beliefs are a subjective probability judgement linked to a personal understanding of environment and self – in this study students' understanding of ICT and its further study post 16. Beliefs precede attitudes in that they reflect the initial information students have – linking the object to the attribute. For example, the belief that ICT is a lesson where male students play games, links the object – ICT – to the Attribute – male students play games in ICT. The strength of belief may differ between students whilst the object to attribute remains the same. Consequently, that strength can be measured by placing the subject along a dimension of subjective probability involving an object and the strength of the link to the related attribute. Beliefs can be both positive – ICT will be an exciting career - and negative – working in ICT will necessitate working within an obsessive, hacker culture.

Belief formation involves the establishment of a link between two aspects of personal experience including, but not exclusively, direct observation. For the purposes of this study, a female student may observe her male peers off task in ICT lessons playing computer games and form the belief that this is particularly male behaviour, which she does not want to be part of her learning environment. This direct experience with the given object – male students and computer games – results in the formation of a descriptive belief. Those beliefs that go beyond observable beliefs are called inferable beliefs. These build upon prior descriptive beliefs. For instance, the female student may hold the inferable belief that male ICT students play computer games. Whenever a belief is formed, some of the implicit evaluation associated with the response becomes conditioned to respond to the stimulus object (Fishbein & Ajzen, 1975). Therefore, the female student's attitude to a subject is a function of her beliefs about the subject and an implicit evaluative response associated with those beliefs (Fishbein, 1967). The eventual, causally responsive, behaviour will be one that is expected to lead to a 'positive' event for the individual (Tolman, 1932) with the highest subjective expected outcome (Edwards, 1954). For instance, the female student opts for post 16 courses that she sees as more valid and engaging than ICT.

The Theory of Planned Behaviour deems human actions to be guided by three beliefs that are addressed in this study:

B*ehavioural beliefs* – the likely outcomes of behaviour and the evaluations of those outcomes;

N*ormative beliefs* – the beliefs that stem from the normative expectations of others and motivation to meet those expectations

Control beliefs – the factors that may support or impede performance and the power of those factors. (Ajzen, 2002).

What, however, are the origins of these beliefs? There are a range of variables that could potentially influence the beliefs people hold towards a particular behaviour: age, gender, ethnicity, identity, socioeconomic status, education, nationality, religious affiliation, personality, mood, emotion, general attitudes and values, intelligence, group membership, past experiences, exposure to information, social support, coping skills, comfort levels, role models and associations. This study addresses whether specifically gender impacts upon the differing Behavioural, Normative and Control beliefs of students in their intent to study ICT post 16.

Background factors have potential importance as a given background factor may influence behavioural, normative or control beliefs, but there is no necessary connection between background factors and beliefs. Whether a given belief is, or is not, affected by a particular background factor is an empirical question (Ajzen, 1991). For instance, the child of racist parents may or not be racist. The daughter of a computer-programming mother may or may not choose to study ICT post 16. The affect of school and peer influence may lead to very different behavioural, normative or control beliefs than those of the parents.

In light of the vast number of potentially relevant background factors that influence female students' attitudes to ICT, The Theory of Planned Behaviour's focus on the behavioural domain of interest is important. This element of The TpB was not part of its precursor, the Theory of Reasoned Action, and has broadened the TpB by identifying relevant background factors to deepen our understanding of a behaviour's determinants (Petraitis et al., 1995). Background factors, explored in this research, influence intentions and behaviour indirectly in their effect on behavioural, normative and control beliefs. Through these beliefs, as demonstrated in Figure 2, attitudes, subjective norms or perceptions of control are determined.

Planned Behaviourists recognise emotions as having an impact on intentions and behaviours, but like other background factors, this influence is assumed to be indirect. General moods and emotions can have systematic effects on beliefs and evaluations: students in a positive mood tend to evaluate events more favourably and to judge favourable events as more likely than those in a negative mood. In a Reasoned Action approach, such effects would be expected to influence attitudes and intentions and, thus, to have an impact on behaviour (Petraitis et al., 1995). The presence of strong emotions may also help explain why female students seem to act irrationally in the sense that they choose not to carry out an intended behaviour that is in their best interest – choosing to study ICT further following prior academic, examination success or career prospects. To understand how emotions may help account for such apparently irrational behaviour, it is important to make a distinction between contemplating performance of a behaviour (e.g., when filling out a TpB questionnaire as part of this research) and its actual performance in a real-life context. There may be, however, little difference in behaviour following an emotional or non-emotional response (Averill, 1980).

Past behaviour is a further background factor that has only an indirect impact on intentions and behaviours. There is a stronger relationship, however, between habit and behaviour. With repeated performance, behaviour can become a 'habit' (Verplanken et al., 1998). With repeated performance, behaviour is assumed to come under the control of stimulus cues, bypassing intentions and perceptions of behavioural control. There are, however, a number of problems with this analysis of the role of habit in the context of reasoned action models (Ajzen, 2002). Firstly, the fact that a behaviour has been performed many times is no guarantee that it has habituated. Secondly, even if habituation occurred, there is no certainty as to how habit strength is related to the frequency of past performance because low frequency of past performance, just as high frequency, may also be an indication of a strong habit. For example, consistent failure to wear a seatbelt may be indicative of a strong habitual pattern of behaviour, not of the absence of habit (Mittal, 1988). With regard to this study, a female student regularly attending an after school GCSE ICT revision class may indicate a strong pattern of behaviour but not a habitual behaviour that will lead to study of ICT post 16. Similarly, a male students' irregular attendance at a revision class will not necessarily be indicative of a lack of habit with regard to studying ICT post 16.

As important as habitual behaviour is, the state of mindfulness when the behaviour is taking place. Mindfulness is a stable individual difference construct, describing a quality of consciousness characterised by clarity and vividness of current experience and functioning (Westen, 1999). When mindful, individuals do not ponder on fantasies concerning the future, as in the case of day dreaming, but instead take reality as it is and are open and receptive to what is taking place in the present (Nyanaponika, 1972). In other words, mindfulness describes an enhanced attention to, and awareness of, present reality (Brown & Ryan, 2003). With regard to this study, the link between mindfulness and habit is important.

Although they may regularly attend a GCSE ICT revision class, female students may be conscious only that this is a temporary situation and look forward to not having to attend. No habit is being formed and there is a very weak link between past behaviour and intention to perform the behaviour in question- the study of ICT post 16 and beyond. A male student may only attend the ICT revision class sporadically but whilst in the class he may be mindful of attendance and experience a quality of consciousness characterised by clarity and vividness of that current experience. As he is mindful, he would not ponder on fantasies concerning the future but instead take reality as it is and be open and receptive to what is taking place in the present (Nyanaponika, 1972). Mindfulness describes an enhanced attention to, and awareness of, present reality (Brown & Ryan, 2003) that is more likely to lead to habitual behaviour – the study of ICT post 16. Mindfulness places emphasis on cognitive operations that explain how people process inputs from the external environment to create new categories and social perspectives (Langer, 1992).

Consciousness does not necessarily reflect normative beliefs, for instance in the case of the female student in this example: 'The teacher of this class does not think I should continue to study ICT Post 16'. They, however, may be similar.

3.2.2. *Attitudes*

Whilst the attitude female students have to learning is a key factor to their success, there are questions to ask about what constitutes an attitude, how it is formed and changed; how it shapes and determines behaviour. Attitude is non-observable as a learned, implicitly anticipatory response (Doob, 1947) and there is a consensus among social psychologists that the term refers to a general positive or negative feeling about some person, object, or issue (Petty et al., 1981). It represents general feelings of favourableness (positive) or unfavourableness (negative) towards some stimulus object (for the purposes of this research, studying ICT post 16 and beyond). As a student forms beliefs about an object (studying ICT), she or he automatically and simultaneously acquires an attitude toward that object. Each belief links the object to some attribute. In this case, female students are likely to link the object – studying ICT – to attributes that they find unattractive and negative: violent language, an obsessive 'hacker' culture and a stereotypical masculine image of the socially inadequate and isolated 'anorak' (Turner, 2005a). The female student's attitude toward the object is therefore a function of her evaluation of these attributes.

General attitudes towards objects – computers and games - and institutions – the school, college, university or work place - are only moderately accurate predictors of behavioural patterns and single actions. The TpB questionnaires given to the female ICT students in this study measure their attitudes to ICT but their responses are also instances of behaviour in themselves and the observable behaviour that follows the recording of attitudes is assessed in the light of the response and may even modify the analysis of attitude. The intent to behave may be, of course, very different from the ultimate behaviour itself.

Attitudes like beliefs are not fixed but may take a great deal of time to change. The determinants of attitudes include not only direct observation but also the inference process. Consequently, whilst some attitudes may be discarded others remain (for instance a religious or political attitude may be less likely to change although may do so). For instance, beliefs about studying ICT post 16 may differ between female students in single or mixed gender educational environments. Their attitude towards studying ICT post 16 may be viewed as determined by their salient set of beliefs that may change if the context for holding those beliefs changes. Although a student may hold a number of beliefs about studying ICT post 16 and beyond, only a small number of beliefs determine attitude.

The basic paradigms that support how attitudes and beliefs are acquired include: primary and high order classical conditioning (Staats, 1968) and instrumental conditioning (Lott and Lott 1968). Thus, associations, goals and rewards or lack of them are viewed as attitudes after 'positive' (passive rather than negative) reinforcement.

3.2.3 *Normative Beliefs and Motivation to Comply*

Normative Beliefs refer to the perceived behavioural expectations of such important referent individuals or groups as family, friends and teachers ('important others'). The Motivation to Comply refers specifically to the motivation an individual has, for the purposes of this study female students, to comply with the perception they have of what the referent group would like them to do. In this research, the participants were asked if they agreed that their important referent individuals felt they should or should not study ICT post 16. Each normative belief about an important other is multiplied by the person's motivation to comply with that important other and the products are summed across all of the person's important others to result in a general measure that predicts subjective norms (Trafimow, 2008)

Normative beliefs therefore have two general uses. Firstly, they add to the possibility of predicting other variables (subjective norm, intention and behaviour). Secondly, their measurement provides information about where intervention strategies should be focused. Effective strategies can then be focussed on the salient beliefs of individuals. For instance for the purposes of this study their perceptions of their teachers' beliefs and possibly their friends if those friends are in the same ICT class.

3.2.4 *Subjective Norms*

A Subjective norm is a predictor of intention to behave which, in turn, is a predictor of actual behaviour (Trafimow, 2008). Subjective, social, norms can be an important factor for individual and behavioural characteristics involving other people. In the context of this research, subjective norms are social in that they are based on information external to the female students and their perceived social pressure to engage in a behaviour. For instance, 'Most people whose opinion I value would approve of my studying in post 16– Strongly disagree- Strongly agree'. How the female students responded to this question is a function of their perception of other people's approval of them studying ICT post 16 and their willingness to comply with those people. Social attitudes involve specific behavioural outcomes that impact on others. Subjective norms, however, deal with what significant reference groups think about the behaviour itself. Both social attitudes and subjective norms involve behaviour in relation to other people and demonstrate why social attitudes are related to subjective norms (Park, 2000).

3.2.5 *Control Beliefs and the Powers of Control Beliefs*

Control Beliefs are beliefs held about the presence of factors that may facilitate or impede performance of behaviour (Dörnyei & Otto, 1998, Dickinson, 1995). The Power of Control constitutes how far these factors control behaviour. Control refers to the ability to influence what is happening or what will happen and control beliefs refer to the control an individual has regarding their ability to influence their behaviour. In the context of this study, students were asked to respond to control belief questions with regard to how far external demands – specifically: unanticipated demands, illness, tiredness, family obligations or other courses - impacted on their intention to study ICT post 16 and beyond.

Students who believe they have control over their behaviour are more likely to engage in positive behaviour and exert effort towards achieving that behaviour (Gabillon, 2005). In the context of this research, the behaviour is opting to study ICT post 16 and beyond. A belief in outcomes being out of control will conversely produce weak intent and less likelihood of a particular behaviour (Dörnyei & Otto, 1998). Control belief guides future behaviours. Alternatively, there are attribution beliefs rather than control beliefs. These are beliefs about external causes of behaviours and refer to interpretations of the causes of events that happen regarding the behaviours of others (Gabillon, 2005). The negative control beliefs indicated by the female ICT students who participated in this study are guided by attitudes and behaviours they have adopted due to external causes and are therefore control attributes rather than beliefs.

The Locus of Control Belief is important. Locus refers to the place where control, rather than outcomes, resides with regard to individuals. Internal and external beliefs are not at the opposite ends of a continuum and therefore a student can simultaneously hold internal and external beliefs about the locus of control of a given response (Wallston, 1989).

As control beliefs are learnt they are salient beliefs that can ultimately, with interventions, be changed if the participants (the female students in this study) gain a perceived sense of control (Shapiro & Astin, 1998). In the context of this research, those interventions could lead to external events having less impact on their ICT studies and control related goals, such as the motivation to study ICT post 16, being set by the female students themselves. They, therefore, could be motivated to gain those controls beliefs. These are key salient belief that teachers can aim to change.

3.2.6 *Perceived Behavioural Controls*

Perceived Behavioural Controls share similarities with Triandis's (1980) conceptualization of facilitating conditions, which deals with a person's characteristics or the environment which make it easier or more difficult to perform the behaviour, independent of a person's behavioural intention (Glanz, Rimer, & Lewis 2002). Perceived Behavioural controls are determined by control beliefs concerning the presence or absence of facilitators and barriers to behavioural performance. These are weighted by the perceived power or impact of each factor to allow or prohibit the behaviour. A female student with strong control beliefs, about the existence of factors that impede the behaviour in question, for instance, regarding how often unanticipated or family demands make demands on her time, will have low perceived control over the behaviour in question- to study ICT at post 16 and beyond. A person with strong control beliefs, for instance, the male students with regard to their intention to study ICT post 16 and beyond as explored in this study, will have a high perceived control over their behaviour (Glanz, Rimer, & Lewis 2002).

3.2.7 *Intentions*

An Intention is a person's location on a subjective probability dimension involving a relationship between themselves and some action. This study recognises that the intention of female students to study ICT post 16 lies between 0 and 1, where 0 is an absolute certainty that ICT will not be studied and 1 is an absolute certainty that it will. A behavioural intention, therefore, refers to the student's subjective probability that they will study ICT post 16 and beyond. Intentions can be directly affected by attitudes and, ultimately, behaviours are, in some circumstances, the result of attitudes, intentions or both although there is no fixed relationship between the two. Attitudes tend, however, to correlate highly with indices based on sets of intentions and the relationship between attitude and single intentions is usually low and insignificant (Ajzen, 1970)

Intentions involve four different elements (Ajzen, 1970). The first element is behaviour. For the purpose of this study the behaviour is female students studying ICT post 16 and beyond. The second element is the target object at which the behaviour is directed, for instance having a secure and satisfying job. The third element is the situation in which the behaviour is to be performed, the educational context, and, finally, the time at which the behaviour is to be performed. In the context of this research the time is either when the student participants consider further study of ICT at Key Stage 5 or beyond in Higher Education or the ICT Industry. These four elements are all specifically addressed through The Theory of Planned Behaviour Questionnaire and discussed in Chapter 5.

It is relatively easy to identify the levels of specificity on the target, situation and time dimensions but the behavioural dimension poses greater difficulty because of the negative associations the female students hold with regard to ICT and their positioning with regard to the subject. To predict whether a student intends to study ICT post 16 and beyond it is therefore necessary not only to know whether the student is in favour of studying ICT post 16, but how much the student feels social pressure to study ICT post 16 and whether the student feels in control of doing so - their perceived behaviour control. By focussing on these predictors, teachers can increase the likelihood that the student will intend to study ICT post 16 and beyond.

Behaviour can, of course, take place independent of attitude (Fishbein & Ajzen, 1975) but not intention. This implies that we should be able to predict specific behaviours with considerable accuracy from intentions alone. However, relatively low intention–behaviour relationships are sometimes obtained. Several factors may be responsible for a low relationship between intentions and behaviour. Clearly, if there is little or no variance either in intention or in behaviour, strong relationships cannot be expected. Perhaps, more importantly, if intentions change after they are assessed, they will tend to be poor predictors of later behaviour. The time interval between measurement of intention and assessment of behaviour is often taken as a proxy for stability because it is assumed that, with the passage of time, an increasing number of events may cause intentions to change. The relationship between intent and behaviour in question – A' Level option choice and University course choice – has a measurable timeframe. Although meta-analyses of intention–behaviour relationships show the expected pattern over time, the effect is not always significant. For example, in the area of condom use, prediction of behaviour from intention was found to become significantly less accurate with the passage of time (Sheeran & Orbell, 1998). In one investigation (Sheeran, et al., 1999), undergraduate college students twice indicated their intentions to study over the winter vacation, 5 weeks apart. After returning from the winter vacation, they reported on how many days a week they had actually studied. For participants whose intentions remained relatively stable during the 5 - week period prior to the vacation, the intention - behaviour relationship was 0.58, whereas for participants with relatively unstable intentions, it was 0.08. Similar results were reported with respect to attending a health screening appointment and eating a low-fat diet (Conner et al. 2000). General attitudes arguably fail to predict specific behaviours because of a lack of compatibility in the action, context, and time elements. They identify only the target element, whereas a specific behaviour involves a particular action directed at the target in a given context and point in time.

The female students who indicate they intend to choose to study ICT may change their intention and behave otherwise. Although the time lapse between post GCSE option choices and the course starting or university course choice, interviews and beginning the course are relatively short, the gap between intentions and behaviour can be literally inconsistent (Fishbein & Ajzen, 2005). This pattern of literal inconsistency, generally speaking, is asymmetric such that those who do not intend to engage in a socially desirable behaviour tend to act in accordance with their negative intentions, but those who intend to perform the behaviour may or may not do so. Research in the health domain, for example, has found that participants who do not intend to use condoms, undergo a cancer screening or exercise rarely, if ever, do so. Of those participants who do intend to engage in these health-protective behaviours, between 74% and 43% consequently carry out their intentions (Sheeran, 2002). Similarly, female students may intend not to study ICT further but GCSE or A' Level results, peer pressure or parental expectations may lead to failing to carry out their intentions, although this is unlikely. Conversely, they may express an intention to study ICT further but their perceived 'masculinisation of knowledge' may have defined their prior experience (Letherby, 2003) leading to beliefs that, ultimately, override rather than form intentions. The importance of intention is, therefore, key if female students are going to opt to choose ICT post 16 and beyond.

Female ICT students will inevitably have attitudes and intentions that are specifically formed due to their gender and placement within an area of dominant masculinity (Turner, 2001). Consequently, the need to address the negative attitudes and low intentions held by female students and increase their participation by studying A' Level ICT and Computer Science and beyond into Higher Education and industry, is rooted in feminist empiricism. There is little criticism of the norms of traditional computer science but instead a criticism of the way the scientific method has been practiced (Letherby, 2003). What female ICT students have experienced is ICT as represented by men from their perspective. What has appeared to be objectivity has been subjectively male, excluding females and their inclinations, ideas and preferred working styles (Smart, 1990). Thus, A' Level ICT courses, University ICT Departments and an ICT industry with parity of female participation would represent 'real' science rather than the 'faulty science' that results from masculine assumptions and ways of working.

Viewed in this light, feminist empiricism represents a threat to the traditional notion of science determined by masculine assumptions and ways of working in that this new, 'successor science' will incorporate the female perspective (Letherby, 2003). Gender and technology, consequently, will become co-constructed; those strategies, which successfully include more women into the information society, will change, inevitably, both ICT and gender and what is meant by both technology and by femininity/masculinity in order to move beyond the traditional stereotypes. For instance, in the case of vocational ICT training initiatives, computers could be strongly portrayed as 'just a tool', which is useful in the workplace. This apparently gender-free construction would distance the technology (and hence trainees) from the nerd/hacker image of computers as something men have a playful, but obsessive, relationship with and from the attitude that men are the 'real' ICT specialists. For some users, the notion of ICT as a workplace tool also distances trainees from the stereotypically feminine associations of office work (SIGIS, 2004). Such a change in attitudes to ICT in the work place, however, can only take place if supported by appropriate behaviours. In the context of this research, the behaviour that female students have chosen to join the ICT training initiative in the first place.

Intention to perform any behaviour is determined by attitudes to the behaviour and to the subjective norm. Additional variables can influence intentions only indirectly by influencing either intention or behaviour. A given variable will therefore have an effect on intentions if it meets one or more conditions. For instance, if it influences the attitudinal component and that component carries a significant amount of weight in determining the intention. Alternatively, if it influences the normative component and that component carries a significant amount of weight in determining the intention or if it influences the relative weight of the two components then intention will also be influenced (Ajzen, 1970).

Students' intent to behave (their intentional behaviour) is, therefore, multidimensional (Chatzisarantis et al. 2007). Self-Determination Theory (SDT) (Deci & Ryan, 1985) assesses the relative autonomy of intention. SDT is an organismic theory that suggests that humans – in the case of these study ICT students - are active in their pursuit of behaviours and activities that will result in a growth and a unified, coherent sense of self (Deci & Ryan, 1985). The students' attitudes to their, 'positive growth and a unified, coherent sense of self,' are found to differ in response to The Theory of Planned Behaviour questionnaire. These differing comparative responses indicate their differing intentions towards the study of ICT post 16 and beyond.

Intentional human behaviour can be described through the processes of intrinsic motivation and internalisation. SDT attempts to understand these factors that facilitate intrinsic motivation and internalisation - engendered when students are in conditions that support three innate psychological needs: self-determination, competence and relatedness (Ryan & Deci, 2000).

The relative autonomy of intentions may be measured through reasons that students give for their intentions. If students report that they intend to study ICT for extrinsic, normative, reasons ('because others say so') then it is assumed that intentions are controlling. If students report that they intend to study ICT for intrinsic reasons ('for enjoyment'), it is assumed that intentions are autonomous. Autonomous and controlling intentions promote qualitatively distinct behaviours. Autonomous intentions promote intrinsically motivated or self-determined activity, which is associated with choice, enjoyment, effort, satisfaction and motivational persistence over time.

Controlling intentions, however, promote extrinsically, rather than intrinsically, motivated behaviour and lead to defiance, tension, dissatisfaction and reduced motivational persistence over time (Chatzisarantis et al. 2007). Autonomous intentions are aimed at skill mastery and competence, and therefore process attitudes that are more likely to influence the attitude–intention relationship for autonomous and core autonomous intentions. Female students' attitudes are conditioned more from their associations and experiences of ICT, than their success in the subject academically. The nature of autonomous intention indicates there is choice and freedom in students' intention to study ICT post 16. When barriers stand in the way of behaviour (in the case of the male students) perceived control is, therefore, less likely to be affected. In contrast, controlling intentions are not aimed at satisfying needs for self-determination. Female students' academic performance may lead them to be advised by their teachers to study ICT post 16 and beyond but to do so would not be satisfying and therefore not an intrinsic, autonomous belief (Brickell et al., 2006).

3.2.8 *Behaviour*

The relationship between the variables: beliefs, attitudes and intentions and actual behaviour is of key significance. Overt behaviour may be defined as observable acts that can be studied in their own right. There has been, however, little research into studying overt behaviour and next to no research has been undertaken with regard to The Theory of Planned Behaviour in school based contexts and gender. Instead, most studies have used observable behaviour to infer beliefs, attitudes and intentions. For instance, pertinent to this study has been a great deal of research looking at the overt gender imbalance on ICT courses post 16 and in the ICT industry rather than analysing the beliefs, attitudes and intentions that lead to this attrition and the links between those beliefs, attitudes and intentions with behaviour. Those determinants are the focus of this research study.

Prior to the development of The Theory of Planned Behaviour, there was a presumption of a strong causal link between attitude and behaviour. This constituted three categories: cognitive (perceptual responses and verbal statements of belief), affect (sympathetic nervous responses) and conative (overt actions – ironically similar to behaviour itself) (Ajzen, 1970). From this attitude/behaviour relationship, it could be surmised that the relationship was virtually semiotic in that attitude denoted behaviour in the same way as behaviour denoted attitude. This, however, is not necessarily the case.

As explored in this research, broad implicit attitudes towards ICT on specific behaviours depend on the nature of the behaviour (spontaneous or deliberate) and on such individual differences as motivation to control a prejudiced reaction to, for instance, option choice. A female student, for instance, could have a very negative, disparaging attitude to ICT but still choose to study ICT post 16 despite, not due to, her attitude. It is only when behaviour is not consciously monitored, or when motivation to control prejudiced reactions is relatively low, that implicit attitudes are expected to predict behaviour. It follows that for a wide range of behaviours, and for some female students, broad implicit attitudes will lack predictive validity. Indeed, implicit measures of general attitudes are likely to encounter the same problems as explicit measures when it comes to the prediction of specific behaviours (Ajzen & Fishbein, 2005).

Intention is, therefore, the most proximal predictor of behaviour (Ajzen, 1991). The cognition that is closely linked to intention in addition to attitudes and subjective norms is perceived behavioural control. Perceived behavioural control entails the perceived ability to perform a specific behaviour and is almost a synonymous construct with self-efficacy, which is the self-belief an individual holds about their ability in a particular area. Self-efficacy, not only in its effect on attitude, is itself, precisely related to competence and future behaviour as a proximal and direct predictor of intention. According to Social Cognitive Theory (Bandura, 1986), a personal sense of control and high self-belief can facilitate a change of behaviour. Self-efficacy therefore, can determine whether behaviour change will be initiated, how much effort will be expended and how long it will be sustained in the face of obstacles and failures. Consequently, in relation to this study, the obstacle of a low GCSE grade may not deter a male student from opting to study ICT post 16. Self-efficacy influences the persistence to continue striving despite barriers and setbacks that may undermine motivation. Low self-efficacy, however, has a negative impact on the intentions of female students and their lack of intent to study ICT post 16 despite their ability in the subject. Students with strong self-efficacy select more challenging goals, focussing on opportunities, not on obstacles (Bandura, 1986).

Self-efficacy rather than prior attainment and ability in ICT has a greater impact upon students' studying ICT post 16 and beyond. Past behaviour and prior attainment, however, may also be a predictor of later action and the behaviour of female ICT A' Level students who have opted to continue the subject post 16. For example, in a study of exercise behaviour (Norman & Smith, 1995), undergraduates completed a questionnaire on two occasions, 6 months apart. Without past exercise behaviour, The Theory of Planned Behaviour variables accounted for 41% of the variance in later exercise behaviour. Adding past exercise behaviour to the prediction equation raised the proportion of explained variance to 54% (an increase of 13%). In the more recent Chedzoy & Burden (2007) research regarding Primary PGCE Student Teachers' intention to teach dance, undertaking a modular dance course led to a significantly positive shift in intention to teach dance ($p <$ than 0.05) that accounted for a 32.9% increase. A $\rho = < 0.05$ implies that there is a statistical difference in the result and that the difference has not occurred by chance.

Prior behaviour or experience may have, some small impact on behaviour, although in relation to this study, however, any similar increase in female students' intention to study ICT post 16 would be tempered by the beliefs, attitudes, self-efficacy and intentions of female students with regard to ICT.

Beliefs influence both attitudes and intention whilst self-efficacy influences intention. In turn, belief, attitudes, intention and self-efficacy affect actual behaviour. Beliefs, like attitudes, however, are not constant. If teachers understand the beliefs female students hold with regard to ICT then this is the first step towards creating learning environments that create the ambiance, ethos and atmosphere of the classroom to encourage female students to study ICT Post 16 and beyond.

3.3 The Transtheoretical Model of Change: An Alternative to the Theory of Planned Behaviour Model?

The Transtheoretical Model (TTM) of Change, as expounded by Prochaska & Velicer (1997) and Velicer (1998) is a theoretical model of intentional behaviour change, with a focus on the individual making decisions in order to change their behaviour. It is an integrative model of behaviour change that describes how people can modify a problem behaviour or acquire a positive behaviour. The central organising construct of the model is the Stages of Change and it includes a series of independent variables, the Processes of Change, and a series of outcome measures, including the Decisional Balance and the Temptation scales. Key to the application of the model is short, accurate and, consequently, valid measurement. This requires a series of specific items that the individual, ideally, can respond to accurately with little opportunity for error or lack of clarity.

Velicer (1998) describes the Basis of Change, as illustrated in Figure 3, as five steps that support behaviour changes that occur before and during a given behaviour change. The steps are:

- **Precontemplation,** the stage in which people are not intending to take action in the foreseeable future, usually measured as the next six months;
- **Contemplation**, the stage in which people are intending to change in the next six months;
- **Preparation**, the stage in which people are intending to take action in the immediate future, usually measured as the next month;
- **Action**, the stage in which people have made specific overt modifications in their life-styles within the past six months and finally;
- **Maintenance**; the stage in which people are working to prevent relapse but they do not apply change processes as frequently as do people in action.

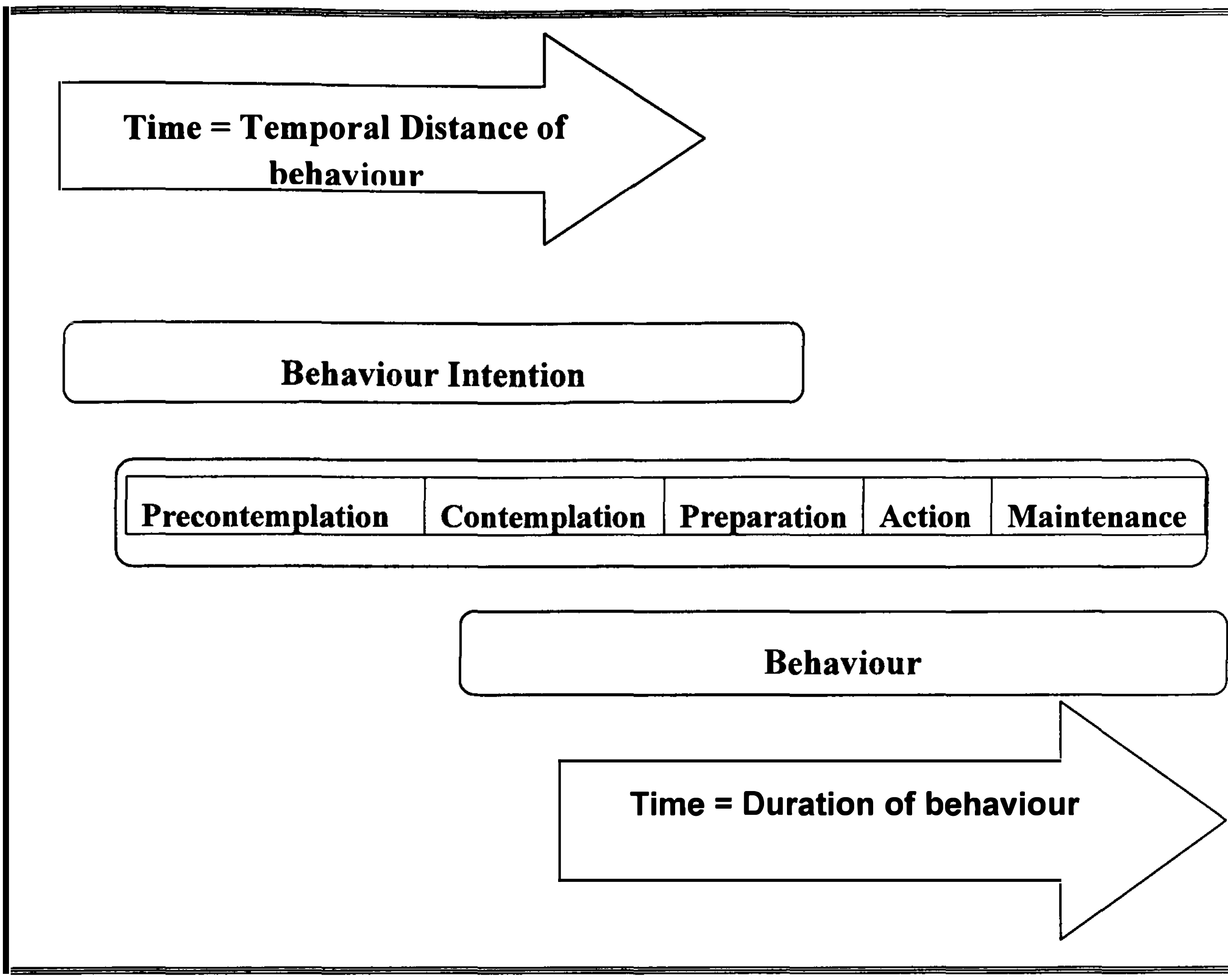

Figure 3: The Temporal Dimension as the Basis for the Stages of Change

The Theory purports that whether or not behaviour will actually change is dependent upon Decisional Balance that is in effect the balance an individual comes to after weighing of the pros and cons of changing their behaviour. These Decisional Balances themselves are affected by a number of influences including self-efficacy (Bandura, 1986). Self-efficacy refers to self-confidence and questions whether individuals have the confidence not to revert to original behaviours. Temptation is another Decisional Balance factor that questions if individuals have the will to resist the urge not to revert to the original behaviour they sought to change.

Whether or not behaviour will finally change will ultimately depend on the 10 key steps being manoeuvred. Five are Experiential Processes used primarily for the early stage transitions of behaviour change:

- Consciousness Raising (Increasing awareness);
- Dramatic Relief (Emotional arousal;
- Environmental Re-evaluation (Social reappraisal);
- Social Liberation (Environmental opportunities) and
- Self Re-evaluation (Self-reappraisal).

The later steps are Behavioural Processes that play a role in modifying behaviour (or not) according to the Transtheoretical Model including:

- Stimulus Control (Re-engineering);
- Counter Conditioning (Substituting);
- Reinforcement Management (Rewarding) and
- Self Liberation (Committing).

The five steps of experiential change begin with Consciousness Raising, which occurs when an individual becomes aware of the behaviour that should change from external interventions that could include confrontational behaviour from others, education and the media. Dramatic Relief involves an increased emotional response that goes beyond awareness. The next stage is an Environmental Re-evaluation that involves an awareness of the external affect of the behaviour whilst Social Liberation, the next stage, requires an awareness of, or access to, external opportunities to support behaviour change. The five later stages of behavioural processes begin with Self-re-evaluation when an individual consciously becomes aware of their behaviour as non desirable. This is followed by Stimulus Control where cues for the negative behaviour are removed and replaced by positive alternatives. Helping Relationships follow and the positive effects that can be gained from having positive support from others. Counter Conditioning follows requiring the adoption of positive behaviours that can substitute for problem behaviours. Reinforcement Management then provides consequences for taking steps towards behaviour that differs from the behaviour to be changed, including rewards. Self-liberation concludes the process of behaviour change when the change is publically articulated and declared.

The Transtheoretical Model affects five areas: recruitment, retention, progress, process and outcome. Individuals will be attracted to the Model when they are ready to make the behaviour change although there are very different stages of readiness. High retention rates may then follow due to the Model having flexibility and personalisation. The progress of change can be measured by a set of outcome measures that are sensitive to a full range of cognitive, emotional and behavioural changes in addition to recognising and reinforcing smaller steps than traditional action-oriented approaches.

The Transtheoretical Model can support an analysis of the meditational mechanisms. The Model can facilitate a process analysis that can modify and improve the intervention incrementally. Finally, and consequentially, The Transtheoretical Model can support an appropriate outcome assessment. Interventions can be evaluated in terms of their impact on changing behaviour (Trafimow, 2008).

3.3.1 Transtheoretical Model of Change – A Critique

The Transtheoretical Model of Change is highly persuasive in its detail and flexibility; however, there is a body of critical evidence (West, 2005) that challenges its effectiveness in changing behaviours. It is claimed that the boundaries between and within 'stages' are arbitrary and the stages of change cannot actually be ascribed with any conviction or precision. Indeed many participants skip or ignore stages in reality. Importantly, why participants reach, ignore, skip or fail a stage is not addressed (Bridle et al., 2005). A strength of The Theory of Planned Behaviour is that it is able to highlight the beliefs that affect attitudes in relation to actual behaviour itself. Additionally, classifying individuals presumes that individuals typically make coherent and stable plans. The instrument to measure the impact of the model at its different stages is a multiple-choice questionnaire and there is a presumption made that the participants will answer honestly (West, 2005). They could be, however, compliant and will generally try to choose an answer to not only please the researcher but also to scaffold their own desired response. There is no internal accounting within the measuring instrument in The Transtheoretical Model of Change as exists in The Theory of Planned Behaviour. Another key criticism is that the Model has no measure of 'Readiness' or 'Preparedness' to change. Most significantly, however, in relation to this study, the Model only focuses on conscious decision making and planning processes and therefore pays no account of the motivating and de-motivating factors that impact on attitudes, beliefs and behaviour (Robinson & Berridge, 2003). Behaviour occurs due to attitudes and beliefs and does not consider the decision making 'pros and cons' weighing as overtly as the Model proposes (West, 2005).

3.4 The Theory of Planned Behaviour- A Critique

In common with The Transtheoretical Model, The Theory of Planned Behaviour does not provide the type of interventions needed to necessitate behavioural changes. It is also limited in that it does not take into account emotional variables such as threat, fear or mood when participants complete the TpB Questionnaires. Additionally, negative or positive feelings are only assessed in a limited fashion (Dutta-Bergman, 2005). Whilst this can clearly impact on results analysis in health related behaviour situations, as many individuals' health behaviours are influenced by their emotional well being, it could be contested that in the secure and familiar contextual environment of the ICT classroom that emotions do not have them same affect.

However, given the participants' ages ranged from 15-18 the students' emotional responses may actually have more impact on their questionnaire responses than first thought. A strength of The TpB model, however, is that there is a level of self-accounting within the questionnaire and emotional responses are factored into some of the questions such as the Behavioural Outcome question, 'My missing out on activities outside of my ICT class would be Extremely Bad-Extremely Good'. This question both implicitly and explicitly requires a partially emotional response with regard to attitudes to the situational context of ICT lessons in both its abstract and concrete meanings.

A further issue that arises with regard to The TpB is the time differential between students completing the questionnaire and undertaking the behaviours in question. The passage of time can influence the strength of the intention–behaviour relationship (Fishbein and Ajzen, 1975). What may also be important, however, is not the passage of time per se, but the difficulty to foresee how, and to what extent, future events will bring about changes in the intent to perform certain behaviours; the non-equivalence between the perceived behavioural control and perceived barriers. Perceived barriers are significant predictors that may work against the effects of intention (Bozionelos & Bennett, 1999). What The TpB questionnaires analysed in this study can identify, however, is the situational and contextual differing response between female and male students and female students in differing school contexts. This provides rich data in order to begin to identify ways in which teachers can change the salient beliefs that impact on female students' lack of intent to study ICT at Post 16 and beyond.

3.5 The Theory of Planned Behaviour- A Justification

The Theory of Planned Behaviour has been selected as the theoretical framework because it enables the exploration and evaluation of volitional behaviour. An individual's behavioural intention cannot be the exclusive determinant of behaviour where an individual's control over the behaviour is incomplete. Building on The Theory of Reasoned Action (Fishbein & Ajzen 1980 1975), Icek Ajzen, by adding the measure of Perceived Behavioural Control and establishing The Theory of Planned Behaviour (Ajzen, 1985), has been able to explain the relationship between behavioural intention and actual behaviour (Glanz, et al., 2002). The Theory of Planned Behaviour has enhanced the certainty of intention in differing, often health-related, fields in addition to explaining an individual's behaviour by considering perceived social norms as an important variable.

That the number of students studying ICT post 16 in the UK is declining (Ofsted 2009) and pipeline shrinkage (Gras-Velazquez et al., 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990) is an international cause for concern is well documented. Female students' antipathy towards ICT has been the focus of many research studies but the findings were superficial in exploring concrete attitudinal differences to the subject itself, often through closed quantitative questions asked on a questionnaire or through qualitative interviews where the female students' attitudes towards the subject results in responses that are reductive and narrow (Christie, 2002). The strength of The Theory of Planned Behaviour model is its breadth and depth. It is a psychological model that, over a series of 55 questions, looks at the broad spectrum of students' Behavioural, Control and Normative beliefs from not only the ICT locus of intent and control but with regard to study and the opinions of significant referents. The comparative data the model provides allows teachers to identify the salient beliefs female students hold, whether in mixed or single gender school contexts, and begin to devise strategies to support them holding more positive beliefs regarding to ICT that will lead to them choosing to study ICT post 16 and beyond.

The power of this evaluative model is invaluable for the purpose of this study: Are there gender differences in Behavioural, Normative and Control Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?
Sub questions seek to address: Whether there are gender differences in ICT students' attainment and what impact this has on their intent to study ICT post 16 and beyond; How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage'; How do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?; and What impact does teacher gender have on the beliefs of female students towards ICT in single and mixed gender schools?

Previous feminist studies have addressed the gender issues of redistribution - the failure to attract female students and women to study ICT in Higher Education and beyond to work into the ICT Industry - and recognition - that ICT itself has become masculinised and perpetuates male dominance (Gracia-Luque & Stein, 2005). The Theory of Planned Behaviour, however, goes beyond the redistribution and recognition that has dominated this research field. The TpB Model as used in this study explores the differences in behavioural attitudes and beliefs between genders and school contexts to establish opportunities for teachers, schools, The Teacher Development Agency (The TDA) and The Department for Children Schools and Families (The DCSF). The objective is to change salient beliefs so that some of the causes of pipeline shrinkage can be addressed.

3.6 The Research Questions

The purpose of this study, as outlined above, is to address the overarching question, from a post positivist paradigm: Are there gender differences in Behavioural, Normative and Control Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

The four accompanying sub questions are:

- Are there gender differences in ICT students' attainment and what impact does this have on their intent to study ICT post 16 and beyond?
- How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).
- How do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?
- What impact does teacher gender have on the beliefs of students towards ICT in single and mixed gender schools?

4.0 Methodology

The Master's Tools Will Never Dismantle the Master's House

(Audre Lourde, 1984)

4.1 Methodological Considerations

Methodology is focused on the specific ways - the methods - that are used to understand the world better. It is a branch of philosophy that analyses the principles and procedures of inquiry in a given discipline. Epistemology, the philosophy of knowledge or of how we come to know, is intimately linked to methodology. The former involves the philosophy of how we come to know the world and the latter, the practice. The term epistemology comes from the Greek, epistêmê, 'for knowledge'. Methodology is also concerned with how we come to know, but is more pragmatic in nature (Trochim & Donnelly, 2007).

For the purpose of this study, the primary instrument of enquiry was a quantitative Theory of Planned Behaviour Questionnaire, undertaken in order to explore female students' attitudinal responses to studying ICT post 16 and beyond. This was supplemented by a series of semi-structured qualitative interviews to provide further data as a benchmark to The TpB. The use of a mixed method approach combines the strengths of both the quantitative and qualitative data in order to ensure that the conclusions reached are valid.

A post-positivist methodology was adopted in order to explore the relationships between female students' attitudes to studying ICT post 16 and a number of variables. There is an expectation that the research findings can identify for teachers ways to encourage female students' participation in the study of ICT post 16 in order to begin to eliminate their attrition in the ICT industry and the consequent 'pipeline shrinkage'.

4.2 A post-positivist paradigm

Traditionally, positivism assumed that there was only one reality and the researcher's role was to explain, predict or control a situation:

> A normative attitude, regulating how we are to use such terms as knowledge, science, cognition (and) information.
>
> (Kolakowki & Gutterman, 1968)

Positivism historically rejects the theories of theology and metaphysics in that they are refutable. Positivism assumes an objective world; hence, it often searches for facts conceived in terms of specified relationships and associations among variables (Gephart, 1999). Used in the social sciences, therefore, a positivist approach allows the researcher to collect data from many subjects on a number of well-defined questions. It is an approach that strives to be unbiased, reliable and rational, thus appealing to many researchers. There are, however, multiple realities within the world. The positivist approach, consequently, may lack depth and richness (Patton, 1990).

Additionally, underlying the apparent objective research approach of positivism are assumptions that reflect the researcher's biases.

> Distance does not guarantee objectivity; it merely guarantees distance
>
> (Patton, 1990).

Post positivism is consistent with positivism in assuming that an objective world exists but it assumes the world might not be readily apprehended. Furthermore, it is assumed that variable relations or facts might be only probabilistic, not deterministic. The positivist focus on experimental and quantitative methods used to test and verify hypotheses has, therefore, been superseded or complemented, to some extent, by an interest in using qualitative methods, as used in this study, to gather broader information outside of readily measured variables. Logically, (i.e. in principle if not in practice) positivism focuses on falsification rather than verification given the complexity of real world phenomena. Only one counter-example or feature is needed to falsify a proposed relationship but one must assess all possible variables to verify if a relationship is consistent across all such conditions. Furthermore, increased effort is devoted to establishing the domain of generalising findings based on the features of the sample and sampling context. These are features that in human behaviour are complex and open-ended. They contrast greatly with the order and regularity of the natural world (Cohen et al., 2007, Gephart, 1999). Positivism does not have the flexibility and depth of description to explore the unique nature of human experience that post positivism can embrace (Cohen et al., 2007).

Post positivist research is an interactive process in which the researcher and the participant learn from each other resulting in a realistic understanding, interpreted through the social and cultural context of their lives. In this study, a realistic understanding of female students' beliefs, attitudes and intentions with regard to the study of ICT post 16 and beyond is reached through analysis of The TpB Questionnaire that produced in-depth, detailed, rich data based on the female students' personal perspectives and experiences (Agger, 1991). The basic assumptions of positivism: ontological realism, metaontology, the possibility of objective truth and the use of experimental methodology are reflected but the post-positivist perspective adopted in this study allows a more pragmatic and conceptual response. Conceptually, unlike the subjects of natural science that can be scrutinised from a purely positivist quantitative position, people are reflexive. In this study, teachers and schools may alter their behaviour based on the findings of the researcher.

4.2.1 Ontological realism, metaontology and the possibility of objective truth

The basic question of ontology is 'What exists?' The basic question of metaontology is: can the question, 'What exists?' be answered with objective truth? There are two positions: ontological realism and ontological anti-realism (Sider, 2008). Ontological realism is rooted in Quine (1948) who believed that what exists could be determined by seeing which entities are endorsed by the best scientific theory of the world. In recent years, the practice of ontology has often presupposed an ever-stronger ontological realism and strong versions of ontological realism have received explicit statements. Alternatively, ontological anti-realism is often traced to Carnap (1950), who held that there are multiple, differing ontological frameworks and that, as different sorts of entities exist; there is no certainty as to which is correct. Although there are objective answers to ontological questions, these answers are somehow shallow or trivial, perhaps reflecting conceptual truths rather than the furniture of the world (Hirsch, 2002). The various alternatives to ontological realism and reality raise a number of questions. For instance: is the rejection of ontological realism based on the desire to make unanswerable questions go away in order to avoid questions that resist direct empirical methods but are not answerable by conceptual analysis? Furthermore, the very assertion that there are alternative theories of reality's objective structure is itself incapable of being established by either straightforward empirical means or conceptual analysis (Chalmers, 1997).

Ontological existence assertions, like external questions, purport to be independent of a framework, but lack determinate truth-conditional content, and typically lack determinate truth-values. Ontology is currently not conceptually analytical; few theorists would ponder, for instance that, "chairs exist". Methodology is rather quasi-scientific, treating competing positions as tentative hypotheses about the world (Chalmers, 1997). Consequently, the existence of different perspectives – the differing beliefs, attitudes and intentions that will inevitably exist between female students when questioned on their intent to study ICT post 16 and beyond - does not rule out the reality of objective truth which, in a sense, encompasses all the perspectives. To dismiss an objective reality is, potentially, to dismiss the individual attitudes and beliefs of individual female students (Sharlow, 2001).

4.2.2 Post-positivism and critical realism

One of the most common forms of post-positivism is the philosophy of critical realism. A critical realist believes that there is a reality independent of our thinking that science can measure. (This is in contrast with a subjectivist who would hold that there is no external reality). The difference is that the post-positivist critical realist recognises that all observation is fallible and has error. Therefore, all theory is revisable. In other words, the critical realist is critical of our ability to know reality with certainty. Where the positivist believed that the goal of science was to uncover the truth, the post-positivist critical realist believes that the goal of science is to hold steadfastly to the goal of determining the nature of reality, even though that goal may not be achievable. Similarly, whilst post-positivists believe that all observations are theory-laden and claim that scientists are inherently biased by their own cultural experiences and perspectives they concurrently reject the relativist idea of the incommensurability of different perspectives. We can thus never understand each other because we come from different experiences and cultures. Post-positivists, therefore, are usually constructivists who believe that we each construct our view of the world based on our perceptions of it (Christie, 2006).

The Theory of Planned Behaviour is used in this study to explore the attitudes, intentions and behaviour that female students themselves have constructed whilst using the results to recommend to schools and teachers how they can work towards creating classroom environments to support all learners despite the view of the world held by male ICT teachers. The TpB is presented as a complete theory of behaviour in that it acknowledges other influences thought to affect action because of their impact on the specified cognitions. It does not specify how other variables, such as past behaviour, might influence these cognitions, as it is open to the inclusion of further variables if they are found to enhance its predictive utility in either general or particular behavioural domains (Ajzen, 1991). It provides a rich, post-positivist analysis of behaviour that acknowledges the complexity of, and apparent contradictions that exist in, participants' attitudes, intentions and influences. The TpB states that individual behaviour is driven by behavioural controls: behavioural intentions that are a function of an individual's attitude toward the behaviour, the subjective norms surrounding the performance of the behaviour and the individual's perception of the ease with which the behaviour can be performed.

Attitude toward the behaviour is defined as the individual's positive or negative feelings about performing behaviour. These can be determined through The TpB

Questionnaires to quantify, assess and analyse beliefs regarding the consequences arising from a behaviour and evaluate the desirability of those beliefs. The TpB views the control that people have over their behaviour as lying on a continuum from behaviours that are easily performed to those requiring considerable effort. These are measured in the questionnaires through a 4-part Likert scale.

4.3 Data Gathering Instruments

4.3.1 *Questionnaire Development*

Before implementing the questionnaire on the population sample, it was both piloted and assessed for reliability on a pre-research study focus group – in this case the students from the mixed gender Academy at the beginning, rather than the end of, Key Stage 4. This pilot study was based fully on the 55-item Theory of Planned Behaviour questionnaire, but had no supplementary questions with regard to teacher gender, prior attainment, ICT association or preferred working preference. These additions to this final research study, as well as the introduction of the semi-structured qualitative interview questions, provide richer, more comprehensive data.

Based on the measurement scales of The TpB, (Ajzen, 1991) a four-part questionnaire was developed to obtain information on the behavioural, normative and control beliefs of students regarding their intent to study ICT at post 16 and beyond. The construction of The TpB questionnaire took place in 9 phases; some swiftly implemented and others involving a longer process of empirical investigation. The first step was to define the population; in this study schools that broadly replicate national average attainment and include both mixed gender and single female gender samples. This was followed by defining the behaviour to be studied. In the case of this research, the behaviour was the intent study ICT post 16. The third step was the measurement of the intentions. For the purpose of this study a 24-item TpB questionnaire using a 4-part, Likert scale to measure intention performance was used. The Likert Scale is a summated ratings method that measures the sum of responses on several items in order to factor analyse the items to determine the number of and strength of scales measured. A 4-part Likert scale was adopted following the pilot study that used a 5-part Likert scale. This was found to be less effective when analysing the questionnaire results due to the ambiguity of the 'neither agree nor disagree' response. This was consequently a forced choice.

The questions then need to be refined to accommodate the measurement decided upon using bi-polar adjectives to anchor responses – a pair of oppositional adjectives or adjectival phrases that are evaluative - such as 'good or bad' or 'worthless or useful'. These adjectives form the basis for numerical scoring to code the times on the scale. The questionnaire then was broken down into sections that encapsulate the Behavioural Beliefs (Behavioural Outcomes Evaluation and Past Behaviour), the Perceived Behavioural Control Beliefs (Subjective Norm, Attitudes and Intention), Normative Beliefs and Motivation to comply, and Control Beliefs.

Finally, before implementing the questionnaire on the population sample, it was both piloted and assessed for reliability on a pre-research study focus group – in this case the students from the mixed gender Academy at the beginning, rather than the end of, Key Stage 4. This pilot study was based fully on the 55-item Theory of Planned Behaviour questionnaire, but had no supplementary questions with regard to teacher gender, prior attainment, ICT association or preferred working preference. These additions to this final research study, as well as the introduction of the semi-structured qualitative interview questions, provide richer, more comprehensive data.

To address the research question that explores strategies to support female students' participation in the post 16 study of ICT and beyond, a question was included to ascertain students' preferred learning style.

4.3.2 *Measurement Design: The Theory of Planned Behaviour Questionnaire*

The first section of The TpB Questionnaire involved Background Data. The next two sections focussed on: Section 2. What ICT means to you; Section 3. Behavioural Beliefs (Outcome Evaluation and Past Behaviour). The final section, Section 4, covers Behavioural Beliefs (Beliefs, Behavioural Control and Attitudes), Normative Beliefs and Control Beliefs.

The Behavioural Beliefs constructs (See Appendix 1, Section 4 Questions 31-39) consists of five components: the perceived likelihood of the behaviour's outcomes and a self-report on past behaviour, direct measures of perceived behavioural control and attitudes and the specific beliefs themselves. The TpB assumes that having a positive/negative attitude toward behaviour is based upon believing that the behaviour will be likely/unlikely to lead to positively/negatively evaluated outcomes (Lam & Hsu, 2004). In order to measure these Beliefs a 24-item measurement was developed with the 4 point Likert scales measuring the evaluative (definitely true - definitely false) and potency (I should – I should not) dimensions of differential response. Students indicated the agreement and importance levels for each item.

Attitudes (See Appendix 1, Section 4 Questions 18, 21 and 25) were further measured by 9 statements) measuring again the evaluative (valuable-worthless) and potency (I definitely will - won't) dimensions of differential response using the 4-

point Likert scale. Students indicated the agreement and importance levels for each item.

The Normative Beliefs Constructs (See Appendix 1, Section 4 Questions 27-30, 51-55) had two components: The motivation to comply with the wishes of the specific referents or the motivation to comply and the perception of specific referents' opinions on whether a student should or should not perform behaviour. The referent group of the study included teachers, parents, close friends and peers. An eight- item measurement with the 4-point Likert scales was used to examine students' normative beliefs from the bi-polar adjectival anchors.

The Control Beliefs Constructs (See Appendix 1, Section 4 Questions 40-51) ***consisted*** of two components: occurrence frequency of the facilitators or inhibitors of the behaviour or control beliefs and the perception of the strength of the facilitators or inhibitors or power. Twelve items were used to measure control beliefs. The 4-point Likert scale was used, again using evaluative dimensions.

Past Behaviour (See Appendix 1, Section 3, and Question 11) was measured with one statement with relation to prior attendance. Students were asked, 'During the past 2 terms, what percentage of meetings of this (ICT) class you have attended' and then required to supply a percentage of meetings.

4.3.3 Interview Question Development

Based on the measurement scales of the TpB, (Ajzen, 1991) a series of 20 semi-structured interview questions were developed to explore students' beliefs, attitudes and intentions towards studying ICT post 16. Each student was asked all the questions, in the same order, but was allowed to answer as they interpreted the questions with no prompting or interruptions.

4.3.4 Measurement Design: The Interview Questions

The first six questions of the semi-structured interview questions (See Appendix 3) mirror the section of the TpB questionnaire involving ***Background Data*** – work styles preferences and associations. The following 14 questions mirror the questions in the TpB questionnaire regarding beliefs and intentions:

The Behavioural Beliefs & Outcome Evaluations constructs consists of five questions. Students were given opportunities to elaborate and discuss the questions as they chose.

The Normative Beliefs Constructs consists of three questions. The participants were given the opportunity to indicate their beliefs regarding three referents: parents, close friends and teachers;

The Control Beliefs Constructs *consisted* of two Control Beliefs questions, two Power of Control Factors and a Motivation to Comply question.
The semi-structured interviews concluded with a question regarding ***Intention.***

4.4 Population and Sample

The population of the study consisted of three secondary schools in South East England but from different Education Authorities (EAs): A Mixed 11-19 Academy, a mixed 11-19 High School and a Singe Sex Female students' 11-16 Comprehensive. During the spring term of the 2006-2007 academic year the sample of 150 students were questioned, 50 from each of the three participating schools. 120 of the questionnaires from the sample were useable; 40 from each of the three participating schools – two Kent (1 Medway Education Authority and 1 Kent Education Authority) schools and one inner London Education Authority school. In two cases (the Kent schools) 25 students were Key Stage 4 students and 15 A' level students. In the London school, all participants in the sample were Key Stage 4, as the school does not have a Sixth Form.

From the 150 students who participated in the study, 120 of the questionnaires were used in the final analysis. The 30 questionnaires that were un useable were discarded for differing reasons. In line with BERA guidelines, the participants, despite prior parental consent, were given the option not to take part in the study. Consequently, ten 10) students chose not to participate. Finally, 20 of the questionnaires were incorrectly completed and were therefore invalid. In some cases they had been graffitied or doodled on rather than responding to the questions and in other cases students had responded with comments such as 'Don't know' rather than using the Likert scale.

All the students were selected by using random procedures (i.e. all similar schools in the three Education Authorities had an equal chance of being selected) and the classes were selected from these schools in order to have equal numbers from each Key Stage.

The questionnaires were administered under the supervision of teachers in school time, in a single ICT lesson. Two versions were given – a Key Stage 4 questionnaire to Year 11 students studying either The Diploma in Digital Applications (DiDA) course or GCSE ICT and a post 16 version to students studying either A' Level Computing or Applied ICT. The questionnaire consisted of four sections and the students were informed that the data would be used for research purposes only and therefore would be anonymised.

4.4.1 The Academy

The Academy is situated in Kent and was, until 2006, A City Technology College (CTC). It was deemed by Ofsted (2005) 'a very good college with many excellent features (and) exceptional leadership.' It was one of the first City Technology Colleges to be established, in many ways, to recreate the philosophy behind the Technical Colleges that were the third and most innovative strand of R. A. Butler's Tripartite 1944 Education Act. It is a mixed 11-19 school, wholly maintained by the Government but with independent status. It has specialisms in technology, sport, business and enterprise and is the lead school in a local teacher training consortium. Education is free and The Academy is required to recruit from within a specified catchment area and to accept students that represent the whole ability range, 10% of the places are reserved for students in the highest ability band and a similar percentage for those with learning difficulties. In 2008, 214 students were eligible for Free School Meals and 5.6% of the school population had special educational needs. The Academy accepts 240 students a year and there is open recruitment at post 16. The Academy has a higher roll than the national average at 14 51, with a ratio of 56% male: 44% female students. GCSE results in 2008 were 94% A* - C but with less than the national average of students achieving a A* - C in both English and Mathematics at 24%. The contextual value added score is 1038.7, higher than the LEA average of 1007.1. The average A' Level point score is 517.4

4.4.2 The High School

The High School situated in The Medway Towns, was deemed 'Outstanding' by Ofsted in 2006. It is on the list of the most Improved Schools for both 2006 and 2007. The school has Specialist Technology College status. There are 1117 students on roll, which is slightly above average and with significantly more male students than female. The school is popular and over-subscribed. The proportion of students with learning difficulties or disabilities is high at 25% although the proportion of students from minority ethnic groups is lower than seen typically in secondary schools, as is the proportion of students who do not speak English as a first language. Whilst the proportion of students entitled to free school meals is around the average, the area the school serves has significant pockets of hardship and many students come from families who have limited experience of higher education. GCSE results in 2008 were 68% A* - C with 31% of students achieving A* - C in both English and Mathematics. The contextual value added score is 1025.5, higher than the Education Authority average of 1006.4. The average A' Level point score is 460.1

4.4.3 The Female students' Comprehensive School

The Female students' Comprehensive is situated in East London. It has been deemed a 'Good' school with 'above average standards' and a Headteacher 'passionate about promoting equalities' (Ofsted, 2008) It is one of the oldest Female students' Schools in England, starting as a charity school in 1777, when it was unusual for benefactors to view Female students' education as important. The ethnic mix of the student population is diverse, reflecting well-established, large communities of White, Asian, Black Caribbean and Black African families in the local area. A high proportion of the students are eligible for free school meals in this inner city area of East London, which is one of the most deprived in the country. Although the percentage of students who speak English as an additional language is high compared with national and London averages, the number of students at the early stages of learning English is comparatively low. The number of students entering the school mid-term is also low for London. Attainment on entry to the school is close to the national average and the proportion of students, who have special educational needs, including those with statements, is in line with national averages. Under the Excellence in Cities scheme, the school has a Learning Support Unit for students who display disaffection or disruptive behaviour. The aim of the unit is to improve behaviour and communication skills and to reintegrate students successfully into classes. Since September 2003, the school has been a specialist language college. All students study two languages up to the age of 14 years and at least one at GCSE. The range of languages covers both European and community languages such as Urdu and Bengali. There are just fewer than 1200 Female students on roll. GCSE results in 2008 were 73% A* - C with 48% of students achieving an A* - C in both English and Mathematics. The contextual value added score is 1003.7, slightly lower than its Education Authority average of 1011.6.

4.4.4 The Selection of the Sample

To explore gender differences in Behavioural, Normative and Control beliefs towards ICT and how far teacher gender, learning styles, past behaviour and prior attainment may affect the behaviour of female and male students as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980) students from mixed schools were necessary to be part of the sample. The selection of two mixed schools and a single gender girls' school allowed a number of variables to be addressed for the purpose of the study. In order to explore the research question: Do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The TpB model?, students attending both mixed and single gender schools necessitated being part of the sample.

Key to selecting individual schools was locality and accessibility, which necessitated using schools in South East England. Ideally situated with regard to location were schools within Kent, Medway and south and east London. Kent and Medway Education Authorities, however, remain areas of High Selection as both retain the grammar school system and approximately 20% of the most able students attend selective grammar schools. In fully selective Education Authorities with High Selection, 'making it' to a grammar school appears to be 'extremely' beneficial and failing to do so results in those students also underachieving compared with their peers with similar cognitive ability in a fully comprehensive school (Atkinson et al., 2006). Data suggests that students who just fail to 'scrape' into grammar schools are less likely to succeed academically than their peers who score as little as a point more on the Selection Test. Yet those grammar school bound children could have lower Standard Attainment Tests (SATs) levels and Cognitive Ability Test (CATS) scores (Shagen & Shagen, 2002,). It was important, therefore, that the two mixed schools chosen for this study were selected to, as far as possible; closely mirror national performance in comprehensive schools as represented by the single sex school in a comprehensive school in an inner London Education Authority.

All three schools are broadly representative of the national average GCSE pass rate of 74.1% A - C grades (Stubbs, 2008) with percentages of between 94% - 68%. The Academy has the highest A-C pass rate but the lowest when calculated with English and Maths – 24%. The single sex comprehensive school has the highest A-C pass rate when calculated with English and Maths – 48%. This is only marginally higher than the national average of 46.7%. Its overall A-C pass rate is 73% and therefore only 1% less than the national average (The BBC, 2009).

4.5 Data Analysis and Representation

4.5.1 The Theory of Planned Behaviour Data Analysis and Representation

The Theory of Planned Behaviour (TpB) was the theoretical basis for a questionnaire administered to the students in this study. All elements of The TpB were incorporated, as well as additional items that measured attitudes towards ICT – gender, learning style and prior attainment. Items were arranged in the order suggested by Ajzen and Fishbein (1980). Modifications were then applied to measure attitudes to learning, work and study style in addition to a question to measure associational responses to ICT.

The data generated by The TpB questionnaires was analysed carefully to indentify attitudinal differences between both female and male students and between female students in different educational contexts. A research study is of no significance if it does not seek to address, describe and explain the important experiences and meanings in participants' lives (Denzin & Lincoln, 1998). Their experiences and the interpretation of those experiences form a specific interpretation of their shared cultural group identity (Cresswell, 1998); in this research the collective attitudinal response of a group of female students who study ICT in either Key Stage 4 or Key Stage 5.

The 150 participants in the population sample were keen to participate and their teachers supportive of the research as is the ideal (Cresswell, 1998). The teachers shared the political educational position of the research aim: to increase participation of female students post 16 as it is in their interests to promote their participation in relation to enhanced rolls and increased attainment.

4.5.2 The Theory of Planned Behaviour (TpB) Questionnaire

The Theory of Planned Behaviour Questionnaire was divided into 3 areas for analysis: Section 1. Background data including prior attainment, learning, work and study style preferences; Section 2. Associational questions with regard to attitudinal belief and Sections 3 & 4, the seven specific categories of The TpB. Questions utilise the response mode of multiple choice using a Likert rating scale. They are closed questions that prescribe the range of responses (Cohen et al., 2007).

The measurable responses are gleaned from students that are independent of their literacy levels and ability to differentiate responses. The questions generate frequencies of response to facilitate the use of SPSS as utilised in this research study. Rating scale questionnaires also enable comparisons to be generated as the research questions in this study necessitate. The results are compared against two measures in order to address the research questions that seek to measure if there are: Differences between female and male students' attitudes, intentions and beliefs in all three schools and measure attitudinal differences between the female students in the Single Sex School and the Mixed Schools. Additionally analysed, are the significance of prior attainment, learning styles, gendered associations to ICT and teacher gender.

Pearson's Chi Square Test is used to analyse the comparative data in order to ascertain the differing statistical significance of gendered student responses and to establish whether there are statistically significant differences in the responses of female and male students. Pearson's Chi Square Test is a statistical test more likely to establish significance to the extent that; the relationship is strong, the sample size is large and/or the number of values of the two associated variables is large. A chi-square probability of 0.05 or less is commonly interpreted by social scientists as justification for rejecting the null hypothesis suggesting that the raw variable is unrelated (that is, only randomly related) to the column variable (Pallant, 2005). The data gathered is presented and discussed in relation to this test. The test measures the distance between a statistically generated expected result and the actual result to ascertain whether there is a statistically significant difference between the two results (Cohen et al, 2007). Additionally, Pearson's Chi Square Test was used to analyse the impact of teacher gender on the beliefs of students towards ICT. It was also used to measure differences in Key Stage 4 GCSE and equivalent attainment prior to post 16 ICT study.

The method of analysing the comparative data in order to ascertain the statistical significance of student responses between the female students in the mixed schools and single sex female students' School is the Kruskal -Wallis Test. This is a non-parametric alternative to a one-way between-groups analysis of variance. (Non-parametric tests are necessitated when assumptions about the underlying population are in question). Scores are converted to ranks and the mean rank for each group is compared. On completion of the test if the significance level is a value less than .05 it can be concluded that, there is a statistically significant difference in the continuous variable across the comparison groups (Pallant, 2005).

Additionally, Spearman's Rank Order Correlation (rho) is used to ascertain the strength of the relationship between gender and learning style preferences. This test is used to calculate the strength of the relationship between two continuous variables. This is the non-parametric alternative to Pearson's product – moment correlation.

To ascertain the strength of the relationship between prior attainment at Key Stage 3 and gender, the Mann-Whitney U test is used. This test ascertains the differences between two independent groups on a continuous measure. The test is the non-parametric alternative to the t-test for independent samples as the Mann-Whitney U Test compares medians and converts the scores on the continuous variable to ranks across the two groups. It then evaluates whether the ranks for the two groups differ significantly, giving the value of the Z - approximation test which includes a correction of ties for the data. The result is of statistical significance if the probability value is less than or equal to 0.05 (Pallant, 2005).

4.5.3 Semi-Structured Interview Questions: Data Representation

Thirty Key Stage 4 ICT students from one of the Mixed Schools participated in a series of semi-structured interviews. These students were not the group who had filled in The TpB Questionnaire, but a parallel Key Stage 4 class. There were 13 female students interviewed and 17 male students. The students were interviewed individually and each interview took approximately 15 minutes. The interviews were recorded and then transcribed. Supplementary probing and clarifying were kept to the very minimum to allow the respondents to talk freely around each question. Consequently, gendered differences in interpretation of questions became part of the analysis when emergent themes were identified. The interviews were conducted in a specifically identified interview room. The door was closed but had a window looking out onto a busy main corridor. This ensured privacy (Cohen et al., 2007) but in a very safe, familiar environment. The students were aware of the aims of this study but also belong to a school culture that frequently seeks student voice. The tape recorder was placed on the table in full view of the participants. It was made clear they did not have to answer all the questions if they did not want to. All respondents, however, chose to answer all the questions. The interviews were played back to the students, at the end of each interview, to allow them to make changes, clarifications and amendments.

4.6 Validity and Reliability

4.6.1 Validity and Reliability: The Theory of Planned Behaviour Questionnaire

Female students' beliefs harden into attitude and in consequence derive intentions that culminate in behaviours: a lack of participation in ICT post 16 and beyond. There is affect – the *feeling* the student has about ICT - that precedes cognition – *beliefs* and *presumed knowledge* – and ultimately conation – how the students choose to *act* regarding ICT. Yet, this behaviour may superficially seem at times at odds with the initial belief or attitude.

Validity and reliability is concerned with the degree to which the measuring instrument is free of error. Reliability refers to the degree to which the measure is free of variable error (e.g. that a student's 'true' attitude has not changed). A perfectly reliable instrument will yield the same result on different occasions. Variable factors such as the students' mood, temperature, time of year or time of day may reduce the instrument's reliability. The lower the reliability of the instrument the less useful it is.

Validity refers to the degree to which an instrument measures the 'true' score it was designed to measure. In this research study, the instrument, The Theory of Planned Behaviour Questionnaire, is designed to measure the comparative beliefs, attitudes and intentions of students in differing educational contexts rather than other variables. The presence of constant error will reduce a measure's validity, hence the observed score will be constantly contaminated by some irrelevant factor.

One potential source of constant error is response bias. For example, students may differ in the extent they tend to agree with statements (acquiescence), give perceived socially desirable responses or extreme or moderate response categories. When a student's response does not reflect their personal belief but rather reflects their perception of what is socially desirable their response will not be an adequate measure of the true response. In order to ascertain students' attitudes the measure deployed must be open to scrutiny in that seemingly conflicting results can obscure conclusions if we do not do so (Nemeth, 1970). For instance, a female student who indicates in a questionnaire she feels very uncomfortable asking questions in class may actually be one of the most dominant participants of either gender in the observed lesson. Such idiosyncrasies have to be built into the data gathering process and the relationship between the data rationalised from the outset.

Overall, consistency and acknowledging variables will determine how attitude is assessed and it is this dimension that is regarded as one of the distinctive features of measuring attitude (Thurstone, 1931). Whilst attitudes culminate in behaviour, observed behaviour does not necessarily immediately demonstrate attitude nor does attitude always act as a predictor of behaviour: it is the consistency of the behaviour and the consequences of the behaviour that lead to inference of attitudes that, in turn, have been reinforced by the measurement of attitude prior to analysis of behaviour. Discrepancies between words and deeds may often be more apparent than real and in consequence, Pseudo Inconsistencies. Verbal and overt responses to an attitude object are both indicators of an underlying hypothetical disposition and one of these responses may be more difficult to perform than the other (Campbell, 1963).

Using the LaPiere (1934) study as an example, Campbell assumed that racist rejection by landlords of potential Chinese tenants in a face-to-face situation (overt behaviour) was more difficult than rejecting a symbolic representation of members of the Chinese race in response to a written inquiry as Figure 4 demonstrates.

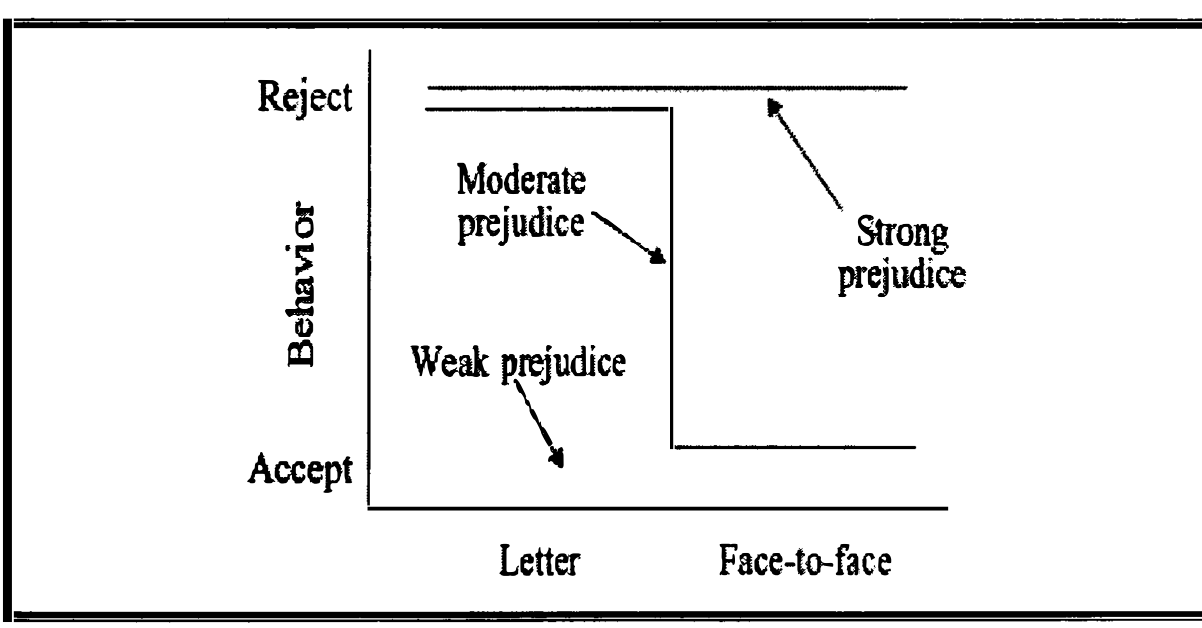

Figure 4: Pseudo Inconsistency (Campbell 1963)

Similarly, the intention to reject an A' Level option or university course in an ICT class may be an easily made on paper, but a very different choice when confronted by the actuality of being asked directly by their teacher if they will opt for the course they are going to teach.

The Theory of Planned Behaviour model is a valid quantitative paradigm in its capacity to measure the contextual responses of students and, regardless of that response, attitudinal comparisons are relevant to the context; in the case of this study, the ICT classroom and gender/grouping differences. The instrument is reliable in that the meaning of each item in the questionnaire is consistent over time and place. In particular, though the instrument was administered in the three schools over three different days, the nature of the items are such that their meaning on each day and at each school would be the same for all participants.

4.6.2 Validity and Reliability: The Semi-Structured Interviews

As the interviews in this study serve to supplement, clarify and enrich the primary instrument, The Theory of Planned Behaviour Questionnaire, validity and reliability were important within that context of this research. I was interested in how students' verbal responses clarified, confirmed or even disaffirmed, the responses made by students who participated in The TpB Questionnaire; if their more elaborate, nuanced verbal responses added different or deeper perspectives. This triangulation of methodology is more robust than solely relying on one method, giving richer and more complex information. The contrast between the research methods and the resulting corroboration of data analysis adds to the reliability and validity of the study (Cohen, et al., 2007).

When using interviews as a research method stability of observations is important (Denzin & Lincoln, 2003). All the Key Stage 4 students who participated in this research study were in Year 11. This was important to maintain stability of observations as if any of the students had been in Year 10 their attitudes or beliefs with regard to the subject may have been different due to either the novelty of the course or perceived difficulties due to it being a new course.

The issue of parallel and comparative forms of questioning (Denzel & Lincoln, 2003) should also be considered. Would different questions have produced the same data? This issue of reliability was addressed by the selection of the questions asked. The 20 questions were derived from each section of the 59 question Theory of Planned Behaviour Questionnaire. Alternate questions from each section would have resulted in differing responses but for analysis purposes, seeking clarification of the same attitudes, beliefs and intentions was important.

In order to ensure that there was respondent validation (Cohen, et al., 2007) the students' taped interviews were replayed for them to add or retract any points they felt they needed to. This gave them the opportunity to clarify points that they felt were not clear, giving further reliability to the material in its authenticity, honesty, depth and meaning (Cohen, et al., 2007).

The respondents answered the questions as they chose; there was very little prompting or probing. This increases the validity of their response. If students specifically asked for clarification, it was given but in a general way without direction. The students were aware of me as an infrequent visitor to the school who was concerned with students doing well in ICT generally but not specifically to their school. Any question of pre-judgments being perceived to have been made by me was therefore eliminated. This was important in order to move beyond the institutional response and prevent the students giving responses that they perceived as pleasing me subjectively (Cohen, et al., 2007). This was further reinforced by the first two questions asked that allowed students initially to explore what they enjoyed and did not enjoy about the subject. These initial responses provided a context for the students to give their responses to a range of attitudes, beliefs and intentions less guardedly, given they had already expressed both positive and negative viewpoints with regard to ICT.

4.7 A Critique of Quantitative Methodology (The Theory of Planned Behaviour Questionnaire) and Qualitative Methodology (Semi-structured Qualitative Interview Questions): A comparative Discussion.

The Theory of Planned Behaviour Questionnaire is a quantitative research method that has; it can be claimed by qualitative researchers, some inherent limitations that may not be found in qualitative interview questions. Firstly, some Special Needs students may find accessing the questions challenging. With regard to this study, in two (2) cases Special Needs students were working with a Teaching Assistant out of the main classroom in order to support the completion of the TpB questionnaire.

Additionally, it is frequently asserted that quantitative research, in its structured and predetermined methodology, narrows the focus of the extent of an inquiry. In the case of this research study, the sample population of, initially, 150 students was large and the 59 question TpB questionnaire allowed the participants to give a fuller response than the qualitative semi-structured interviews could. It has been claimed that quantitative research is only ‘one way of telling stories’. Limitations could exist in that this methodology silences too many voices and leaves too many stories untold

(Denzin & Lincoln, 2003). It has been labelled, historically, as alienating, restricted, dehumanising and depersonalising with its reliance on quantification (Cohen et al., 2007). These criticisms may be levelled at some quantitative research but The TpB, in it breadth and depth, allows for the voices of both female and male students to be heard through the psychological perspective of the questions and the detailed focuses on their behavioural, normative and control beliefs. The responses of the students who participated in the qualitative semi-structured interview made nuanced comments and observations that confirmed the responses to the TpB questionnaire, but were often quite light hearted and lacking in reflection. Both approaches in the context of this research study, however, sit comfortably within the postpositivist philosophical position in its multi-faceted, revelatory capacity.

The criticism that quantitative research does not capture the individual's point of view is, again, not relevant with regard to The TpB questionnaire. The data is neither both 'remote' and alienated from real experiences, nor is it, as positivists use as a critique of qualitative methods, impressionistic and too subjective (Denzin & Lincoln, 2003). The TpB questionnaire's objectivity derives from the validity and reliability of the method, as previously discussed, but the data generated is not 'remote' given the psychological subject matter. A criticism of quantitative research can be that it fails to account for idiosyncrasies of human behaviour, ignoring individual interpretations of that behaviour (Cohen et al., 2007). The TpB questionnaire, however, identifies individual beliefs, attitudes and, in some questions, intentions. The students who participated in the informal interviews gave more anecdotal responses but the focus of their responses did not differ from The TpB analysis.

Traditionally quantitative research is not concerned with rich data that can detract from developing generalisations. The data generated from The TpB can be described as both 'rich' and 'generalised'. It is a strength of The TpB that there is no dichotomy. The TpB questions are structured in such a way as to give participants an opportunity to reply to a range of questions that allow a very personal response to subjective locus of intent and control with a flexible range of responses in the subtlety and variance of the adjectival descriptions. The responses can then be 'generalised' in the analysis that looks for statistically significant differences in responses, and demonstrates those differences in graphical and tabular forms. The verbalised responses of the interview participants could be described in some instances as quite general and unspecific, but when responses were analysed cohesively differences in gendered responses could be extrapolated.

The analysis of The TpB questions, in the context of this research however, do not necessitate an impersonal, objective discussion that is typical of quantitative research (Denzin & Lincoln, 2003). Seeking to identify why female students fail to study ICT post 16 and beyond requires suggestions to be discussed regarding how teachers and schools can circumvent this important gender issue. The nature of this discussion demands a more subjective, speculative narrative that is more commonly, but not exclusively, used in qualitative research.

When responding to any quantitative questionnaires, female students may find it difficult to anticipate correctly the strong drives and emotions that may compel their behaviour in reality (Ajzen & Fishbein, 2005). In their actual option choice forms and UCCAS applications, they may respond differently from their anticipated intention given on The TpB questionnaire. The potential discrepancy between responses provided on a questionnaire and responses in a behavioural context can, however, be viewed as largely a question of proper measurement.

Response realism can be increased by asking female students to predict a specific intention (Gollwitzer, 1999). With reference to this research, the specific intention is the intent to study ICT. The question was repeated verbally and the responses were largely concurrent. This should therefore minimise the criticism that quantitative research is too objective and trivial to be of use to the professionals, in this case teachers, who need to use its findings (Cohen et al., 2007).

Any quantitative questionnaire will inevitably have some erroneous, misleading responses in that participants will strive to answer questions in relation to the beliefs themselves and, in some cases, aiming to please the recipient. Problems may also occur when the participants indicate that there is only one coherent way to answer a question, as they thought that their previous answers implied an answer to a subsequent question or problems completing due to lack of comprehending the questions, due to perceived question complexity. This could include problems of information retrieval, when participants' answers depended on other information that was not specified, or when participants did not feel they had appropriate knowledge or beliefs to answer the question adequately (French et al., 2007). Perceptions of control, attitudes, intentions and norms are measures elicited via self-report and are consequently inevitably subjective, although again, this is the case for attitude itself and therefore self-accounting in a TpB questionnaire (Petty & Krosnick, 1995). This inherent weakness in quantitative research is therefore less problematic in relation to The TpB. In their verbal responses interview participants generally employed a level of self accounting in their response themselves, by justifying or contextualising their response and using conjunctions such as ‘but’ and ‘although’ to demonstrate when they did not want to articulate a precise, definitive answer.

A further limitation of quantitative research arises if participants interpret questions differently from the intention of the researcher, giving information that the question did not directly seek. This can be superficially the case in The TpB questionnaire with questions concerning normative beliefs, where students may answer questions about significant others’ perceived attitudes and beliefs. Again, however, this is ultimately unproblematic as the motivation to comply is inherent in these responses and can be measured accordingly. The differences in either female and male or school context response are what are important, rather than the participant’s individual response. Similarly, the students interviewed sometimes re-interpreted the questions they were asked but when their responses were analysed this re-interpretation had little impact on the differences articulated by the female and male students.

Finally, it is also possible that participants will have a mental ‘disagreement’ with a question and therefore, endorse a ‘compromise’ response option on the questionnaire that in some way may accommodate a clash of attitude or intent. For instance, in response to a motivation to comply question the participant may think, ‘Generally speaking I want to do what my friends think I should but in reality I tend to do what I want to do! So I’ll neither agree nor disagree!’ Following the pilot study where this was a common response made on a 5–point Likert Scale, The TpB questionnaire was amended to a 4-point Likert Scale so that the possibility of making an ambiguous, ambivalent response was eliminated. Moreover, the motivation to comply is inherent in all responses in that rather than give the response that suggests autonomy a more compliant attitude is actually indicated (French et al., 2007) and becomes part of the final comparative analysis. At time students, particularly female students, contextualised their response in this way verbally but, ultimately, arrived at a concrete answer that could have been denoted numerically on a Likert Scale.

Limitations and criticisms of quantitative methodology is largely redundant in The Theory of Planned Behaviour model in the rich data and psychological insights it provides. The verbal responses of the students who participated in the semi-structured interviews illuminated their peers' responses to The TpB questionnaire with anecdote, humour and reflection in some instances but ultimately, their verbal responses were less complex than the results generated by The TpB questionnaire. This is unsurprising as The TpB model gives a comprehensive psychological profile that students, however reflective, serious and thoughtful, will not be able to replicate in an interview situation.

4.8 Ethical Considerations

The University of Greenwich Ethics Committee (see Appendix 6) gave ethical approval before the questionnaire was filled in by a sample of 150 students from the three schools.

In all research key ethical issues relating to anonymity, seeking permission and transparency must be considered in order to reach an ethically acceptable position in which the actions of the researcher are considered justifiable and sound. All educational research should be conducted within an ethic of respect for the person, knowledge, democratic values, the quality of the research and academic freedom (The British Educational Research Association (BERA), 2004). In all aspects, the research undertaken in this study sought to satisfy the BERA criteria.

Consequently, in order to undertake The TpB Questionnaire in my selected population – the anonymised schools known as: The Academy, The Mixed High School and The Single Gender Comprehensive School, I initially sought voluntary informed consent from the Headteachers. Although Heads act in loco parentis, their consent is not ethically sufficient. Therefore, specific positive parental consent was gained in response to an explanatory letter to parents sent prior to the questionnaires being given. Additionally, consent was sought from the Head of ICT who would be facilitating the administration of The TpB Questionnaire and any queries they had were answered either face to face or by email. No assumptions were made about their understanding of the research (Cohen et al., 2007).

Inevitably, any questionnaire will be an intrusion on the life of the respondents who are not passive data providers, being subjects not objects of research (Cohen et al., 2007). In this study that required Key Stage 4 and Key Stage 5 ICT students to complete a TpB Questionnaire, the age of the students had to be considered as many, but not all, of the students who were asked to participate were under 18. BERA (2004) requires researchers to comply with Articles 3 and 12 of The United Nations Convention on the Rights of the Child, that the best interests of the child should be paramount and that children who are capable of forming their own views are enabled to by the form of the research.

Regardless of parental permission to participate, all students had the right to withdraw from the research with an opt out clause. Permission from the students was requested with the clarification provided for them that they did not need to be involved if they did not wish to take part in the questionnaire. Their willingness to complete the questionnaire was denoted by their permission, although students' contextual positioning in relation to the researcher had to be subsumed in the clarity of information and choice offered to them (Cohen et al., 2007). Their responses were confidential and anonymous with regard to data as was their entitlement. Gender, Key Stage and School were the determinants for analysis of the data.

5.0 FINDINGS AND DISCUSSION

Today despite the progress made over recent decades men are more likely to use Information and Communication Technology than are women

(Douglas Alexander, The Fabian Society, 2001)

The Theory of Planned Behaviour (TpB) questionnaire was filled in by a sample of 150 students from three schools with the intention to address the overarching question, posed by this study from a post positivist paradigm:

Are there gender differences in Behavioural, Normative and Control Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

The four accompanying sub questions are:

- Are there gender differences in ICT students' attainment and what impact does this have on their intent to study ICT post 16 and beyond?
- How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).
- How do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?
- What impact does teacher gender have on the beliefs of students in single and mixed gender schools?

Data analysis took place using four differing tests in order to best represent the results of the questionnaire and address the research questions posed by this study. Pearson's Chi Square Test was utilised to ascertain the differing statistical significance of gendered student responses to the 55-item TpB questionnaire in the overarching research question. Pearson's Chi Square is a test of goodness of fit used to establish whether an observed frequency distribution differs from a theoretical distribution. The test assesses whether paired observations on two variables are independent of each other. For the purpose of this study, whether female or male students differ in their associational responses to ICT and the frequency with which they report attitudinal responses that infer intention to study ICT post 16.

To ascertain the strength of the relationship between prior attainment at Key Stage 3 and gender- the first sub research question – the Mann-Whitney U test was used. This was in order to compare and ascertain the differences between the two independent groups - in this study the female and male students' Key Stage 3 prior attainment on a continuous measure. Tests of significance were used to determine whether the differences between the two sets of sample data were truly significant or whether these differences occurred by chance. Whether there was a statistically significant difference in Key Stage 4, attainment prior to post 16 study was then analysed using Pearson's Chi Square Test.

The next sub research question, which examines how female students' learning styles and associations with ICT impact on pipeline shrinkage, was analysed using Spearman's Rank Order Correlation (rho) and Pearson's Chi Square Test. Spearman's Rank Order Correlation (rho) was the most appropriate test used to ascertain gendered learning style preferences as it calculates the strength of the relationship between two continuous variables. This is a non-parametric measure of correlation that was used to describe the relationship between gender and preferred learning style without making any assumptions about the frequency distribution of the variable. Pearson's Chi Square Test was then utilised to analyse the female and male students' gendered associational responses to the term 'ICT'.

The next sub research question explored the differing attitudes of female students in single gender and mixed schools. This investigation necessitated using the Kruskal - Wallis Test. This is a non-parametric test, which measures assumptions about the underlying samples and analyses comparative data in order to ascertain the statistical significance of responses between the female students in the mixed schools and single gender female students' school.

The final sub research question explored the impact teacher gender has on the beliefs of students in single and mixed gender schools. Pearson's Chi Square Test was used to ascertain the differing statistical significance of the gendered student responses.

5.1 The Sequence of Analysis

In sequencing data, it is important to retain the context of the research and, in relation to the population sample, retain the integrity of the respondents' contributions. The sequencing of the data analysis in this study mirrors the order of the overarching research question and the four sub research questions. The research questions, therefore, are systematically analysed to retain coherence (Cohen et al, 2007). Consequently, the first and greater part of the analysis section, Section 5.2, addresses the results generated by The Theory of Planned Behaviour questionnaires that reflect the overarching research question: What are the gender differences in Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)? Comparative data is presented to explore these gendered responses.

The sequence of analysis goes on to mirror the order of the four sub research questions. Section 5.3 explores the first of the sub research questions: Whether there are gender differences in ICT students' attainment at both Key Stage 3 and Key Stage 4. What impact has this on their intent to study ICT post 16 and beyond?

Section 5.4 analyses the learning style preference indicated by the students in The TpB Questionnaire to address the sub research question: How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Grid Talk, 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990). This is followed by Section 5.5 where the students' comparative gendered responses are considered, contextualising the students' initial responses to ICT as a term isolated of any intent to study it as a subject. This question begins to assess gendered differences in attitudinal responses towards ICT and determine how those responses may affect future uptake of the subject.

In Section 5.6, there is an examination of the comparative responses made by female students in differing school contexts. This section addresses the third research sub question: How do female students in single and mixed gender schools differ in their behavioural, normative and control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

Section 5.7 is a discussion of the final sub research question addressed: What impact does teacher gender have on the beliefs of students in single and mixed gender schools?

5.2 The Theory of Planned Behaviour Questions: Gender Differences in Behavioural, Normative and Control beliefs

This section of the chapter addresses the overarching question that this study poses from a post positivist paradigm: Are there gender differences in Behavioural, Normative and Control beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

According to The Theory of Planned Behaviour, human behaviour is guided by three kinds of considerations: behavioural, normative and control beliefs. Behavioural beliefs constitute the likely outcomes of behaviour and the evaluations of those outcomes. Normative beliefs are the normative expectations of others and the motivation to comply with these expectations. Control beliefs are the beliefs about the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors. (Ajzen, 2006). The interplay between these three considerations and the strength of these beliefs determine attitudes. Attitudes, in turn, determine the intentions that will ultimately lead to the performance of a particular behaviour (See Figure 2). For the purposes of this research, the behaviour is studying ICT post 16.

5.2.1 Behavioural Beliefs

This section of the chapter specifically addresses the first component of the overarching research question as outlined above: Are there gender differences in Behavioural Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

5.2.2 Discussion of Behavioural Beliefs Relating To Specific Future Behaviours

There were nine items in the questionnaire designed to explore behavioural beliefs relating to the specific future behaviours involving ICT uptake at post 16 and beyond. The questions the students responded to were with regard to both career prospects and social and emotional life. These responses were analysed to ascertain if there were significant differences between female and male students' responses. The Chi Square analysis showed that in seven (7) of the items there were statistically significant differences (See Table 1).

Table 1: Direct Measures of Behavioural, Beliefs

Item	χ^2	df	P
31 Will studying ICT at post 16 help me to understand the subject better	11.030	3	0.012
36 Development of good study habits, self-discipline and a feeling of self-satisfaction	24.269	3	0.000
39 Studying ICT at post 16 will be tedious and boring	23.430	3	0 .000
38 Improvement of my intellectual powers	13.757	3	0.003
34 Studying ICT at post 16 will cause me to miss my friends	13.281	3	0.004
35 To study ICT in post 16 will keep up with peers' earning capacity	35.116	3	0.000
37 Missing out on activities outside University or college if I study ICT at post 16	18.069	3	0.000

The data in Table 1 shows that behavioural beliefs link the behaviour of interest (in ICT) to expected outcomes (with regard to ICT uptake post 16 and beyond). This addresses further, the first component of the overarching research question.

An individual's belief about the consequences of a particular behaviour – the uptake of ICT post 16 and beyond- is the subjective probability that the behaviour in question will result in a given outcome. Students may hold multiple behavioural beliefs but only those that are readily accessible are likely to impact upon a specific behaviour. The prevailing attitude that a female student has towards ICT is dependent on her readily accessible beliefs - for instance, that it is a subject dominated by competition-in conjunction with the subjective values of the expected outcomes. Every behavioural outcome is evaluated and the consequent behaviour is determined by both the accessible beliefs and the subjective probability that the outcome of the behaviour will occur (Ajzen, 2006). If a female student believes the outcome that will occur is she chooses ICT is that she will be 'bored' then it is unlikely she will opt for the subject.

Not all female students responded negatively towards ICT in all questions. The questions' locus of intent had a significant impact on how students responded. The question, 'Will studying ICT help me to understand the subject better?' elicited 'likely' and 'extremely likely' responses from female students (See result 13 in Appendix 2). The response to the question was statistically significantly different from the male students' response. The female students' response implied that they were less confident regarding their current ability than their male peers who indicated that their current understanding was better and would not be improved upon by further study of ICT. This appears contradictory given female students' higher prior attainment, (Ofsted, 2009), as verified with regard to the study sample later in the discussion. A confidence in their current subject knowledge is inferred by the male students' response that is not necessarily rooted in their academic ability but in male students' higher comfort levels in the subject itself (SIGIS, 2004, Bernstein, 1991). Higher comfort levels may result in higher self-efficacy (Bandura, 1986).

Figure 5 shows that the question, 'To study ICT in post 16 will help me to develop good study habits, self-discipline and a feeling of self-satisfaction' produced a high statistically significant difference. [χ^2 =24.269; df =3; $\rho \cong$ 0.000].

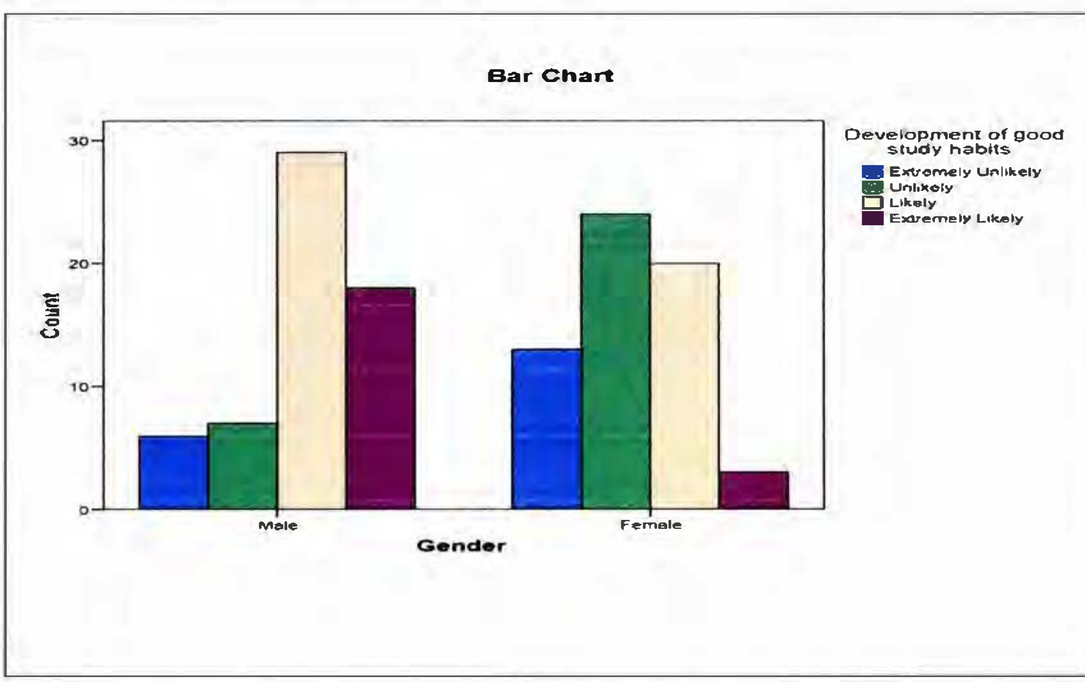

Figure 5: Item 36: Development of good study habits, self-discipline and a feeling of self-satisfaction.

Juxtaposed with female students' previous responses to the question, 'Will studying ICT help me to understand the subject better' elicited 'likely' and 'extremely likely' responses, this is superficially surprising. Male students responded that this was predominantly 'likely' and 'extremely likely' whilst female students responded mostly, 'unlikely'. Rather than demonstrating a negative response to the question with regard to work ethic in developing 'good study habits' and 'self discipline', the negative response to the question by the female students seems to suggest their belief that they will not feel 'self-satisfaction' if they study ICT post 16. It is well documented that female students perceive ICT as a subject associated with 'geek', 'nerd' culture (Mitchell, 2005). This perception may be linked to their disinclination to study post 16 and beyond as studying a subject with such negative associations is unlikely to be satisfying. This response reinforces the view, discussed at length later in this chapter, that female students also find the subject 'tedious' and associate it with 'boredom'. These associations are the antitheses of feeling 'self–satisfaction'. Over the last thirty years, there has been a steady drop in the number of female students who have opted to take ICT based degrees in the UK (Reding 2009, Ali, 2001, Clegg et al., 2000). These female students did not have 'feelings of self satisfaction' in studying ICT whilst the obverse is equally true. Male students who are stimulated and engaged will be likely to experience 'feelings of self-satisfaction' in the ICT classroom environment.

The students who participated in the semi-structured interviews gave replies that echoed the responses given by the students who answered the TpB questionnaire. When asked the questions 'How would you describe the feeling of being in an ICT classroom?' and 'Do you ever find ICT lessons to be tedious and boring?' female students were much more likely to give answers that demonstrated a lack of self-satisfaction than their male peers. Male students were likely to say that ICT was their favourite lesson, that they were good at it, enjoyed it or that it was only 'boring' when they were moved from their friends or reprimanded by the teacher. The female students' answers were more complex and tended to reflect much less 'self satisfaction'. The majority of respondents felt that ICT was usually both 'tedious' and 'boring', even if they were actually successful at the subject and the majority of female students reported that they did not feel happy in ICT lessons, citing other lessons in preference to ICT.

In response to the TpB question, 'To study ICT post 16 level will subject me to tedium and boredom', significantly more male students perceived this as an 'extremely unlikely' response whereas female students felt tedium and boredom to be a 'likely' response. [$\chi^2 = 23.430$; df =3; $\rho = 0.000$]. (See result 24 in Appendix 2). This, coupled with female students not anticipating further study of ICT to be self satisfying, suggests the experience of studying ICT at school being less boring and 'tedious' and more self satisfying for male students. As discussed at length later in this study, this may be due to male students finding the learning environment of the ICT classroom more conducive than do female students (Wilson, 2008, Letherby, 2003). As outlined in the Literature Review female students think of ICT as a subject with negative connotations that could account for their belief that further study would be tedious and boring (Webster, 2005, Margolis & Fisher, 2002). They reject the focus on the computer and computing itself (Margolis et al., 2000) with monotonous, repetitive tasks such as programming, preferring to use the computer as a tool to communicate at their own pace (Christie, 2002, Francis, 2000, Singh, 1997). Female students prefer to work in an atmosphere that lacks the inherent aggressive competition that is norm in ICT classrooms (Barnes & Todd, 1995, Edwards & Westgate, 1994, Moses, 1995, Howell & Avolio, 1993, Edwards & Mercer, 1987, Edwards & Furlong, 1978). As often taught in the UK, female students experience low comfort levels in ICT lessons and there is a direct link between comfort levels and subject enjoyment (Wilson, 2008). A variety of teaching styles used in ICT lessons, with more emphasis on student centred learning and collaboration, would make the subject less humdrum for female students.

Interestingly, the question, 'To study ICT in post 16 will help me improve my intellectual powers' also produced a response of statistically significant difference: [χ^2 = 13.757; df =3; ρ = 0.003]. (See result 25 in Appendix 2). Female students felt this was slightly more 'unlikely' than 'likely'; male students felt it was 'likely' and 'very likely' rather than 'unlikely'. Once again, this response may, superficially, seem to contradict the responses that emphasise the positive work ethic of the female students and their desire to study hard, regardless of the subject area (as is discussed at length later in this research). In response to this question, however, the female students' lack of confidence with regard to ICT (as previously discussed with reference to female students' response to the question 'Will studying ICT help me to understand the subject better?) may be reflected in their negative response to the term, 'intellectual'. This is supported by recent research as detailed below.

A European study found that 55% of the female students questioned found studying ICT 'difficult' as opposed to 40% of their male peers (Gras-Velazquez et al., 2009). Similarly, their response to the locus of intent in the question 'To study ICT in post 16 will help me improve my intellectual powers' is likely to be less confident and negative in contrast to male participants. This attitude to ICT is reflected in women's representation in Higher and Further Education. The perceived 'intellectual' or 'superior' roles are male dominated. The predominance of male Full Professors, Tenure Professors, Associate Professors and PhD students in ICT faculties in Spanish universities (Sanz, 2004) is reflected across the European Union where there are 60% more male PhD computing students than female and male ICT graduates significantly outnumber female (Gras-Velazquez et al., 2009). This disparity in formal academic qualifications leads to differences in status, prestige and power associated with the industry and a consequence of 'pipeline shrinkage'. Along with the different positions they hold in the social structure, both men and women are expected to display gender-consistent behaviour (Atwater et al., 2004).

In mixed gender classrooms female students, I have observed, will defer to their male peers, constructing their femininity to present themselves as needy rather than independent, powerless rather than powerful (Francis & Skelton, 2005). This stereotypically gendered behaviour stems from the beliefs fostered in female students by their low comfort levels in their ICT classrooms as found in a number of research studies that specifically measure how comfortable and confident female students feel in ICT classrooms and laboratories (Wilson, 2008, Sanders, 2006, Francis et al., 2006, Margolis & Fisher, 2002). The female students' negative beliefs about the subject are therefore likely to be further perpetuated and the problem of 'pipeline shrinkage' and iniquity in the work place exacerbated.

In response to the question, 'To study ICT beyond post 16 level will cause me to miss my friends' there was a statistical difference. (See result 26 in Appendix 2). Female students believed, more frequently than male students did, that not being with their friends would disadvantage them. Their preferred way of working is well documented as being collaborative with an emphasis on communication (Christie, 2002). Women associate work with supportive team building, net working and sharing stories (Davies, 2003). If female students perceive ICT as an area where this way of working is ignored in favour of aggressive, independent learning (Frenkel, 1990) they are going to respond negatively to a question that infers they will not be working collaboratively with their friends in a lesson but working in isolation in front of a computer screen.

Figure 6 illustrates statistically significant responses following the question: 'To study ICT in post 16 will help me to keep up with my peers' earning power'.

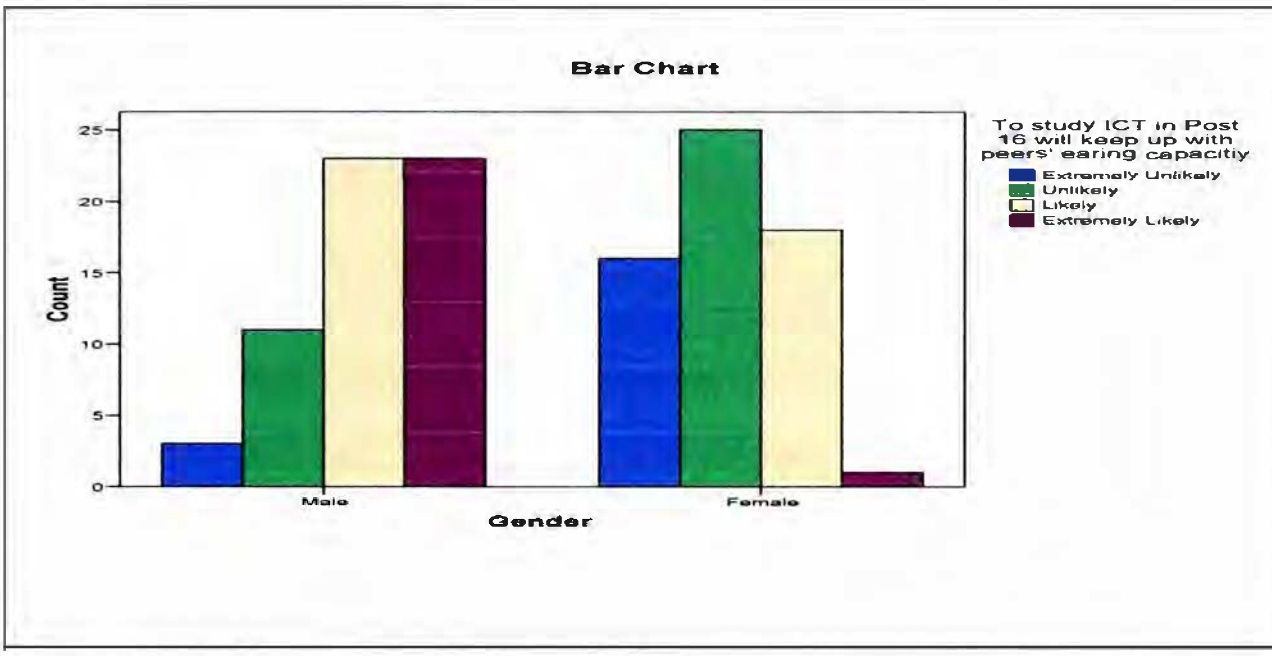

Figure 6: Item 35: Studying ICT at post 16 will enable me to keep up with my peers' earning capacity

This response supports the typically negative attitudes female students hold towards ICT and their lack of interest in pursing careers in ICT (Creamer et al., 2005). It is not surprising that female students do not perceive working in the ICT Industry as a job with the potential to keep up with 'peers' earning capacity'. They have few positive role models of highly paid women in the ICT industry in either the home, media or school as a number of recent research studies confirm (Donaldson, 2009, Gras-Velazquez et al., 2009, Cox, 2003). Women represent only 30% of managers in the European ICT industry and are both poorly represented and paid less than men in all ICT sectors (Grid Talk, 2009, Trauth et al., 2004). Moreover, the number of women employed in the industry is declining (Gras-Velazquez et al., 2009,The DTI, 2004) with the highest drop out rate in Europe of women from the ICT industry being the UK (Gras-Velazquez et al., 2009).

When asked in the semi-structured interviews if they considered if studying ICT would help them get a good career, female students responded with nuanced reflection, as discussed in detail later in the chapter. They acknowledged that they would use ICT in their careers in most responses but they very clearly differentiated between the practical use of ICT and working within the ICT industry itself. Only two female respondents (out of 13) affirmed they were considering a career in ICT as opposed to 14 out of the 17 male students interviewed.

The final question in the discussion of behavioural beliefs relating to specific future behaviours that produced a statistically significant response was, 'To study ICT beyond post 16 level will make me miss out on activities outside college/university'. (See result 28 in Appendix 2). Again, female students responded negatively in comparison to their male peers. Despite their academic success at A' Level (Ofsted, 2009) female students are less likely to study ICT beyond post 16 than male students across the European Union (Gras-Velazquez et al., 2009). Previous research has found that female students perceive the culture of ICT faculties in universities to be dominated by a hacker culture that is anti-social (Webster, 2005). They may project their perception that their male peers in the classroom are 'anti-social coach potatoes' (Christie, 2002) onto their imaginary university colleagues and equally, as discussed above, fail to recognise positive, high paid female role models in any realistic capacity.

All nine items in the questionnaire exploring behavioural beliefs with regard to ICT study were analysed using a Chi Square test. The seven items showing statistical differences have been discussed. There were only two questions with regard to behavioural beliefs that did not produce a statistically significant response. Item 33 of the questionnaire, 'To study ICT beyond post 16 will give me an opportunity to react with more interesting people' and Item 32 of the Questionnaire, 'To study ICT beyond post 16 Level will help me to do well and get a good career in the future' did not differ statistically significantly between female and male participants.

A question relating to meeting 'interesting people' if studying ICT post 16, had a more divergent response, however, when asked to the students in the semi-structured interviews. Female students were much more hesitant to describe anything linked to the ICT industry as 'interesting' and very few answered positively to the question. Of significance is that female students who did feel they might meet 'interesting people' all cited female role models who were important to them and who had clearly influenced their attitudes and beliefs with regard to the subject.

At first glance, therefore, the responses female students made to The TpB questions, 'To study ICT in post 16 will help me to do well and get a good career in the future' and, 'To study ICT in post 16 will give me an opportunity to interact with more interesting people' seem contradictory. There were no statistically significant differences between the female and male students' answers to these questions despite the female students' previous responses that they found ICT environments uncomfortable, unsatisfying and lacking intellectual stimulation. This was due to the abstract nature of the questions that elicited positive responses from the female students. They seem to have dissociated their generalised beliefs that ICT could be a 'good career' with 'interesting people' with that career being the career that they would personally choose. Consequently, when they answered the question: 'I intend to study ICT in post 16', this question produced a high statistically significant negative response of [χ^2 =23.004; df =3; $\rho \cong$ 0.000]. The relationship here between belief and intention is demonstratively inconsistent. Key is that the female students' beliefs with regard to 'good careers' and 'interesting people' are not sufficient basis for predicting intent. As argued Fishbein & Ajzen (1975) the combination of their attitudinal beliefs and normative beliefs form, in this context, their intention not to study ICT post 16.

5.2.3 Behavioural Outcome Evaluations

There were ten items in the questionnaire designed to explore the differences in students' gendered evaluations of the consequences – behavioural outcomes – of ICT study, ranging from the academic outcomes to the social, including emotional responses to the subject. Their responses were analysed using the Chi Square test to ascertain if there were any differences between female and male students' responses. The Chi Square analysis showed that in eight (8) of the ten (10) items there were statistically significant differences as demonstrated in Table 2 below.

Table 2: Statistically Significant Behavioural Outcome Evaluations

Item	χ^2	df	P
3 For me to have an opportunity to interact...	12.278	3	0.006
7 Missing out on activities outside ICT class	13.971	3	0.003
4 For me to miss being with my friends...	13.472	3	0.003
9 Subjection to tedium and boredom	16.015	3	0.001
5 For me to keep up with my studies	7.857	3	0.049
6 Developing good study habits	11.606	3	0.009
8 Information on ICT test material	9.321	3	0.025
10 Gaining part time work due to ICT	28.746	3	0.000

A Chi Square analysis of the data indicated a statistically significant difference between the views of female and male students [χ^2 =12.278; DF=3; ρ = 0.006] in response to the question, 'For me to have an opportunity to interact with the teacher and other students in my ICT classroom would be...'

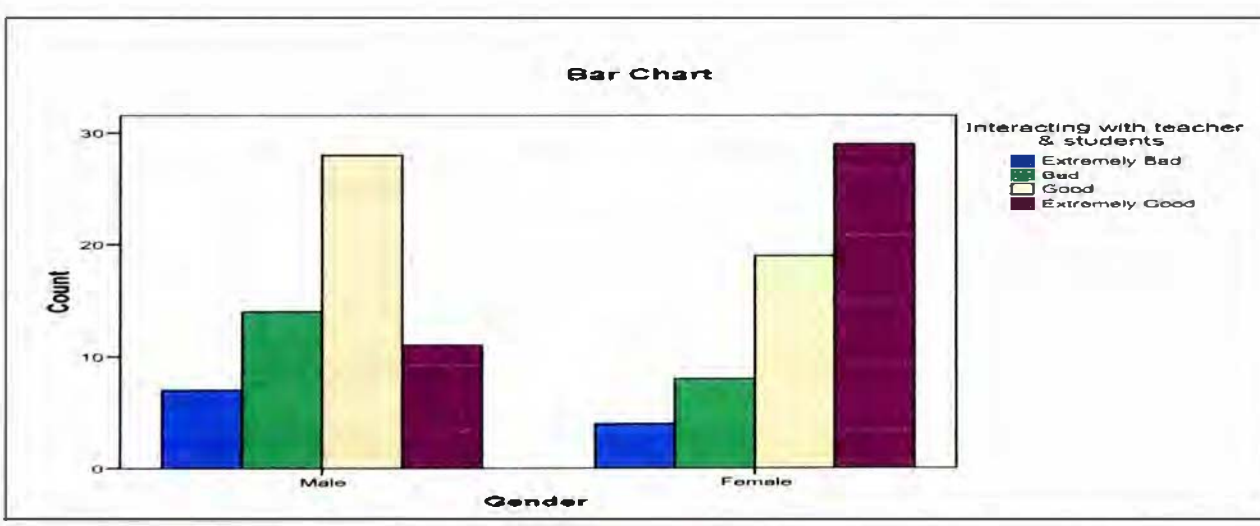

Figure 7: Item 3: For me to have the opportunity to interact with the teacher & other students in my ICT class

Female students preferred interaction and collaboration in the ICT classroom and this is well documented and corroborated not only by this study, as discussed at length, but also from a body of previous research (Schmitz & Messmer, 2005, Christie, 2002, Barrett and Lally, 1999). It can be surmised, therefore, that most female students perceive working interactively and collaboratively positively. Male students in this study perceived having the opportunity 'to interact with the teacher & other students in my ICT class' as 'good' although not 'very good' as did the female students, at least suggesting that more collaborative work in ICT classrooms would benefit all students to some extent.

ICT itself does not necessitate gender differences in work style but can be harnessed to support collaborative learning (Gracia-Luque & Stein, 2005). Great benefits have been gained by using the internet to support female students in developing countries. Female students have been given opportunities to net work and interact in ways beyond cultural norms. This way of working greatly enhanced both their personal and ICT self-efficacy, although had very little impact on the already higher self-efficacy of their male peers (Derbyshire, 2003).

In order to foster interaction teachers can facilitate group-based collaborations to maximise female students' appreciation of peer support (Dolmans et al., 2001). If ICT teachers are aware of the notion of providing the optimum class environment for producing higher levels of comfort for female students this would begin to stop the steady attrition of female students from the subject that culminates in 'pipeline shrinkage'. It is suggested that teachers of ICT should understand the importance of providing a more collaborative classroom environment. This would encourage all students to discuss their learning, interact more with both other students and teachers and ask and answer more questions, both in and outside of class. More collaboration would allow the female students to feel comfortable and not intimidated and consequently, raise their comfort levels.

My ICT classroom observations in a wide variety of schools in the South East of England, however, has led me to the conclusion that rather than group-work being more prevalent in schools it is becoming less so. The recent move in many Academies to increase class sizes radically to 60 ICT students has, by its very nature, discouraged dialogue and interaction both between students themselves and with their teachers. As is the norm across the curriculum, and the decades (Spender, 1982), the more vocal demands of the male students tend, in my experience, to dominate. In the much bigger classroom environment, female voices are still further lost. This pedagogical move is an indication of the misunderstanding of the importance of the level of comfort female students may need in this discipline. If the issue of ICT classroom size is not addressed it will further exacerbate the problem of 'pipeline shrinkage'.

Also statistically significant was the students' response to the question, 'My 'missing out on activities outside of my ICT classroom would be... '. (See result 6 in Appendix 2). The male students' response was positive and this could be attributed to the fact that they are content in their ICT classroom environment. This would further suggest they have a high comfort level with both the classroom environment and the learning/teaching style. [χ^2 =13.97; df =3; ρ = 0.003]. The female students' anxiety and concern at what they are missing outside the classroom suggests the obverse, their lack of comfort and unease at the competitive working style of the ICT classroom (Wilson, 2008). They would rather be engaged with the notional 'activities' suggested by the question than in the concrete reality of the ICT classroom. This could be due to their unease and anxiety in the classroom and the sense of what they are 'missing' beyond the 'club house' atmosphere of their competitive ICT classrooms.

The students questioned in the semi-structured interviews were asked: How would you describe the feeling of being in an ICT classroom? Male students overwhelmingly responded that they enjoyed the experience of being in ICT lessons, citing that they found the lesson 'easy' and that they liked being able to 'get on'. They frequently responded that ICT was one of their favourite (or the favourite) lessons, often linking this with being 'left to get on' and 'playing games', whether illicitly or as a 'reward' for finishing work quickly. The most common response from the female students was that they found the lesson to be 'boring' or 'sometimes boring'. Many answered the question by explaining which lessons they would rather be instead of ICT. Ultimately, these attitudes to working in an ICT environment are likely to exacerbate the problem of 'pipeline shrinkage' as the female students leave the ICT environment for the notional 'outside' that they prefer to occupy.

The Chi Square analysis also indicated a statistically significant difference between the view of female and male students in their answer to the question, 'For me to miss being with my friends in the same class would be …' [χ^2 =13.472; df =3; ρ= 0.003]. (See result 7 in Appendix 2). Female students put a far higher value on being with peers than male students who felt working in a different classroom environment from their friends would be positive rather than negative. Given that many of the students questioned in this study would be in classes with their friends, the divide between the gendered responses is even more significant. Their responses are synonymous with the favoured working style of autonomous, competition (Webster, 2005) that prevails in most ICT classrooms. Female students' preferred way of working is collaborative and interactive. The lack of collaboration in some of their ICT classes and the few opportunities for interaction with their peers could lead to the response female students made to this question with regard to missing their friends.

In the semi-structured interview questions, students were asked the more generic, 'do you feel you are missing out' by studying ICT. The male students overwhelmingly felt that, rather than missing out, they were gaining skills and information by being in the class (or gaining by enjoying a lesson that they felt lacked challenge and was 'easy'). The female students, however, often discussed, in some detail, the experiences their friends had in other option choices, the fun they had interacting and the trips and visits they had the opportunity to go on. They articulated clearly that there was a sense of 'missing out' that the male students were oblivious to as none of the 17 male students questioned described external experiences they were not having, but always focussed on the experience of the ICT classroom itself.

The female and male students' response to The TpB question, 'My being subjected to tedium and boredom is...' supported their response to the questions regarding interacting with peers and teachers and missing out on activity beyond the ICT classroom. Again, there was a significantly different response between the genders, [χ^2 =16.015; df =3; ρ= 0.001]. From Figure 8 and the statistical data generated from the questionnaire response, the female students' attitudes to the subject, that it is 'tedious' and 'boring', clearly represents their general feeling of disfavour towards the 'stimulus object' – ICT.

The verbal responses of the female students, who took part in the semi-structured series of interviews, were in line with these responses. Female students wanted more interactions with teachers and classmates in ICT lessons, talked at length about not enjoying working alone with the computer and all interviewed, to some extent, found elements of the lesson that were tedious or boring.

My observations lead me to perceive 'boredom' and 'tedious' to have multiple meanings. Female students can find many of the components of some ICT lessons disengaging. As discussed above, and later in this study, the competitive, working style is not the chosen work style of female students. Lessons spent in front of the computer screen, with little dialogue or collaboration – either face to face, in groups or on line- will feel 'tedious' to many female students. In addition, female students may also find the pace of the lesson adds to their tedium and boredom. Lessons are organised and shaped around male experience. A fast paced, non-discursive, competitive lesson, with very short periods of processing time, suits male students' work styles (Riding & Rayner, 2005).This work style, however, alienates female students who prefer to work discursively and collaboratively with longer periods of processing time. Ironically, the male students' off task behaviour that slows down the lesson is also detrimental to female students. They frequently have to wait for their male peers to settle down to complete work, pacing their work rate to fit in with theirs.

The subject content, I have observed, further adds to this 'boredom'. 'Gaming' projects appeal to the competitiveness of male students and creating databases and spreadsheets to incorporate football teams or the most popular type of sports car blatantly appeals to male students in a transparent attempt to address the perception of the 'problem' of the underachievement of male students (Weaver-Hightower, 2003b).

Another factor that may have contributed to the 'tedium' and 'boredom' experienced by the female students is the lack of rigour demanded by the vocational Diploma courses. Vocational qualifications have been successful in attracting girls to choose an ICT course at Key Stage 4 due to their emphasis on coursework and tasks based on using ICT for communicating and presentation. The repetitive nature of the vocational courses, however, with an emphasis on exemplifying basic skill competency and monotonous routines rather than acquiring higher order new skills has further exacerbated their lack of participation post 16 (Ofsted, 2009).

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Although specific software is being designed to pro-actively address the male bias of software, it is often an 'add on' to the curriculum rather than central to the curriculum. The courseware provided by Computer Clubs 4 Girls (CC4G) for instance includes twelve modules incorporating topics such as Designtime, eco-friendly interior and garden design, Fit4Sport, Dance M8 and Celebrity. The company specifically markets the software from the point of view of changing attitudes and behaviours, claiming CC4G offers, 'girls an opportunity to reap great rewards later in their education and future careers', and to see, 'the transformation of the girls' attitudes towards the use of computers and their increased confidence' (CC4G, 2009). That the CC4G brand exists is a positive move (Ofsted, 2009). However, it is an additional computer class for female students who find computer classes 'tedious' with associations of 'boredom' and is, in my experience, a self defeating prophecy.

The factors that dominate female students' attitude to their ICT lessons, such as negative attitudes towards the many components of the learning environment, add to a series of attitudinal associations to the object (in the case of this research, ICT uptake at Post 16 and beyond) (Fishbein & Ajzen, 1975). Female students make associations that will move them away from working in an ICT environment – associating ICT with 'missing out' on experiences, friendship and fun. These are all factors that contribute to 'pipeline shrinkage'.

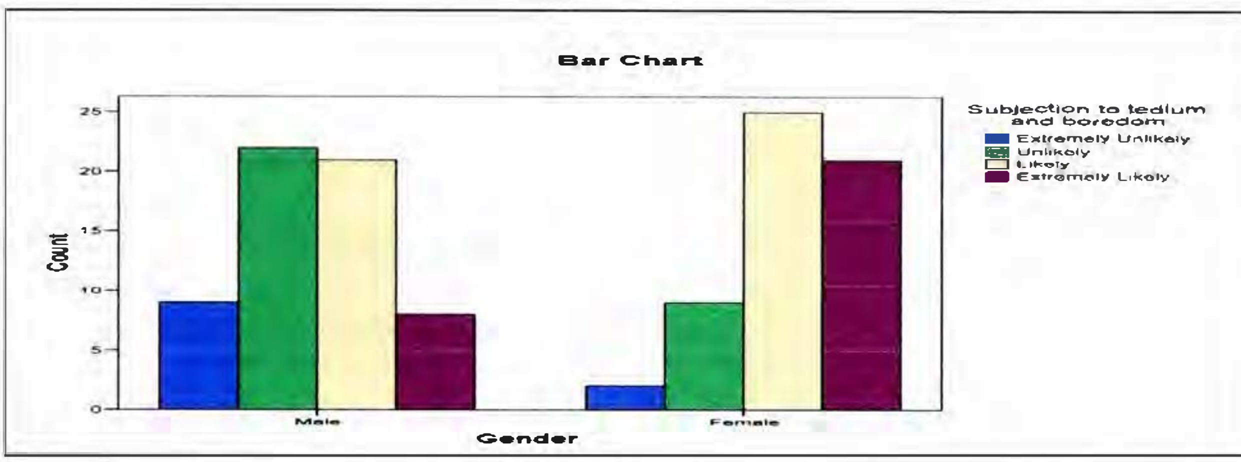

Figure 8: Item 9: Subjection to tedium and boredom

Yet, as has been discussed above, female students academically out perform male students in GCSE and A' Level ICT (Ofsted, 2009, The Daily Telegraph, 2007, The Times, 2006,). Correspondingly, the female students' response to the question: 'For me to keep up with my studies in my ICT class would be...' was significantly more positive than their male peers' attitude as demonstrated in Figure 9.

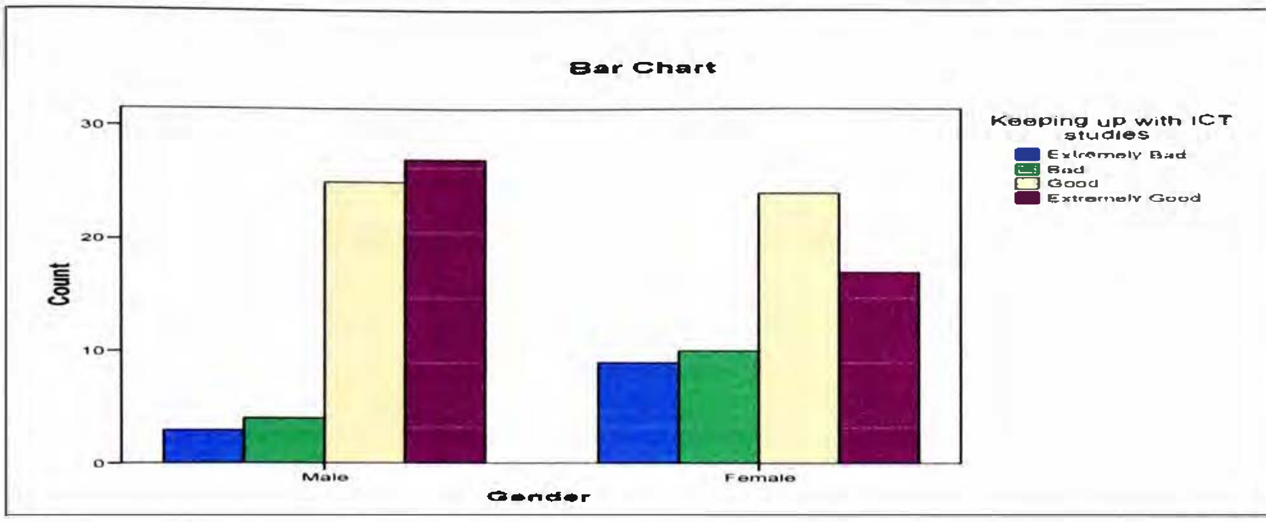

Figure 9: Item 5: Keeping up with ICT Studies

Additionally, as can be seen in Figure 10 and the statistical data generated from the questionnaire response, female students questioned in this study were more positive regarding developing good study habits, (See result 10 in Appendix 2), getting information and explanations regarding materials to be covered in ICT tests and attending ICT classes.

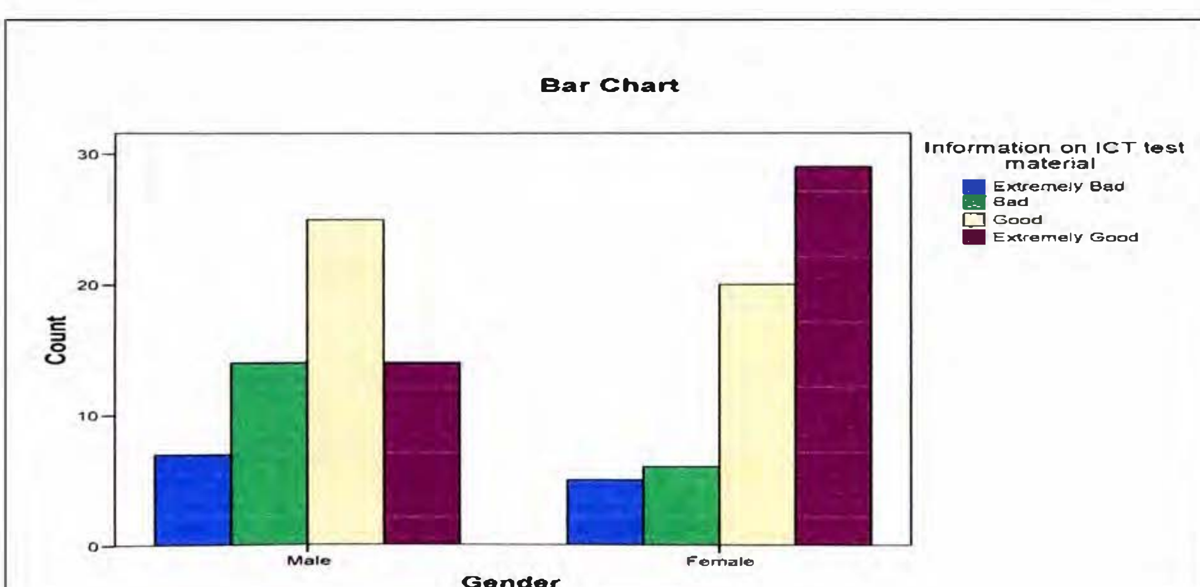

Figure 10: Item 8: Gaining Information regarding materials to be covered in tests

There is not a strong relationship; however, between the positive attitudes female students have towards their learning (that they wish to keep up with their ICT studies and gain information regarding materials to be covered in tests) and their negative outcomes and attitudes to the subject. This is because the divergent attitudes and intentions are measured at different levels of target specificity. Intention is loaded on differing clusters of intention (Fishbein & Ajzen, 1975). The cluster of intention towards studying and missing lessons is a different cluster from the responses that measure the preferred intention of being with friends not in their ICT classroom or 'outside' the classroom and, by inference, a more comfortable environment.

Whilst intentions may be directly affected by attitudes and, ultimately, behaviours, that there is frequently no consistent correlation between attitude and intention is a feature of The TpB (See Figure 2). Attitudes tend to correlate highly with indices based on sets of intentions and the relationship between attitude and single intentions is usually low and insignificant (Ajzen, 1970). A measure based on a heterogeneous set of intentions or a very general measure of intention, for instance enjoyment, the desire to be with friends or to perform positive or negative behaviours with respect to some object, will correlate with attitudes toward the object in question. In relation to this study, when the object is study or work ethic related the female students' responses are generally positive. When the object is specific to ICT, the female students' responses are generally negative.

The contemporary concern of male students' underachievement in comparison with female students' achievement, has led many teachers to assume that their experiences in the classroom are equitable with those of male students. As female students outperform their male peers academically, teachers have made the supposition that the teaching styles they are deploying, therefore, must suit the work styles of female students. This is no more the case in 21st century classrooms than 30 years ago (Francis & Skelton, 2005). Female students want to succeed academically; gain information and not miss lessons as Figures 9 and 10 demonstrate. They, however, do not want to be in the learning environment of the ICT classroom and, in the future, do not want to go on to study ICT post 16 or be part of the ICT industry – leading to 'pipeline shrinkage'. For female students there is no dichotomy here.

When interviewed, female students repeatedly responded negatively to the question: 'How would you describe the feeling of being in an ICT classroom?' suggesting they would rather be in another lesson and that they found the lesson to be 'boring'. Indeed the reference to 'boredom' in relation to ICT was recurrent in response to a number of questions, including the question relating to the intention of studying ICT Post 16. A common response was that they would not be interested in doing so as they would find it boring. This was not the case for male students who, even if they did not consider ICT as a prerequisite for their career or further study usually said they would have liked to study more ICT and that it would be interesting to do so.

This attitude to ICT and the work place was further underpinned by the female students' response to the question posed in The TpB questionnaire: 'Is getting part time work more likely due to studying this subject'. From Figure 11 and the statistical data it can be seen that this question produced a statistically significant difference between the views of female and male students [χ^2 =28.746; DF = 3; P≅0.000].

What is important is not necessarily the female students' response specifically to this question with regard to part time work, but that the male students' belief that part time work was more likely due to ICT and therefore their association with ICT and work that the female students did not perceive. Additionally, when interviewed female students generally responded negatively to the question, 'Would studying ICT after KS4 help you get a good career?' with negative responses. Some respondents acknowledged they might use ICT in their future career or that a career in the ICT industry may be perceived as a 'good' job, but the majority of female students indicated they would not be studying ICT post 16 and did not see this as a determiner of career success.

Female students who participated in this study, either through the TpB questionnaire or by interview, did not consider ICT as a determiner of success in the workplace and this data concurs with the supporting research that there is a steady decline in the numbers of women working in the ICT industry (Trauth et al., 2004). This attrition leads to male dominated environments with gender-stereotyped management roles. Consequently, the behaviours of female and male workers in the ICT industry mirror this stereotyping reinforcing the underlying beliefs that women and men hold different places in the social structure (Desvaux & Devillard, 2009).

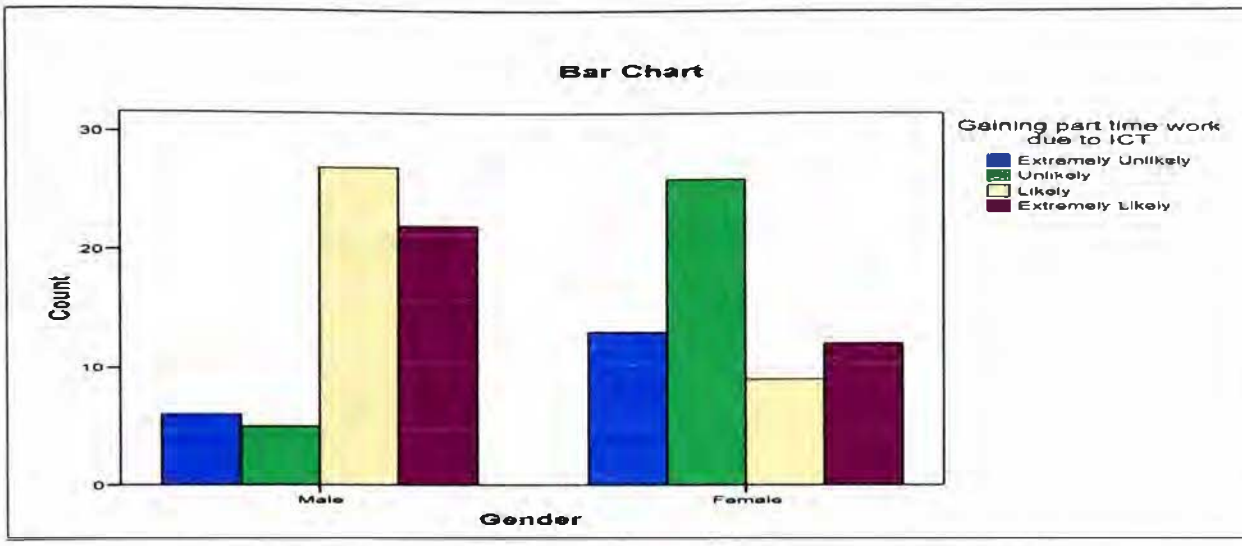

Figure 11: Item 10: Gaining Part Time work due to ICT

5.2.4 Discussion of Behavioural Outcome Evaluations of no statistical significance

Both the questions, 'For me to develop good study habits, self discipline and a feeling of self satisfaction' and, 'To have an opportunity to get a high grade in my class' did not elicit responses of differing statistical significance between genders. In this case, however, this is not a measure of the students' attitude towards further study of ICT as the attitudes of the female and male students themselves differ towards the subject (Fishbein & Ajzen, 1975). Both genders desire the same outcome, in this case to do well academically, but have differing intentions following examination success with regard to the study of ICT post 16. Although there are no behavioural outcome evaluations of statistical significance, in relation to the overarching research question under discussion, it has been demonstrated that there are gender differences in behavioural beliefs concerning the intention to study ICT post 16 as measured through The Theory of Planned Behaviour (Ajzen & Fishbein, 1980).

5.2.5 Attitudes

This section of the chapter continues to specifically address the first component of the overarching research question as outlined above: **Are there gender differences in behavioural beliefs and how do these differences shape the students' attitudes to studying ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?**

There were three items in the questionnaire designed to explore the attitudes ICT students hold regarding the study of ICT post 16 and beyond: Items 18, 21 and 25 (See Appendix 1). Attitudes are determined by the accessible behavioural beliefs and reflect a positive or negative evaluation of the behaviour in question. For the purposes of this study, the evaluation of the behaviour was the study of ICT post 16. The Chi Square test analysis was used to indicate whether there were statistically significant differences between the views of female and male students. This was the case in their answers to two of the questions. The results are shown in Table 3.

Table 3: Statistically Significant Direct Measures of Attitude

Item	χ^2	df	P
25 Interest level of studying ICT at post 16	30.257	3	0.001
21 How pleasant would it be to study ICT at post 16	14.988	3	0.002

Female students had a negative response to the question: 'For me to study ICT in Post 16 is... (Boring/Interesting', [χ^2 =30.257; DF = 3; ρ = 0.001] in comparison to their male peers. This is in line with their response to the question 'My being subjected to tedium and boredom is...' as discussed above and their response to the semi-structured interview question regarding whether they found ICT ever to be ‘tedious and boring’. Female students overwhelmingly replied positively to this question whereas male students often referred to ICT as their most interesting (or easiest) lesson.

Concurrently, their response to the question: ‘For me to study ICT in post 16 is ... (Extremely unpleasant/extremely pleasant’, [χ^2 =14.988; DF =3; ρ= 0.002] was also negative as can be seen in Figure 12.

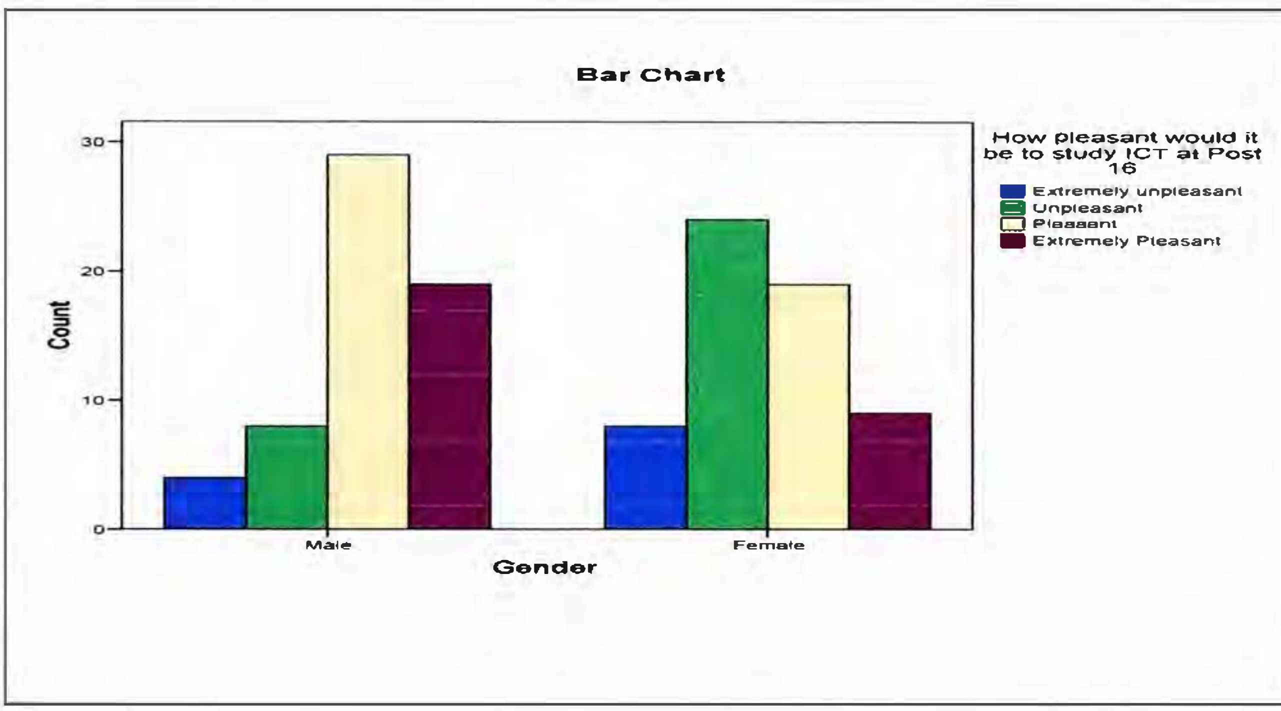

Figure 12: Item 21: How pleasant would it be to study ICT at post 16?

Female students’ most common response to this question was that it would be ‘Unpleasant’ to study ICT at post 16. The responses female students make to these questions suggest their negative attitudes towards studying ICT at Post 16 and beyond. Unless teachers are aware of the salient beliefs that form these negative attitudes held by female students, they cannot work towards changing this perception and female students will continue to hold negative attitudes towards the study of ICT. If this is the case the attrition of women from the ICT industry and problem of pipeline shrinkage (Gras-Velazquez et al., 2009, Grid Talk, 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990), will be perpetuated.

5.2.6 Normative Beliefs

This section of the chapter specifically addresses the second component of the overarching research question as outlined above: **Are there gender differences in Normative Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?**

There were four items in the questionnaire designed to explore the norms ICT students are exposed to in relation to their normative beliefs regarding the study of ICT. These beliefs are with regard to the perceived beliefs held by their teachers, parents, close friends and classmates – the referents. The gender-based responses were analysed to ascertain if there were any differences between female and male ICT students' responses. The Chi Square analysis showed that in all four (4) of the items there were statistically significant differences (See Table 3).

These questions assume that normative beliefs, in combination with the students' motivation to comply with the different referents, determine the prevailing subjective norm (students' perception of social normative pressures). Specifically, the motivation to comply with each referent contributes to the subjective norm in direct proportion to the female students' subjective probability that their reference groups think that they should perform the behaviour in question (Aizen, 2006). In this study, the behaviour in question is the intent to study ICT post 16. There is an understanding that the consequences of performing an act – studying ICT post 16 –

may please or displease the reference groups with the consequence of some notional 'reward or punishment'. This leads to an expectancy-value formulation where the weight put on the opinion of the reference group is evaluated (Fishbein & Ajzen, 1975).

The data in Table 4 shows the quantitative analysis of the gender differences in normative beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980).

Table 4: Statistically Significant Normative Beliefs

Item	χ^2	df	P
55 My classmates think I should study ICT at post 16	4.332	3	0.228
52 My teacher thinks I should study ICT at post 16	3.172	3	0.366
53 My parents think I should study ICT at post 16	21.444	3	0.000
54 My close friends think I should study ICT at post 16	33.835	3	0.000

The analysis of the semi-structured interviews undertaken with 30 Key Stage 4 ICT students concurred. Female students cohesively felt that their referents were at best ambivalent regarding them studying ICT post 16 with some expressing mild surprise that they would even consider it. The male students felt much more positively in that for them to study ICT post 16, was a shared normative belief held by referents, although, importantly, this belief was of little concern to the male students who routinely responded, 'It's up to me, anyway'.

Female students responded negatively to The TpB question: 'My classmates think I should study ICT at post 16'. The perception that their classmates do not think they should study ICT is not synonymous with female students' academic success. It is more likely to be due to their low self-efficacy and lack of comfort level in an alienating 'club house' environment (Fisher et al., 1997). This is an environment where their favoured work style of collaborative interaction is rarely expected. Female students often over-rate the difficulty of ICT (Gras - Velazquez et al., 2009, Arnot et al., 1998) and perceive male students' quick, competitive answers to questions as indicative of ability and competency rather than their preference for short processing time (Riding & Rayner, 2005). It is likely that the female students' perception that their classmates do not think they should study ICT is reflective of their own low self- efficacy with regard to the subject.

Female students also responded negatively to the question: 'My teachers think I should study ICT at post 16'. The initial analysis of the female and male responses, however, did not take into account teacher gender in relation to this question. (This is discussed at length in section 5.7 'Teacher Gender'). The importance of positive female role models in ICT for female students has been stressed in the Literature Review and this is important aspect for schools to consider if female students are going to believe that their teachers think they should study ICT.

There are a number of possible reasons as to why female students may believe their teachers do not want them to study ICT. Female teachers may have transmitted their own low self-efficacy with regard to ICT (Saunder, 2005, Cox, 2003). Both female and male teachers may have unknowingly perpetuated their own gendered attitudes though their responses to their students, subject matter choices and teaching styles (Sukhnandan et al., 2000). Just as female students can misconstrue male students' aggressive, quick responses to questioning as being indicative of better subject knowledge rather than the ability to process information swiftly, if superficially

(Riding & Rayner, 2005) their teachers may also believe these attributes show a level of understanding that is in fact often only illusionary (Li, 1999).

From Figure 13 and the statistical data, it is evident that female students are significantly statistically less confident in their belief that their parents wish them to study ICT than their male peers: [χ^2 =21.444; DF =3; $\rho \cong$ 0.000].

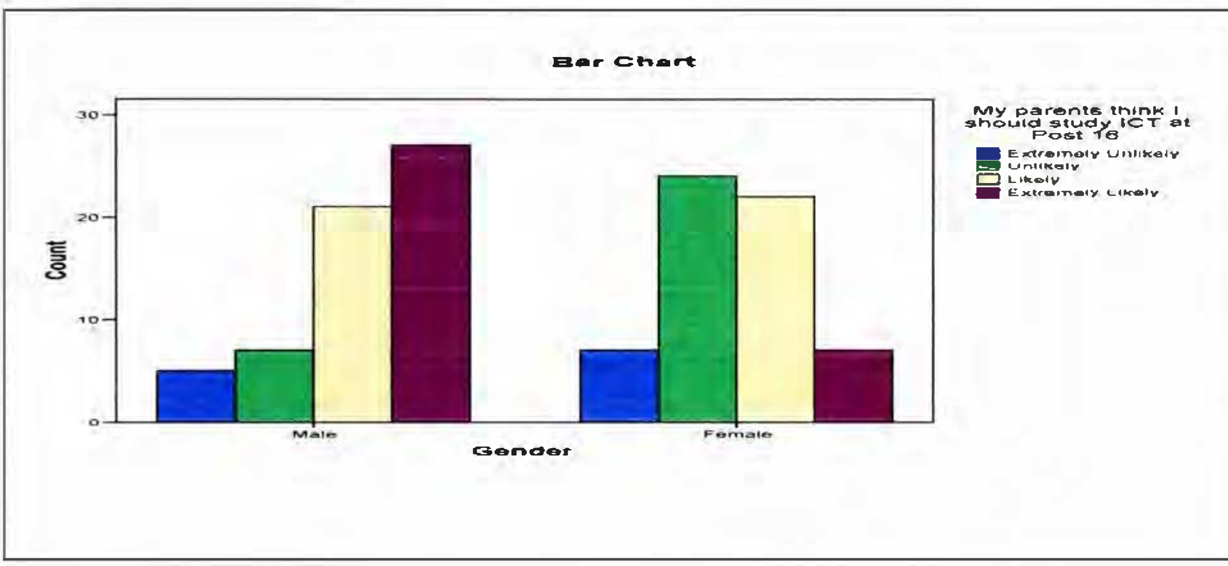

Figure 13: Item 53: My parents think I should study ICT at post 16 and beyond

The differing normative beliefs held by female and male students may have been embedded through discourse from earliest childhood as parents articulate subliminally their own beliefs regarding what interests and motivates their daughters and sons. For instance, US research focusing on middle class children of between 11 and 13 years old, used questionnaires to measure parents' and children's attitudes to science. Each parent also engaged his or her child in four structured teaching activities (involving science and non-science tasks). There were no child gender or grade-level differences in children's science-related grades, self-efficacy or interest. Parents were, however, more likely to believe that science was less interesting and more difficult for daughters than sons. In addition, parents' beliefs significantly predicted children's interest and self-efficacy in science. An examination of language the parents used found that fathers tended to use more cognitively demanding speech with sons than with daughters during one of the science tasks (Tenenbaum & Leaper, 2003).

The norms established in childhood will resonate for children throughout their education and unless those norms are challenged, gender segregation in the workplace will remain (The Women and Work Commission, 2009). Acknowledging that this is the case will provide a starting point for teachers in their planning and delivery of lessons to circumvent the negative impact of normative beliefs held by students.

Figure 14 indicates that female students are also significantly less confident than their male peers in their belief that their close friends wish them to study ICT: [χ^2 = 33.834; DF =3; $\rho \cong$ 0.000] in their response to the question: 'My close friends think I should study ICT at post 16'.

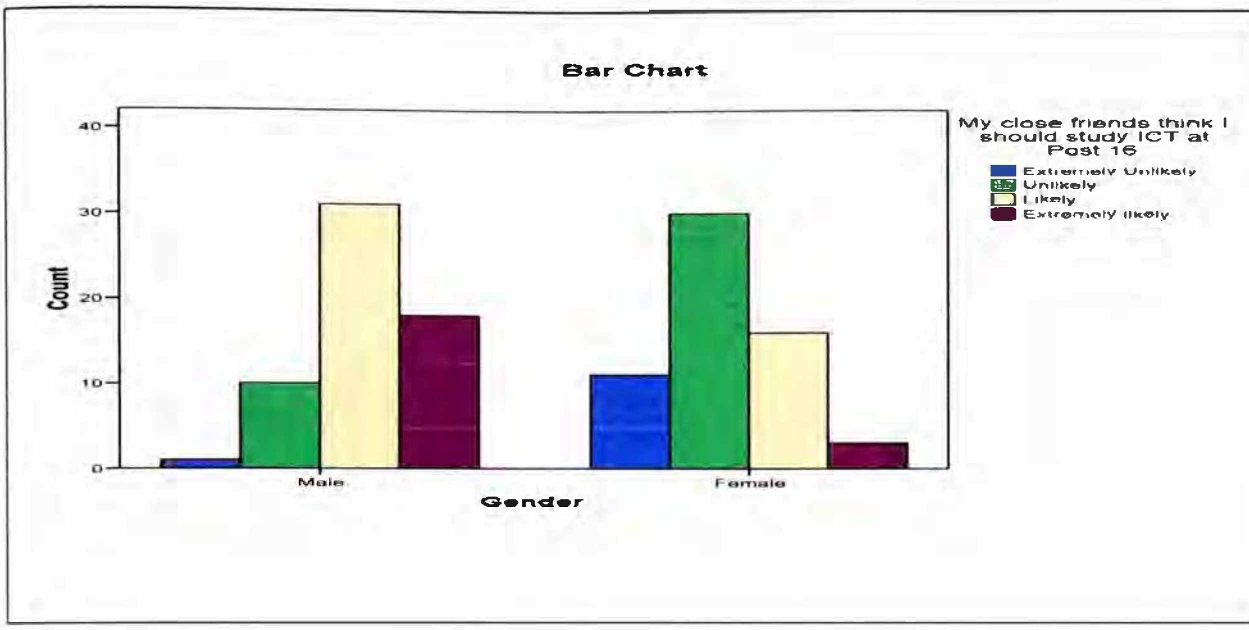

Figure 14: Item 54: My close friends think I should study ICT at post 16 and beyond

This result is unsurprising given their response to the previous behavioural outcome evaluation question: 'For me to miss being with my friends in the same class'. This question produced a negative response that implied the importance of their friendship groups and their lack of association with ICT as a place where they work with their friends, coupled with their belief that studying ICT is 'tedious' and 'boring'.

Just as female students do not associate ICT classes with an environment that is conducive to friendship it is likely that they do not perceive that their friends would believe anything different. Female students feel marginalised and isolated in ICT learning environments (Wilson, 2008) and their attitudes to the subject have been positioned within this context. They perceive male students as more vocal and more confident and in doing so, within the aggressive, competitive 'hacker' culture of the ICT classroom; believe the subject to be at odds with supportive friendship and fun (Gras-Velazquez et al., 2009, Francis, 2006, Volman & Eck, 2002). Additionally, the female students, through a lack of positive role models (Gras-Velazquez et al., 2009, The Women and Work Commission, 2009), often perceive female ICT success as unattractive. They would rather be perceived as "cute" rather than "smart," (Mitchell, 2005).

5.2.7 Normative Beliefs: The Motivation to Comply

This section of the chapter continues to address specifically the second component of the overarching research question as outlined above: **gender differences in Normative Beliefs: The Motivation to Comply as measured by the theory of TpB.**

The data in Table 5 shows that there were four items in the questionnaire designed to explore students' attitudes to pleasing teachers; parents; close friends and classmates. The gender-based responses were analysed to ascertain whether there were any differences between female and male students' responses. The Chi Square analysis showed that in all four (4) of the items, there were statistically significant differences.

Table 5: Statistically Significant Normative Beliefs: The Motivation to Comply

Item	χ^2	df	P
28 How much I care with regard to my parents' opinion	8.348	3	0.039
27 How much I care with regard to my teacher's opinion	13.322	3	0.004
29 How much I care with regard to my friends' opinion	16.609	3	0.001
30 How much I care with regard to my classmates' opinion	27.255	3	0.000

ICT students' motivation to comply, combined with normative beliefs about whether specific individuals or groups think one should perform the behaviour, results in subjective norms.

Normative beliefs are the attitudes (of female and male ICT students) towards performing behaviour namely, studying ICT at post 16 and beyond. The motivation to comply, however, represents the extent to which a student wants to act as the reference group member in question (teachers, parents, close friends and classmates), desires. These beliefs set a standard or norm although each referent group's belief is reflected individually through the questions in The TpB questionnaire.

When questioned verbally about their motivation to comply, students' responses differed. Female students overwhelmingly felt that they did want to please their parents, friends and teachers although for reasons that were complex and nuanced. There was a shared presumption that the desire to please was often a reciprocal aim; that parents, friends and teachers wanted to support and please them so deserved the same from them in turn. Male students were more likely to acknowledge they did not want to 'upset' anyone or 'cause trouble' but ultimately, they would actually please themselves, not their referents.

Female students responded positively to the question: 'Generally speaking how much do you care what your parents think you should do?' Coupled with their negative response to the normative belief question: 'My parents think that I should study ICT beyond post 16 level' it can be inferred that female students' desire to please their parents will lead to them being unlikely to opt to study ICT post 16.

Conversely, if female students' perceived parental attitudes towards studying ICT are positive, then they themselves are also likely to hold positive beliefs towards the subject. Recent European research into why females students in Italy, The Netherlands, Poland, France and the UK fail to study ICT post 16 (Gras - Velazquez et al., 2009) found that mothers' positive attitudes and enthusiasm with regard to ICT, rather than personal knowledge, had a significant influence over their daughters. Parental attitudes with regard to ICT cannot necessarily be affected by school intervention, but schools increasingly do run courses and programmes aimed at enhancing parents' confidence and self-efficacy (Cronin, 2009, Ofsted, 2009a). The importance of positive teacher role models for female students also cannot be over looked (Gras - Velazquez et al., 2009, Myhill & Jones, 2006).

Female students responded positively to the question: 'Generally speaking how much do you care what your teachers think you should do?' Given that, female students responded negatively to the Normative Belief Question: 'My teachers think I should study ICT at post 16' it can, therefore be surmised that female students hold the belief that their teachers do not think they should study ICT. As they want to please their teachers, more than their male peers, female students are less likely to study ICT post 16. The female students' response that they care about pleasing their teachers is in line with their behavioural belief question response where the locus of intent was on work ethic and study. Female students have been shown to have positive attitudes to study and this is borne out by the prior attainment of the female students who participated in this study and national trends (Ofsted, 2009, The Telegraph, 2007, The Times, 2006).

Female students responded positively to both the questions: 'Generally speaking how much do you care what your close friends think you should do? and 'Generally speaking how much do you care what your class mates think you should do?' In each case, their responses demonstrated that they cared more about the opinions of referents than their male peers. If, as the female students' negative responses to the normative belief questions: 'My close friends think I should study ICT at post 16' and: 'My classmates think I should study ICT at post 16' indicate, female students believe that their friends and classmates do not think they should study ICT, then the likelihood of them doing so is lessened.

There is evidence that rather than challenge gender stereotyping and assumptions, peer groups reinforce traditional gender stereotyping. Many female students position themselves within gender stereotypes with regard to ICT. They perceive themselves as 'geeks' if seen to be successful in the subject (Mitchell, 2005) and 'just users' or 'chatterers', rather than 'programmers' as their male peers are (SIGIS, 2004). If they presume these perceptions are the beliefs of the referents they want to please then it is highly unlikely that female students will have attitudes and beliefs that lead them to the intent to study ICT at post 16 and beyond.

In each of the four motivation to comply questions, the reference group has far more influence over the female students' beliefs than the males', with a significant statistical difference in each case. They hold normative beliefs that referents do not want them to study ICT and it can therefore be assumed that the female students believe that their teachers, parents, close friends and classmates themselves hold normative beliefs that are negative towards female students studying ICT post 16 and beyond. The female students desire to please their referents increases the likelihood that they will not opt to study ICT post 16 and beyond. The obverse, however, is likely to be true for the male ICT students.

5.2.8 Subjective Norms

This section of the chapter continues to specifically address the second component of the overarching research question as outlined above; **gender differences in Subjective Norms as measured by the theory of TpB.**

There were five items in the questionnaire designed to explore students' subjective norms. Items: 13, 16, 17, 20 and 24 (See Appendix 1). Subjective norms are the students' perceptions of the social normative pressures or their friends, teachers, parents and classmates' beliefs that they should or should not study ICT post 16 and beyond

With regard to the questions in The TpB Questionnaire that referred to subjective norms, the female students responded negatively to the question, 'Most people whose opinions I value would approve of my studying in post 16... (Strongly disagree/Strongly agree)': [χ^2 =26.160; DF = 2; ρ= 0.000]. (See Appendix 2: Result number 20). The female students' response with regard to their perception that their referents did not believe that they should study ICT, coupled with their desire to please their referents, is not surprising given their previous responses to normative and motivation to comply questions. The female students believed that none of their referents would want them to study ICT and implied by their responses that they wished to please all their referents. It is, therefore, concurrent with those responses that the female students believe most people whose opinions they value would not want them to study ICT post 16.

The remaining four questions that explored students' subjective norms did not result in responses that were of significant difference between female and male students. The question that produced a significantly different response, however, had the locus of belief on the specific people whose opinions the female students 'valued' which may have been an important difference when they responded to the question.

5.2.9 Control Beliefs

Beliefs concerning the presence or absence of factors that make performance of behaviour easier or more difficult, are termed control beliefs. This section of the chapter specifically addresses the third component of the overarching research question as outlined above: **gender differences in Control Beliefs as measured by The TpB.**

The data presented in Table 6 describes the third component of the overarching research question, that there are gender differences in control (and attribute) beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980). There were twelve items in the questionnaire designed to explore factors that to some extent control beliefs regarding studying ICT linked to health, well being and workload. The responses were analysed to ascertain if there were any differences between female and male students' responses. The Chi Square analysis showed that in five (5) of the items there were statistically significant differences.

Table 6: Statistically Significant Control Beliefs

Item	χ^2	Df	P
40 How often are there unanticipated demands on my time	13.213	3	0.004
41 How often do I feel ill, tired or listless	21.274	3	0.000
42 How often do family make unanticipated demands on my time	13.436	3	0.004
46 Would unanticipated demands make it more difficult to study ICT at post 16	24.440	3	0.000
51 Failure to complete assignments on time would make it more difficult to study ICT at post 16	15.943	3	0.001

Five of the control belief TpB questions focus on general controls rather than specifically relating to the study of ICT. The questions were answered, however, in the context of an ICT lesson. Three questions focused on external controls to motivation at school or college: 'How often do you encounter unanticipated events that place demands on your time?', 'How often do you feel ill, tired or listless?' and 'How often do family obligations place unanticipated demands on your time? In each case, there was a statistical difference in the female and male response, with the female students responding that they felt they experienced external demands more frequently.

That 'unanticipated' domestic demands and health concerns demonstrated statistically significant concerns of female students rather than their male peers is compatible with the findings of research studies exploring why the attrition of women in the ICT industry. The lack of workplace flexibility in the ICT Industry benefits male employees who have a perceived greater commitment in the work place in comparison to female employees resulting in enhanced promotion and salaries (Diamond & Whitehouse, 2005, Grodzinsky & Gumbus, 2005). A number of studies, referred to in detail in the Literature Review, concluded that the ICT industry frequently makes demands on its work force that go beyond the working day. These demands are incompatible with the domestic demands that impede women's capacity to work irregular, inflexible hours. The European Social Fund (ESF) project - Women in IT (WINIT) found that only 19% of the female workforce had school age children. The women interviewed attributed this to the inflexible nature of the ICT industry (Adam et al., 2005). Similarly, the European research project – Widening Women's Work in Information and Communication Technologies (WWW-ICT) concluded that, more than any other industry, the ICT industry has less flexible working hours and more performance related pay (Webster, 2005). This lack of workplace flexibility leads to women being paid less than men are as women make up less managerial roles. The Women and Work Commission (2009) found that in the UK, women are still paid, on average, 22.6 per cent less per hour than men and this pay differential is further exacerbated for part-time workers who make up 39.9 per cent of the workforce. In research commissioned by the multi-national McKinsey Company, 'Women Matter-A Competitive Edge for the Future' (Desvaux & Devillard, 2009), it was found that the women employed by McKinsey felt their careers were not only held back due to the lack of flexibility in the work place but that they would consider leaving the industry due to their comparative low pay. This research was commissioned in an attempt to find ways to attract women to the McKinsey Corporation, its board believing that whilst pipeline shrinkage is an ethical issue it is also a practical concern that will impact on the performance of the company in the future.

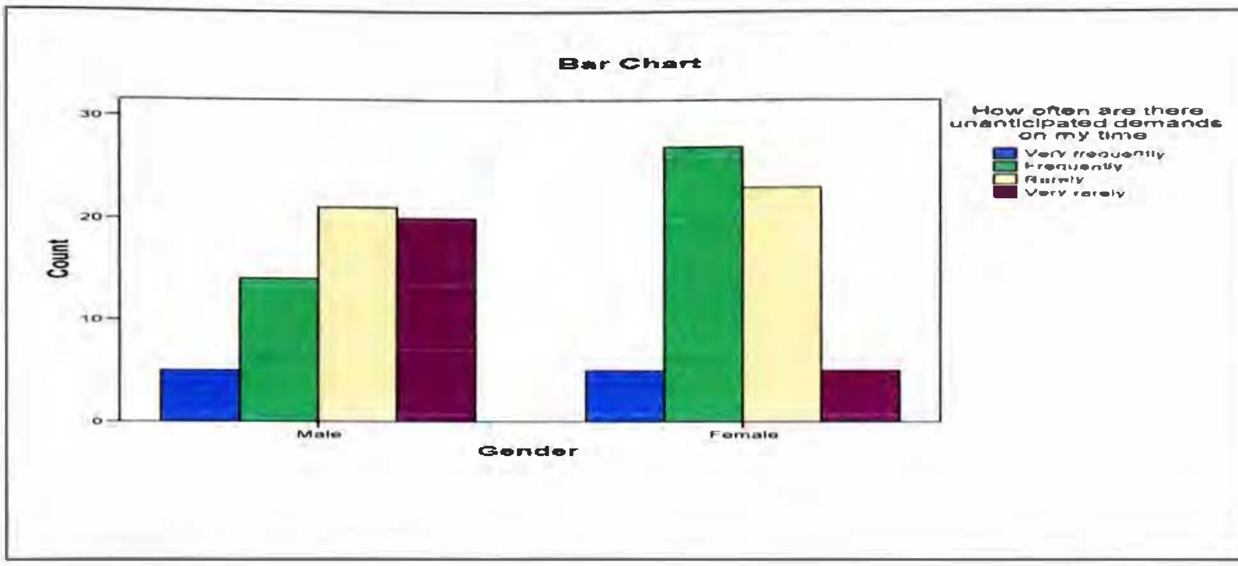

Figure 15: Item 40: How often are there unanticipated demands on my time?

From Figures 15 & 16, it can be seen that there are gender discrepancies in the control beliefs of the sampled students, as explained above. It is a cause for concern, that by 15, 16 or 17 years of age, female students questioned believe that external factors – unexpected 'events' and family demands - 'control' their lives (in that they are control beliefs that impact on female students more significantly than male students) in ways that do not affect male students to the same extent.

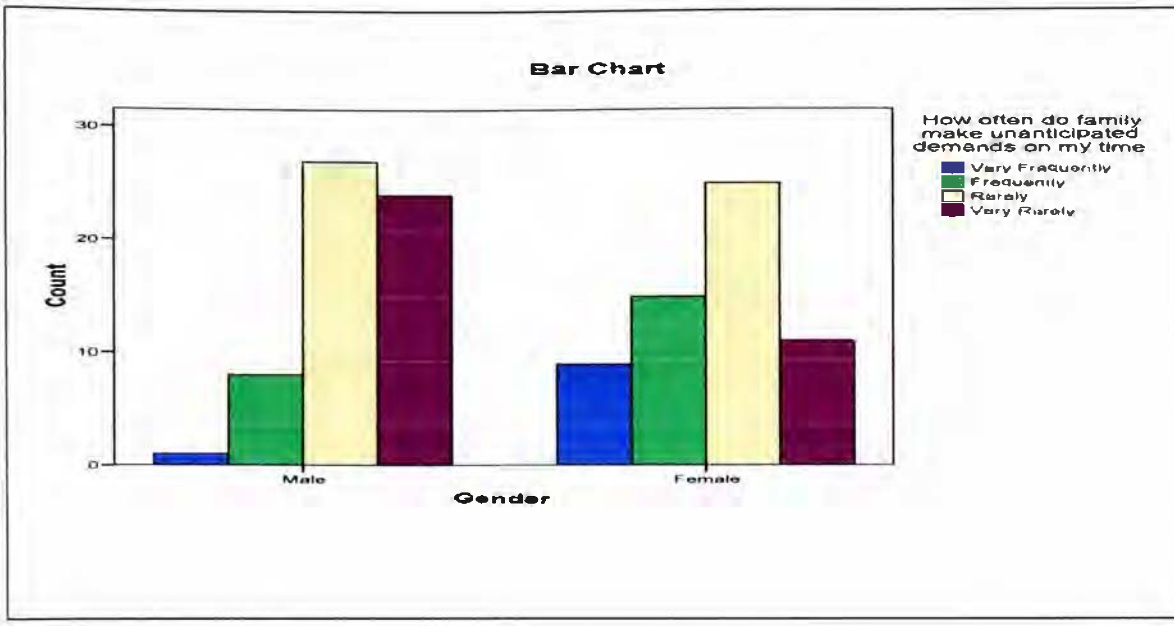

Figure 16: Item 42: How often does my family make unanticipated demands on my time?

Feminist research suggests that men still hold power in society because of the differing relationships women and men hold and that are affected by social constructs and gender roles (Leatherby, 2003). The disparity between the control beliefs the male students and female students hold suggests that male students already have beliefs that strengthen their potential to hold power and dominance. Although still at school, they are less affected by external demands from events and family and less anxious about their own health. For over a decade the issue of female students failing to gain equality in the workplace, despite their academic superiority, has been an issue. Schools have been aware that they should not only focus on the academic achievement of female students but also focus on the important skills of development and decision making that will enable them to maximise their opportunities and potential (Ofsted,1996). This, however, has failed to be a prime impetus of school policy. The focus has become the examination performance and, in many schools, the underachievement of white, working class male students. Any attempted redistributive policies - not only in schools but also in the wider social and economic contexts - the labour market, changing families and feminist action – have been generally unsuccessful (Skidmore, 2007). The results from The TpB questionnaire (see Table 6) suggests that this is the case in ICT classrooms. Female students feel the effects of domestic responsibilities that their male peers do not.

The male ICT students' responses to the control belief questions, generally suggest a confldent control belief with regard to their future intention to study ICT post 16 (see Table 5). This is an internal control. Their 'likely' and 'very likely' positive responses suggest strong clusters of locus of control beliefs when the locus of control is on ICT and little perception that external factors may influence their intention to study ICT. The female students, however, feel external factors, such as unexpected 'events' and family demands have a greater control over their behaviour. They are, therefore, affected by attribution beliefs rather than control beliefs (Gabillon, 2005).

5.2.10 The Power of Control Factors

Six questions in The TpB questionnaire, (See Appendix 1, Items 46-51) determine the strength of external factors relating to time management, health and well being and their specific impact on studying ICT. These questions identify the power of control factors and constitute how far the factors determine behaviour. There were few differences in the responses of female and male students. The only significant difference was that female students believed they would find studying ICT more difficult than their male peers if unanticipated events placed demands on their time: [χ^2 =24.440; df =3; $\rho \cong$ 0.000].

All students responded that ill health or family obligations – concrete distractions rather than the more abstract notion of 'unanticipated demand'- would make the study of ICT more difficult, but the male students believed the 'unanticipated demands' would not impact on their study to the same extent. One could speculate that male students are able to disassociate themselves personally from the more abstract 'unanticipated' demands rather than from problems relating to their own and their family's health and well-being.

The female students, however, presume that they will have to deal with the 'unanticipated' in the same way as their own health and family demands, lacking the belief that others will be responsible and presuming that they will have to deal with the unknown, abstract, situation. When they articulated their responses to control belief questions verbally, female students were swift to contextualise the 'unanticipated demands' into concrete examples that included: shopping for the family, visiting relatives, showing visitors around school or baby-sitting. The male students had little perception of what those 'demands' could, be so rejected them as having no relevance for them. Their response differed when discussing the more specific 'family' demands. All the students had very specific examples- referring to grandparents and brother and sisters with details of how these referents put demands on their time. Male students, however, were more likely to quantify these demands: 'only for two days', 'not often', 'my mum usually goes herself though'. Female students' responses, cheerfully made and often humorous, were more likely to be suggestive of duty or obligation: 'I can't say no can I?' and 'I am always there for them'.

These beliefs will possibly lead to the behavioural, normative and control beliefs typical of women in the ICT industry worldwide who need flexibility in the workplace at odds with the male workers who direct their flexibility to the workplace itself (Griffiths, 2005).

Within the industry, family responsibilities often prevent women's career advancement due to their lack of flexibility in the work place and consequently the number of single women in the ICT industry is increasing (Black et al., 2005). Women who are successful within the ICT industry are more likely not to be involved in childcare and are free to devote long and erratic hours to the work place (Desvaux & Devillard, 2009, Griffiths et al., 2005).

In my experience as an observer in many mixed gender classrooms across the South East of England, I have frequently watched female students take on responsible roles in ICT classrooms that are those of peace-keepers and 'mothers' to their male peers, adopting 'quasi-teacher' roles (Francis & Skelton, 2005). They put away boys' folders, log off for them if they forget to, tuck in their chairs and even quickly finish off their work if the male student being 'mothered' has spent too much class time on game playing and is now at risk of being kept behind. Their pragmaticism, whilst clearly indicative of ICT competence to an observer, creates associations for the female students that are linked with the stereotypical female attributes of nurture and care, whilst reinforcing male dominance in the ICT environment.

Of The TpB questions, the response that was most surprisingly of significantly statistical difference was that given to the question: 'If I failed to do the assignments for this course on time it would make it more difficult for me to study ICT in post

16'. Figure 17 overwhelmingly demonstrates that male students felt that this would be more problematic than females: [χ^2 =15.943; df = 3; p= 0.001].

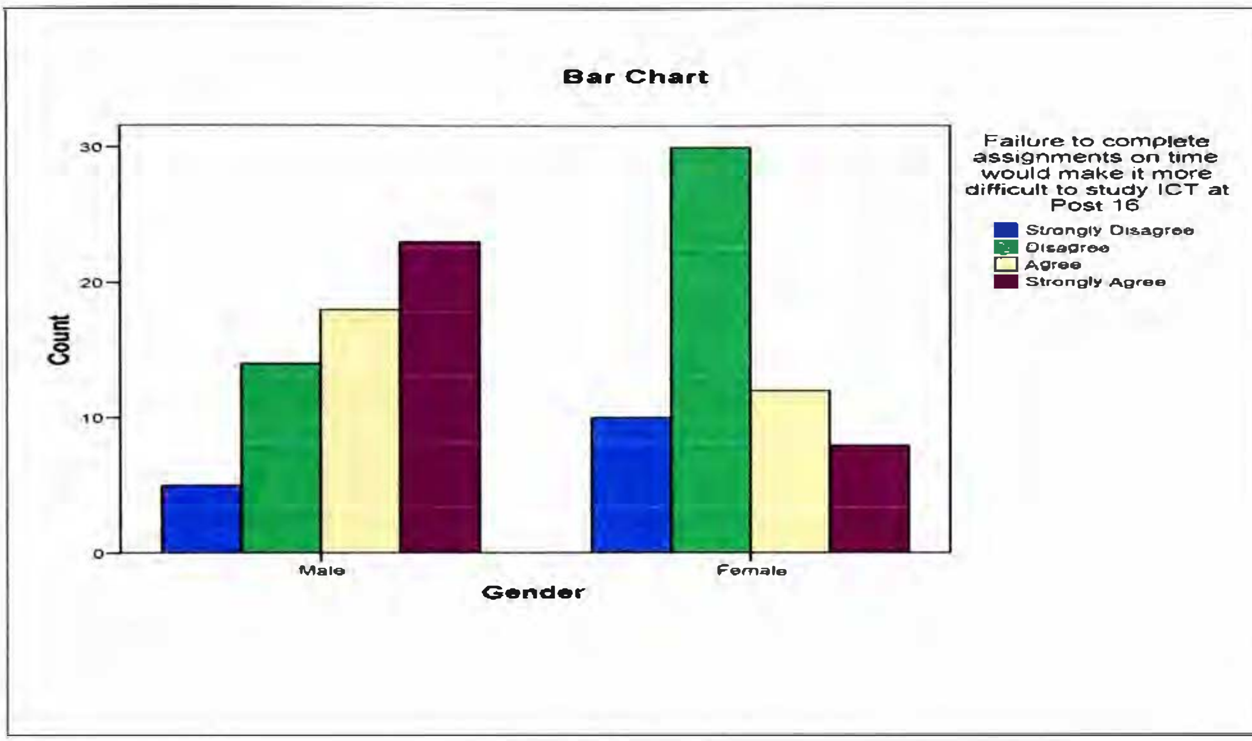

Figure 17: Item 51: Failure to complete assignments on time would make it more difficult for me to study ICT at post 16 and beyond

This result suggests the single-mindedness of the male students and the strength of their intention in comparison to female students. The belief in the importance of the ICT assignment is a locus of control belief that can be controlled by the male student in order to guide their future behaviours. The female response, that the failure to complete an ICT assignment on time would not make it less likely to study ICT is, as described by Gabillon (2005), an attribution belief in that there are external causes for behaviour. In this case, the failure to hand in assignments may be due to the behaviours of others or 'unanticipated' events out of their control, not due to their own lack of organisation, hard work or academic aspiration. These were areas that the female students indicated in the TpB questionnaire as being important to them in comparison to their male peers who answered less positively in response to the questions regarding developing good study habits, gaining information on ICT test material and keeping up with ICT studies (See Table 2).

All the items in the questionnaire exploring control beliefs and power of control beliefs were analysed using a Chi Square test. All five items showing significant differences have been discussed as have the items where the control beliefs of female and male students did not statistically significantly differ. In relation to the second component of the overarching research question under discussion it has been demonstrated that there are gender differences in control beliefs as measured through The Theory of Planned Behaviour (Ajzen & Fishbein, 1980) that inevitably will impact upon 'pipeline' shrinkage.

5.2.11 Analysis of Direct Measures of Perceived Behavioural Control Beliefs

Control beliefs lead to the perception that behaviour is possible or not possible. For the purposes of this research, the perception is that it is possible or not possible for female students to study ICT post 16. This belief is termed as 'perceived behaviour control' (Ajzen & Fishbein, 2005) or self-efficacy. According to Bandura (1986) the way individuals, in this case Key Stage 4 ICT students, behave is determined by their perceptions of how skilled, competent and efficacious they are. Self-efficacy is the mechanism by which they navigate paths to achieve goals – in the case of this study their goal to study ICT Post 16 or their goal to cease to study ICT post 16.

There are four important sources of information affecting students' perceptions of self-efficacy. The first source is performance accomplishment. Students' perceived self-efficacy for an activity tends to increase if their experiences provide positive information about related competencies. For instance, male students' preferences for game playing creates opportunities for their perceived successful performance on computers. As ICT is perceived, in many sectors, as a maths related subject, with some teachers' over-rating male students' ability (Li, 1999) those male students' perceptions of self-efficacy may be affected by their perceived better performance than female students in mathematics.

The second source of information affecting perceived self-efficacy is seeing others succeed or fail. Male students have numerous successful role models in ICT, whereas females have relatively few. In the numerous ICT class observations that I make in the South East of England, including the two mixed gender schools participating in this study, male ICT teachers, technicians and managers predominate.

The third source of information included is verbal persuasion from peers, family and teachers (as discussed above). Finally, the fourth source of information that can affect perceived self-efficacy are the behavioural, normative and control beliefs discussed above that describe female students' emotional responses to the subject. Emotional responses, in the context of this study, refer to whether the female students will be bored or intellectually stimulated by the subject (Bandura, 1986). Female students' perceived self-efficacy with regard to ICT impedes their control beliefs with regard to their studying ICT post 16 and begins the attrition of women from the ICT work force that culminates in 'pipeline shrinkage'.

Multiple observations in many schools across South East England have led me to see that self-efficacy is frequently covertly at play in ICT classrooms. Female students are often more capable and quick in the use of ICT in the classroom but if they are under scrutiny, undertaking highly competitive, individual tasks, their performance can be less confident than their male peers. They may excel at producing and completing extended course work tasks, often at home, but there can be differences in the public and private ICT performance of female and male students. Sanders (2006), who cites numerous research studies, corroborates this. She concluded that frequently female students performed less well in the public context of the classroom if the activities are designed and structured to engage male students.

Male students can demand more teacher attention, particularly as they deftly zoom from one illicit website to another, off task, and slow to complete the set work that is too often not broken down into chunks with mini plenaries to keep learning on track. (Although I frequently observe the female students are not only on track with their work but ahead of what has been set). As male students use their general ICT knowledge to hide their game playing and web surfing from the teacher, their perceived self-efficacy with respect to computers is enhanced. The lack of attention the female students receive and their irritation that their male peers are off task decreases their computer-efficacy. My observations are corroborated by the numerous research examples cited by Sanders (2006) who concluded:

> That females consistently under-estimate their technology skills regardless of what their skills really are. Betty Collis memorably referred to girls' tendency to deprecate their own skills but assert confidence in females' skills in general as the "I can't, but we can" paradox.
>
> (Sanders, 2006:11).

The male students have high self-efficacy because they perceive that they have the skills to accomplish any task and find what they are doing easy (as game playing and web surfing are). Their confidence is misplaced but this has no impact on self – efficacy that is based on personal belief, not actuality. Those beliefs are computer confidence, status value of computer use and general usefulness of a computer. The more female students see their male peers wasting (both their own and their) time on game playing, their beliefs in the status and general usefulness of computers decreases.

The Theory of Cognitive Behaviour can make further sense of the apparent contradiction between female students' academic success in ICT and their low self-efficacy (Beck, 1976). They have unconsciously contextualised their experiences, in and out of the ICT classrooms, in such a way as to position themselves as not only uncomfortable in the ICT classroom environment but also as having less status as learners. The influence of these unconscious control beliefs that are hardened in traditional ICT environments, leads to the under representation of female students in the study of ICT post 16 and beyond into the ICT industry.

Female students, in my experience, do not have low self-efficacy in the ICT classroom because they lack an ability to use computers but because they do not enjoy the atmosphere engendered by how their male peers use computers. External factors, therefore, influence their computer confidence – not necessarily in using the computer itself but in its contextual environment.

The students who took part in the semi-structured interviews were asked what aspects of the lesson they both enjoyed and did not enjoy. Almost all of the students, both female and male, indicated that they enjoyed at least some aspects of the lessons. The majority of male students, 82%, however, referred specifically to working on the computers, in comparison to only 23% of the female students. Female students were more likely to cite that they liked the teacher or enjoyed being with their friends and any opportunities they had to work together.

I have often observed this link between female students' self-efficacy and learning and the differing perceptions female and male students have of themselves as learners. When problem solving or completing an ICT task set by the teacher, the female and male students have very differing responses to their own learning. I have frequently observed that when a male student cannot complete the task or fails to solve the problem, he will, often aggressively, blame the computer itself, smash down the mouse or switch off the machine without saving and then claim he has mysteriously 'lost' his work. Female students will respond very differently, blaming their own abilities to use computers. Again, Sanders' (2006) review of two decades of research in female students and ICT corroborates my observations. She found that numerous studies conclude that female students consistently perceive themselves as less able in their use of ICT, regardless of their actual ability. Male students may have lower ICT competency than their female peers, but have lower computer anxiety in that they do not doubt their own ability, they doubt the machine's ability. Consequently, their self-efficacy is higher and they believe they perform better with computers than those with higher computer anxiety. It is observable that the increase in anxiety of the female students decreases their self-efficacy, and the lower computer anxiety of the male students correlates with high computer confidence.

5.2.12 Statistically Significant Direct Measures of Perceived Control Beliefs

Perceived control beliefs are the beliefs about the presence of factors that may facilitate or impede performance of the behaviour, which for the purposes of this study is the performance of the behaviour to study ICT post 16. A student's perceived behavioural control is determined by the total set of beliefs that Ajzen (2006) terms as 'accessible beliefs' and which include self-efficacy. Perceived behavioural control or self-efficacy can be used, with intention, to predict behaviour if it is an accurate reflection of actual behavioural control (See Figure 2).

There were four items in the questionnaire designed to explore students' perceived behavioural control beliefs regarding studying ICT post 16. These are items: 12, 14, 19 and 23 (See Appendix 1). The responses were analysed using The Chi Square test to ascertain whether there were any differences between the female and male students' responses. Table 7 shows that in three (3) out of four (4) items there were statistically significant differences.

Table 7: Statistically Significant Direct Measures of Perceived Control Beliefs

Item	χ^2	df	P
12 Ease of studying ICT post 16	16.415	3	0.001
23 Possibility of studying ICT at post 16	18.918	3	0.000
19 Confidence of ability to study ICT at post 16	28.954	3	0.000

From Figure 18, it can be seen that female and male students had statistically significant differing responses to the question: 'For me to study ICT in post 16 is extremely difficult…'

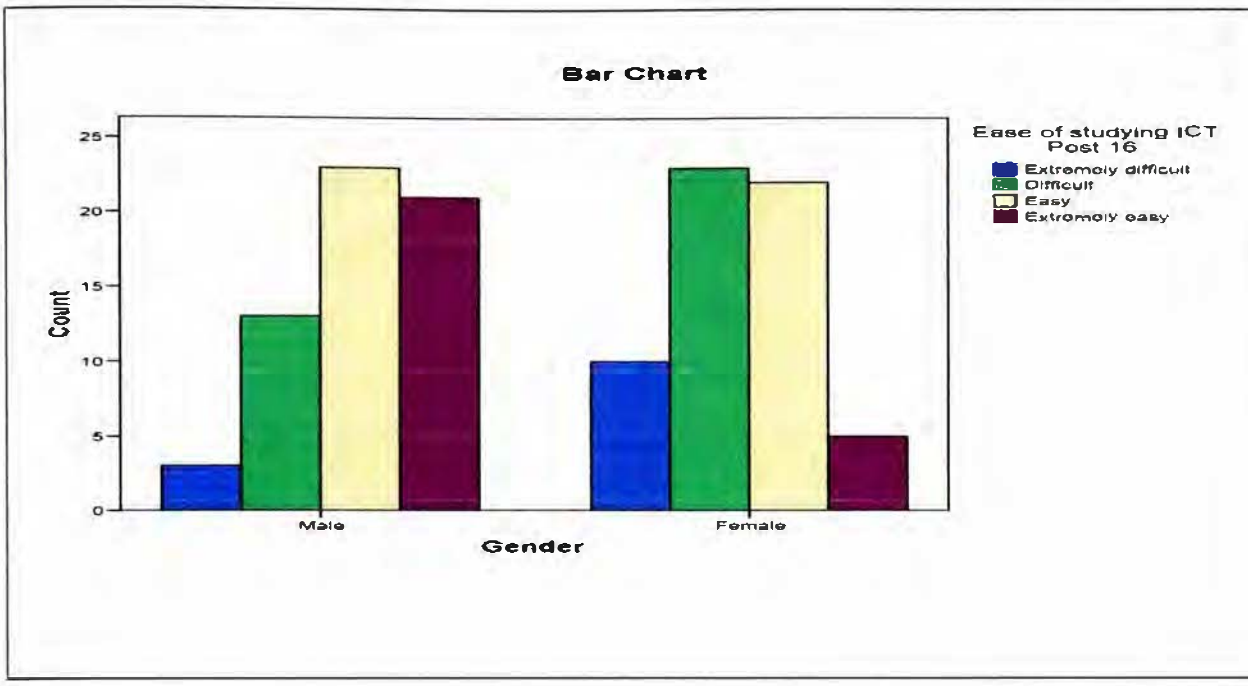

Figure 18: Item 12: Ease of Studying ICT at post 16

The response to this question is indicative of female students' low self-efficacy towards the question and not their prior academic success. Rather than believe that they are successful academically in ICT, and will therefore find it easy to study it further, they believe it will be difficult to do so. This response is therefore an emotional response.

To the question, 'For me to study ICT in post 16 is... (impossible/possible)', female students responded in ways that, again, demonstrate their low self-efficacy in ICT rather than confidence in their academic ability. Their perception of their ability to study ICT post 16 is similarly, as previously discussed, at odds with their motivation in class and work ethic.

To the question, 'I am confident that if I wanted to I could study ICT post 16 is... (Definitely false/ Definitely true)', female students were significantly less confident: [χ^2 =28.954; df =3; $\rho \cong$ 0.000]. The female students perceive difficulties in further study of ICT that their male peers do not. They, therefore, have less perceived control of their behaviour.

Each control belief is multiplied by the perceived power of the particular control factor to facilitate or inhibit performance of the behaviour. The more female students' perceive they are unable to study ICT post 16; the stronger will be their controlling belief that they cannot do so. The results are summed across the salient control beliefs to produce the perception of behavioural control (Ajzen, 1991). In this case, the belief that studying ICT post 16 would be difficult for female students is the belief that impacts upon their intention.

That TpB acknowledges other influences and variables. Ajzen (1991) allows that two further sets of behaviour-specific cognitions may be relevant. Firstly, the anticipated perceived risk or threat from a behaviour (how female students feel about studying ICT post 16). Secondly, the anticipated positive affects linked to a perceived cognitive understanding of the consequences of the anticipated behaviour (male students' positive anticipation regarding the post 16 study of ICT). Therefore, the risk/threat anticipated by female students if they study ICT post 16 and the positive affects of doing so for male students impact upon their control beliefs (Conner & Abraham, 2001). Female students anticipate threats that include disempowerment, boredom and distance from their influential peer group. Conversely, male students do not perceive these threats. They anticipate the effects of empowerment and engagement by ICT and therefore are more likely to carry out their intent of studying ICT post 16.

My observations in many ICT classrooms concur. As discussed, female students are marginalised by their preferred working styles of collaboration, discussion and listening which are rarely the norm in ICT classrooms. The (usually) male teachers, however, frequently allow the male students to disempower the female students physically. Unless there is a pre-determined seating plan, male students often dominate the learning spaces by positioning themselves in the centre of the room, 'sprawling' as described but Francis & Skelton, (2005) in front of their screens. Female students are then left to fill in the periphery edges of the room. In many lessons I have observed the male students also dominate one to one teacher/student discourse, leaving the female students, as their responses to both the interview questions and TpB questionnaire confirm, 'bored' in a 'tedious' lesson. These emotional associations become the determinants of future intention.

The findings of this study suggest that conscientiousness (female students' desire to achieve and do well in ICT at GCSE) is the character trait most applicable to the female students. This increased conscientiousness of the female students towards study would seem at odds with their declared intentions to study, or not, ICT post 16 unless mediated by the control (and normative as discussed previously in this chapter) beliefs highlighted by TpB. Those scoring highly on measures of conscientiousness are thought to be: more organised, careful, dependable, self-disciplined and achievement oriented (McCrae & John, 1992). There is also evidence that they tend to adopt problem-focused rather than emotion-focused coping responses (Watson & Hubbard, 1996) and that they are less likely to use escape-avoidance strategies (O'Brien & Delongis, 1996). Thus, conscientiousness may result in a greater capacity to plan and so promote intention formation and behaviour. As found in this study, female students, despite their low comfort levels and 'boredom', are able to plan their work effectively in order to achieve academically in ICT. Coursework, the organisation and implementation of long pieces of work, drafted and redrafted to a deadline, is the antithesis of the competitive work male students prefer. That the female students choose behaviours that take them away from the further study of ICT beyond GCSE is consequently of even greater concern if these very attributes of conscientiousness and planning that would benefit the ICT, industry are going elsewhere (The European Commission, 2007, Turner, 2005).

5.2.13 Past Behaviour

Students were asked the question, 'During the past 2 Terms what percentage of meetings of this class have you attended?' The perceived attendance of the female students was significantly statistically higher than that of the male students: [χ^2 = 16.345; df = 4; ρ = 0.002], as can be seen in Figure 19.

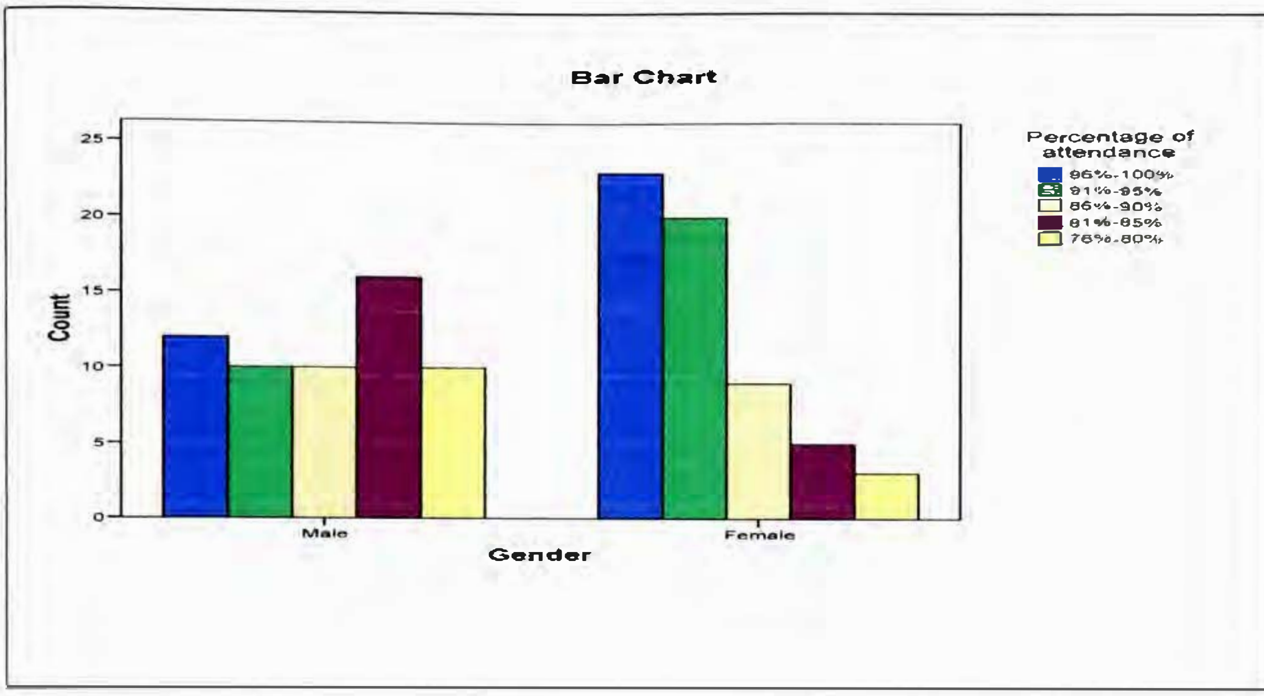

Figure 19: Item 11: My perception of attendance to ICT lessons

Superficially, female students' perceived positive attendance suggests a very positive attitude to the subject; however, past behaviour does not have the same status as the other predictors. Unlike attitude, subjective norm, perceived behavioural control and intention, frequency of past behaviour cannot be used to explain performance of later action (Ajzen & Fishbein 2005). In the context of this study, the female students' perception of their past behaviour that constitutes high attendance to ICT lessons, is not an indicator that they will continue to attend ICT lessons post 16 and beyond.

With repeated performance, behaviour can become a 'habit'. It is habit strength, rather than past performance frequency, that may influence later action (Verplanken et al., 1998). Consistently attending ICT lessons may be indicative of a strong habitual pattern of behaviour in that the female students habitually attend as many lessons in school as possible. The habitual element of their behaviour, therefore, does not relate to ICT but to attending lessons. The male students' lack of consistently attending ICT lessons can, alternatively, represent the habitual missing of lessons and have no negative bearing on their intent to study ICT post 16 and beyond.

From my experience, a parallel explanation can be offered regarding the responses female and male students gave to the question regarding past attendance. Female students' more diligent, rule governed behaviour towards school may lead them to, conscientiously, overestimate their lesson attendance whilst male students' 'self-satisfaction' and high ICT self-efficacy may lead them to under estimate, in a cavalier spirit, their attendance. They are conscious that their behaviour with regard to attendance is indicative of their perceived understanding of their relationship with school and its expectations.

Consciousness of behaviour influences the intention-behaviour relationship held between ICT students' attendance and non-attendance to ICT lessons because of its quality of mindfulness (Westen, 1999). Mindfulness describes a quality of consciousness characterised by clarity and vividness of current experience and functioning. It describes an enhanced attention to, and awareness of, present reality (Brown & Ryan, 2003). For female students this is the reality of their attitude to ICT within lessons. Attending the lessons may be a habit directed towards academic attainment, but one that is not consolidating an intent to study ICT further as, ironically, their very regular attendance hardens the negative attitudes towards ICT. Rather than being mindful of the reality of their repeated attendance to ICT, lessons the female students may instead be conscious of their lack of engagement in their ICT lessons and the hostility of their environment.

Regular attendance has less influence on the attitudes of the female students than their conscious state, which is not to study ICT post 16 and beyond. For the male student the obverse is true; poor attendance does not affect their mindful state to study ICT post 16 and beyond.

5.2.14 Intention

Intention is an indication of students' readiness to perform a given behaviour, in the case of this study the readiness to study ICT post 16 and beyond. Intention is considered to be the immediate antecedent of behaviour (See Figure 2). These intentions are based on attitudes toward the behaviour, the subjective norm and perceived behavioural control or self-efficacy. Each predictor is weighted for its importance in relation to the behaviour and population of interest (Ajzen, 2006).

There are three questions in The TpB Questionnaire that focus on students' Intentions: Items 15, 22 and 26 (See Appendix 1). The question with the most clear and specific locus of intent toward studying ICT post 16 was, 'I intend to study ICT in post 16... (Strongly Disagree/Strongly Agree)'. Female students' responses indicated that they have a strong disinclination to study ICT post 16 compared to their male peers, as conveyed visually in Figure 20: [χ^2 =23.004; df = 3; ρ= 0.000].

Male students 'strongly' agreed or agreed they intended to study ICT post 16 and beyond as opposed to female students who were statistically more likely to disagree 'strongly'. There is no dichotomy between this response and their responses to previous questions that acknowledge that further study of ICT at post 16 exists as a possibility and their positive responses to questions regarding work ethic and study.

ICT resources and opportunities at post 16 are available to female students and they have the ability to succeed in the subject.

When asked this question directly in the semi-structured interview questions, the students' responses concurred with the analysis of The TpB questionnaire. Only 1 female student, out of 13, stated she wanted to/intended to study ICT post 16, and 2 were considering it. This was in comparison to 8 of the 17 male students who replied positively, 'Yes' and 6 who responded, 'Possibly'.

What influences the intent, and eventual behaviour, of the female students, is largely their low self-efficacy and perceived behavioural control (Ajzen, 1991). Their responses, cited above, may suggest the female students have an emotional rather than intellectual response to ICT and its masculine 'club house' atmosphere. These responses demonstrate a similar rejection of notions of masculinity at odds with their perception of their own femininity as reported by Adams et al., (2005) in The European Social Fund (ESF) funded project, Women in IT (WINIT) – a project devoted to reporting back why women are under-represented in IT.

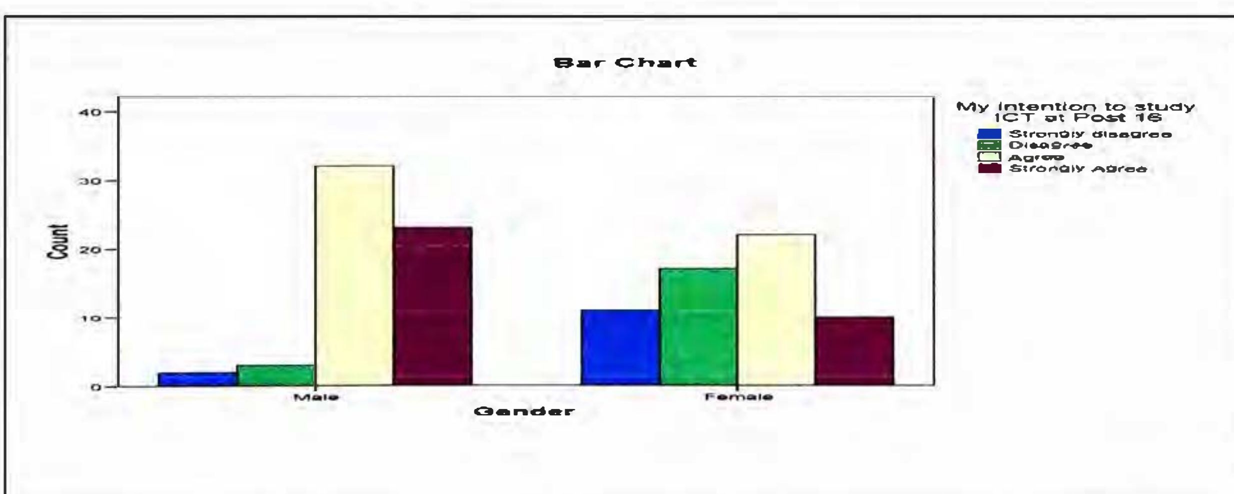

Figure 20: Item 26: I Intend to Study ICT in post 16

The female students' perceived behavioural controls that they will find studying ICT post 16 tedious, boring and difficult, leads to them having a weak intention towards the behaviour that is the focus of this study. This weak intention is further exacerbated by the female students in working towards the performance goals of academic achievement and the intent to do well academically rather than the goal to study ICT in the future (Sideridis & Padeliadu, 2001). This is the obverse of the goal attribution held by the male students who are likely to have stronger goals to study ICT and work in the ICT industry than to achieve well academically. Many female students have academic goals that are divorced from their attitudes to ICT and their intent to study ICT post 16. They may aspire to get the best grade possible in ICT and this can be labelled a goal, but have no further goal to succeed in the subject post 16.

The female students who responded that they wanted to please their normative referents have controlling intentions with regard to studying ICT post 16. A response that indicates students intend to study ICT because they want to and will not be influenced by referents is an autonomous intention (Chatzisarantis et al. 2007). In the case of this study, the male students' responses indicate a more autonomous intent to study ICT post 16 than their female peers do (See Figure 20). The female students' intentions are controlling intentions as they are influenced by external experiences and referents' views. These have a stronger influence than their success in the subject academically, which is therefore not a controlling intention. Their academic success may actually lead to referents suggesting the study of ICT Post 16 and beyond but this may not affect the female students' intentions. They do not have associations, beliefs or attitudes that are satisfying and, despite referents' suggestions that they do so, the intention to study ICT post 16 does not become an intrinsic, autonomous belief (Brickell et al., 2006).

To summarise this section of the chapter, the analysis of the responses to The TpB questions discussed above confirm that there are gender differences in behavioural, normative and control beliefs in the intent to study ICT post 16 and beyond as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980). These gender differences in behavioural intent mirror the gender patterns and female/male segregation that dominate the traditionally male world of the ICT Industry (Grid Talk, 2009, Lagesen et al., 2005, Sanz, 2005, Vehviläinen & Brunila, 2005, Gender in Technology, 2001).

5.3 Attainment: Gender Differentials

The issue of prior attainment raised in the first research sub question is addressed in this section as to whether there are gender differences in ICT students' attainment and what impact this has on their intent to study ICT post 16 and beyond.

At the beginning of The TpB questionnaire, the Key Stage 4 students were asked to give their end of Key Stage 3 ICT National Curriculum Level. These were analysed using the Mann-Whitney U Test in order to ascertain the differences between two independent groups on a continuous measure, in the case of this study the female and male students. This test is the non-parametric alternative to the t-test for independent samples. The Mann-Whitney U Test evaluates whether the ranks for two groups differ, giving the value of the Z- approximation test, which includes a correction of ties for the data. The result is of statistical significance if the probability value is less than or equal to .05 (Pallant, 2005).

The results found after applying The Mann-Whitney U Test were in line with national trends (Ofsted, 2009, The Daily Telegraph, 2007, The Times, 2006). There was a statistically significant difference between the performance of female and male students with the female students gaining higher results. The Z value of -3.793 with a significance level of $p \cong 0.000$ demonstrates that the probability value (p) is less than .05 so the result is statistically significant. This indicates that the female students in this sample out performed their male peers in ICT at Key Stage 3. The attitudes of female students, who participated in this study, with regard to their intention to study ICT post 16, however, do not reflect this out-performance of male students.

The Key Stage 5, A' Level students who participated in this study were asked to indicate their prior attainment at Key Stage 4 GCSE or equivalent vocational award as shown in Figure 21. Pearson's Chi Square Test was used to analyse this comparative data in order to ascertain the differing statistical significance of gendered student responses and to establish whether there was statistically significant differences in their academic achievement prior to opting to study ICT at post 16. There was a significant difference in Key Stage 4 results: [χ^2 =1.0818; df = 3; ρ= 0.009]. The female students in the Key Stage 5 classes who participated in this study have generally higher GCSE or equivalent grades than their male peers in the same classes. They did not, however, have more positive attitudes to the intent to study ICT beyond Key Stage 5.

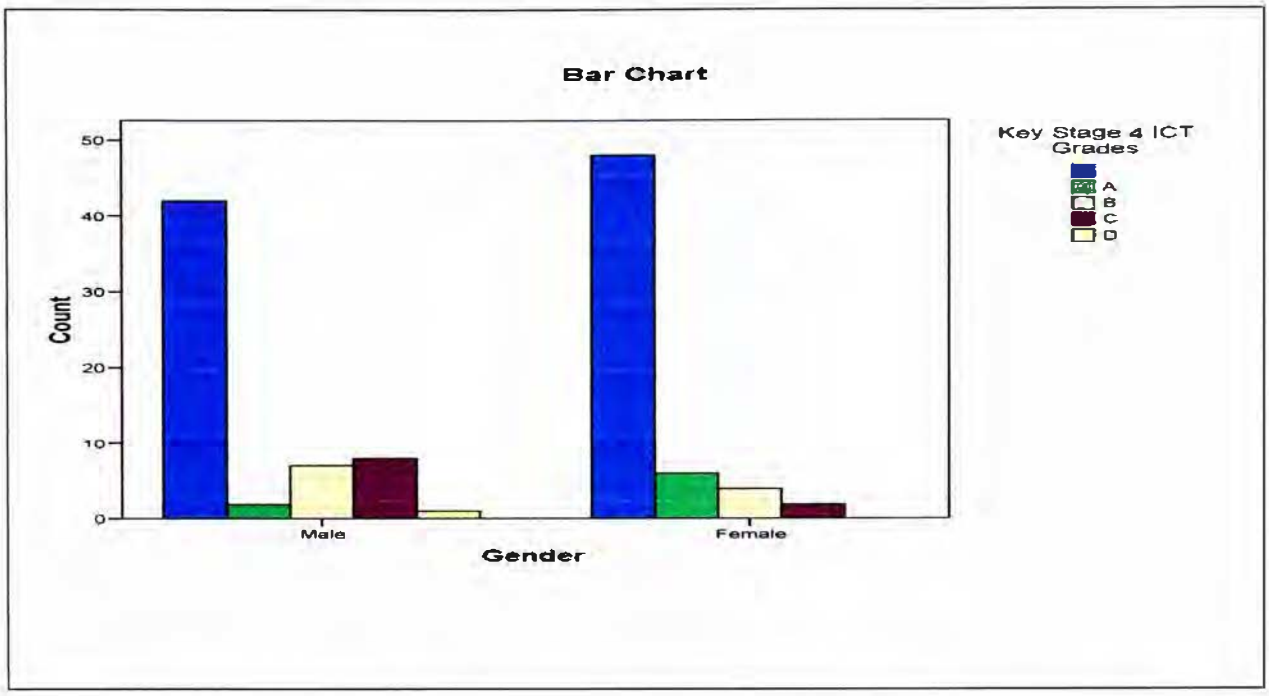

Figure 21: Key Stage 4 ICT Grades

Nationally, despite outperforming male students at Key Stage 4, a low and declining number of female students choose ICT or computing at Advanced level (Ofsted, 2009). My experience of teaching in the Academy and observing Key Stage 5 ICT lessons in many schools across the South East of England verifies Ofsted's findings that more male students than female opt to study ICT at Key Stage 5.

There is a dichotomy between female students' attitudes to ICT and their academic achievement. This could be exacerbated by the strategies, discussed at length later in this study, necessitated to circumvent the 'problem' of male underachievement (Younger & Warrington, 2006). These strategies include teaching styles, subject matter and classroom organisation that best suits male students' work style preferences and alienate their female peers, leading to their lack of participation in the further study of ICT post 16 and beyond. This lack of participation leads to the 'leaky pipeline' in the ICT Industry (Gras-Velazquez et al., 2009, Grid Talk, 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).

5.4 Learning Styles/Group work

The first issue raised in the second research sub question is addressed in this section: How do female students' learning styles impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Grid Talk, 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).

Female and male students have been found to negotiate their identity as learners and their preferences as learners from subject to subject. Constitutionally based and learning approach theories of learning 'styles' suggest that students' learning style preferences can be fluid and may differ from subject to subject, with contextual influences (Coffield et al., 2004). For instance the social context of their peer group, family culture and complex relational classroom dynamics impact upon what are appropriate and 'safe' preferences for learning (Skelton, 2001). The 120 students who participated in this research study were asked to identify their preferred learning style. Spearman's Rank Order Correlation (rho) was used to ascertain the strength of the relationship between gender and learning style preference in order to calculate the strength of the relationship between the two continuous variables. This is the non-parametric alternative to Pearson's product – moment correlation.

The students identified on the questionnaire if they preferred:

- Observation and note taking (Visual Learners);
- Hearing, discussion and listening (Auditory learners);

- Practical work (Kinaesthetic learners) or Touching;
- Working silently on the computer (Tactile learners)

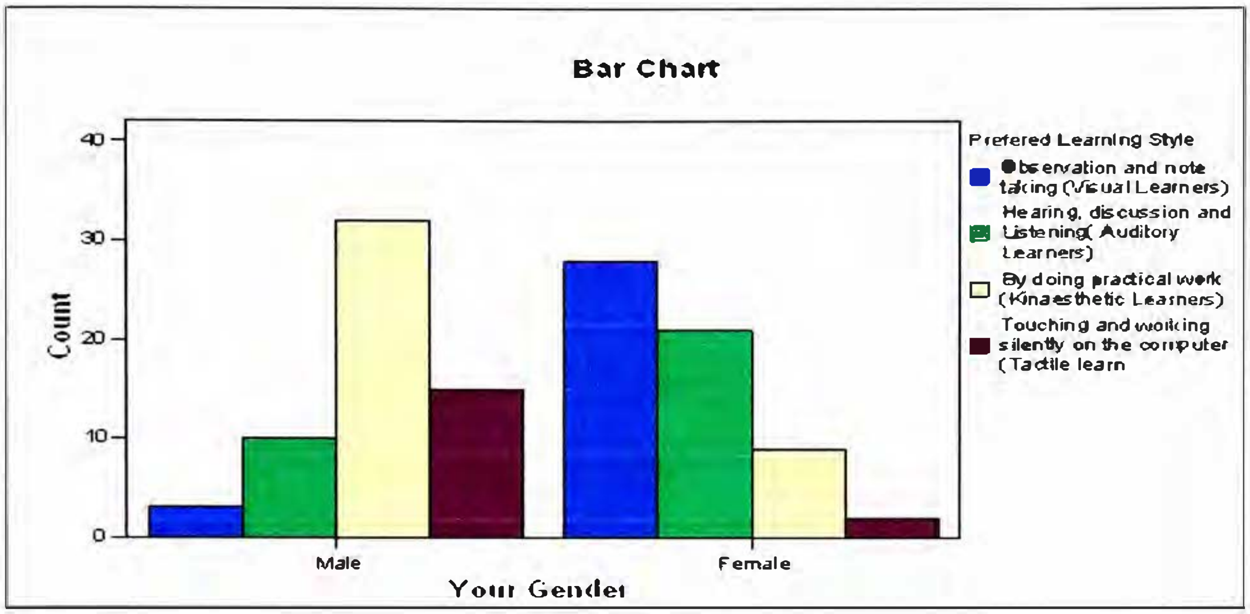

Figure 22: Learning Style Preferences

Figure 22 shows that female and male students had differing responses to the questions regarding work/study/learning style preferences. There are differences between the female and male students' preferred learning styles as verifed by The Spearman's rank order test. Female students have a statistically significant preference for Observation and note taking (Visual Learning) and Hearing, discussion and listening (Auditory learning). Male students prefer Practical work (Kinaesthetic Learning and Touching) and working silently on the computer (Tactile learning). The output Spearman's rank order correlation of - 0.607 shows that there in an inverse relationship between female students' learning preference and their male peers.

Similar preferences were articulated by the students when they were asked, 'How do you most like to work?' The female students usually mentioned some form of collaboration – whether group work, in pairs or with friends. Almost half of the male students indicated they liked working with or 'next to' friends, but their most consistent response was that they enjoyed working on the computer itself, rather than any other method.

The female students' preference can be categorised according to previous research studies. According to Reichmann and Grasha (1974), the female students who participated in this study are 'collaborative' as opposed to 'competitive' learners. The female students therefore prefer sharing activities, interaction and group work as opposed to self-centred, self interested work and game playing (Riding & Rayner, 2005). Whilst describing similar characteristics of the female students' learning preferences Dunn and Dunn's Learning Style Inventory (LSI) (1974) would describe them as preferring learning in Sociological Learning Groups (Coffield et al., 2004). This is corroborated by a comparative study using the LSI carried out by De Paula & Hlawaty (2002). They found that learning-style preferences of Brazilian and German students differed according to gender. Both Brazilian and German female students tended to not only exhibit more characteristics of responsibility/conformity (the desire to please as found by the TpB analysis of female student responses to control belief questions in this study) but also a stronger preference for learning in various sociological environments than males who preferred kinaesthetic learning.

In my role as an ICT Post Graduate Certificate of Education (PGCE) educator, I have observed many ICT student teachers teach across the South East of England in various school contexts. I have very often observed that in those lessons where teachers play to the strengths of the male students, with an emphasis on individual, competitive work - usually working silently on the computer - and kinaesthetic learning, fewer female students are engaged. Frequently observed activities are: copying demonstrations, making models, highlighting and copying key points. There is very little teacher instruction and there is rarely interaction or collaboration. Teacher intervention is usually one to one. This support is predominantly given to the male students who demand more teacher time and are more often off task, game playing. Francis & Skelton (2005) also observed that female students often have to wait their 'turn' to ask the teacher a specific question but as they are 'getting on' well, remaining on task, the attention they receive is often minimal. Female students may react to this is a number of ways, from my observations. They may be frustrated and hence articulate a negativity with regard to the subject, passively accept the situation or slip into a model of acceptance that acknowledges the male students' attitudes in a 'mothering' stance that 'allows' the male students to dominate.

This teaching style and classroom discourse is at odds with the female participants' learning style preferences in ICT analysed in this study (See Figure 22). Female students enjoy listening to others as well as eagerly joining in themselves, preferring and benefitting more from working together (Christie, 2002). The data analysed in this study confirms that a higher percentage of female students prefer auditory learning in ICT lessons than their male peers. Their preference for interaction also influences gender differences in an on-line learning environment. Whereas men send both longer and more frequent messages than women do, women's work is more interactive, referring to other contributors, communicating and creating dialogue (Christie, 2002, Barrett & Lally, 1999).

Working together is unavoidable in many schools because there are not enough computers for individual work (Gurian, 2002). Although there are also social and cognitive benefits of working together, male students frequently dominate the learning space by ensuring they have commandeered the available computers so that even though female students work in pairs this arrangement has been an opportunity to reinforce male dominance and competitiveness.

Female students are alienated when the use of computers is coupled with competitive or even individual tasks. They do not have opportunities to use group work as a means of interaction within their ICT classroom. Quite often, they are compelled to learn in an environment, which is the antithesis of their preferred learning styles. An environment where the academic discourse is normally dominated by the, usually, male teacher (Cox, 2003) and where 'traditional' learning takes place in a competitive not discursive atmosphere (Barnes & Todd, 1977, 1995, Edwards & Westgate, 1994, Edwards & Mercer, 1987, Edwards & Furlong, 1978).

If their learning environment is constructed in a style that is preferred by male students, it does not allow female students to escape from well established, male-orientated gender norms. Female students, therefore, develop attitudes towards the subject that will ultimately lead to a lack of intent to study ICT post 16 and beyond. This lack of intent belies their previously discussed academic achievement. Instead, their attitudes to the subject and their low ICT self-efficacy leads to the male student predominance in A' Level courses and beyond that culminates in the 'pipe line shrinkage' that is of such concern to the ICT industry (Vehviläinen & Brunila, 2005).

The ICT industry recognises that powerful leadership requires participative decision making skills, a characteristically female behaviour and preferred working style, rather than individualistic, independent decision making which is a preferred male working style (Desvaux & Devillard, 2009). Teachers must recognise the importance of their teaching styles in order to ensure that all students are able to benefit by the attitudes and beliefs created in ICT classrooms. This is paramount if schools are going to establish learning environments from which female students will go on to work within the ICT industry; an industry that increasingly acknowledges it needs the skills women bring to that industry if it is to succeed in the 21st Century.

5.5 Students' perception of ICT

The second issue raised in the second research sub question is addressed in this section: How do female students' associations with ICT impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Grid Talk, 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).

The Students' Perception of ICT question was based on simple word association and asked students to indicate what 'came to mind' when they heard the term ICT from a list of possible associations. The words selected to use in the question were derived from an open question asked in the pilot study. The students involved, an equal number of female and male students, were asked to list the first five associations they had with ICT. The most popular choices, from both genders, were incorporated into the Section 2, Background Information, 'What ICT Mean to You' question.

Pearson's Chi Square Test was applied in order to establish if there were any significant differences between the associations/perceptions of female and male students to the extent that: the relationship is strong, the sample size is large and/or the number of values of the two associated variables is large. A chi-square probability of 0.05 or less is commonly interpreted by social scientists as justification for rejecting the null hypothesis suggesting that the raw variable is unrelated (that is, only randomly related) to the column variable (Pallant, 2005). In this case the test indicated a statistically significant difference between the views of female and male students [$\chi^2 = 14.189$; df = 7; $p = 0.046$].

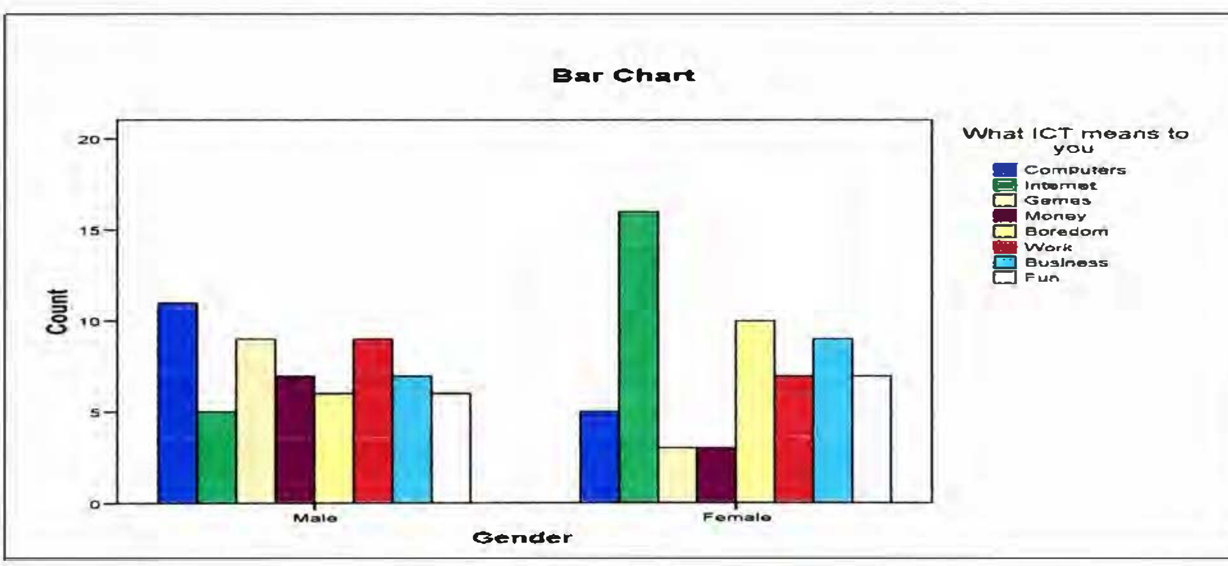

Figure 23: Students' perception of ICT

Figure 23 shows the results when the most common responses were analysed. Marked gender differences are apparent. Male students are more likely to associate ICT with computers, games and work, whilst female students, in line with earlier research, predominantly make the association with use of the internet and communicating – particularly social networking sites such as Facebook, Bebo and Web 2.0 technologies (Luckin et al., 2008, Christie, 2002).

These associations were supported by the analysis of the semi-structured interview responses when students were asked what words came to mind when they thought of ICT. Female students most frequently referred to social networking and male students playing games. They rarely mentioned additional associations but when they did so female students referred to shopping or using the internet, whilst male students referred to using the ICT for business or work.

Using Web 2.0 technologies in lessons could enhance female students' motivation, making their learning more effective and reflective. They particularly value the opportunity to reach a consensus or at least discussion based conclusions (Schmitz & Messmer, 2005) that mirror the friendship networks they establish on social networking sites. There are a number of Web 2.0 technology based activities that ICT teachers can introduce into lessons, such as online discussions, contributing to wikis and podcasting. These activities/resources can be used to supplement any collaborative or presentational topic.

Online discussions that begin in ICT classrooms can go beyond the boundaries of the school timetable and engage students wherever they are, as long as they have internet access. For instance, my PGCE ICT students participated in an Online discussion day of research, collaboration and reflection that did not necessitate them coming into the University. They were given specific topics and the brief that the day had to include specific points of collaboration alongside the research activities and personal reflection. The day was successful and all students participated. This case study can be replicated by ICT Teachers through homework and revision tasks as well as in 'virtual' clubs and out of hours activities. Contributing to wikis could be part of the online collaborative brief, or a classroom activity. Again, students working together on wikis can be a task that goes beyond the confines of the classroom and moves away from any associations that students, of either gender, may hold about working with ICT.

Many students are excited by podcasting as a learning tool in its flexibility that goes beyond that of online discussions and adding to wikis. Students take their i-pods or MP3 players with them everywhere and therefore their ICT work ceases to have many of the traditional associations with competitive learning in front of a screen. The collaborative nature of podcasting is part of it appeal to many students; work can be shared with a wide audience and groups of students can contribute to creating podcasts.

These help to create a non-threatening, non-competitive learning environment that can be a comfortable environment for female students to achieve learning objectives quickly. They are allowed to share in and practice forms of academic discourse in the classroom normally dominated by the teacher: sharing, comparing, contrasting and arguing from different perspectives; providing opportunities for 'instructional conversation' or the 'shared construction or negotiation of meaning' that have been cited as a positive class room environment for two decades (Edwards & Mercer, 1987).

Female students positively see ICT as more business orientated than their male peers, but they also have a much stronger association with boredom. Pearson's Chi Square Test was applied in order to establish significance between the views of female and male students to the extent that: the relationship is strong, the sample size is large and/or the number of values of the two associated variables is large. A chi-square probability of .05 or less is commonly interpreted by social scientists as justification for rejecting the null hypothesis suggesting that the row variable is unrelated (that is, only randomly related) to the column variable (Pallant,2005). In this case the test indicated a statistically significant difference between the views of female and male students [χ^2 =14.189; df =7; ρ=.046]. This data confirms the second sub research question that there are gender differences in ICT associations that may affect the behaviour of female ICT students who have opted not to continue the subject post 16 or beyond. These views and associations are the antecedents of attitudes, subjective norms and perceived behavioural controls and therefore antecedent to what will determine intentions and actions (Ajzen, 1991). The associations female students make with ICT as 'boring' reflects their hesitation to enter a world of further study and work that neither engages their interest nor supports their preferred ways of working (Ali, 2001,Margolis et al., 2000).

5.6 The Theory of Planned Behaviour Questions: Comparative Theory of Planned Behaviour responses from Female Students in Single Gender and Mixed Gender Schools

This section of Chapter 5, addresses the third sub research question:

- How do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

There is some evidence that single gender education for female students does begin to counter traditional stereotyping when selecting GCSE options in some subjects (NFER, 2002). A comparison of female students in mixed and single gender schools who participated in this research, found, however, few statistically significant differences between the outcome evaluations, control and normative beliefs or intentions of female students to study ICT post 16 and beyond. As found in earlier research studies gender, rather than school type, accounts for greater attitudinal differences (Colley et al, 1994).

The Kruskal-Wallis Test was used as a non-parametric alternative to a one-way between-groups analysis of variance in order to ascertain whether there were differences in female students' attitudes between school contexts. Scores are converted to ranks and the mean rank for each group is compared. On completion of the test if the significance level is a value less than 0.05 it can be concluded that, there is a statistically significant difference in the continuous variable across the comparison groups (Pallant, 2005).

5.6.1 Outcome Evaluations

From the 10 TpB questions that specifically measured Outcome Evaluations, The Kruskal-Wallis Test demonstrated no statistically significant differences between the attitudes of female students in the single gender students' school or the mixed schools in seven Items: 3, 5, 6, 7, 8, 9 and 10 (See Appendix 1). Attitudes to studying (Items 3, 5, 6 and 8), missing activities out of class and boredom in class (Items 7 and 9) did not differ for female students between the single gender and mixed schools. The Kruskal-Wallis Test, however, did demonstrate that the female students in the single gender school were found to have more negative outcome expectations to studying ICT in comparison to their female peers in the mixed schools in response to three questions (See Table 8). Female students in the single gender mixed school had less positive responses to the following items: 'How good gaining a better understanding of studying ICT' would be, 'How good gaining a high grade in ICT' would be' and, 'How bad missing being with my friends in the same class' would be.

Table 8: Statistically Significant Outcome Evaluations

Item	The Mixed School Mean Rank	The Single Sex School Mean Rank	χ^2	df	p
1.Gaining a better understanding of subject matter	39.90	25.80	9.868	1	0.002
2. Gaining a high ICT grade	40.78	24.47	13.131	1	0.000
4. Missing my friends in the same class	37.70	26.90	5.659	1	0.017

These results show that the female students in the mixed school had more positive attitudes to ICT than their peers in the single gender school. Although there is no consensus in research regarding the benefits of single gender education some studies have concluded that single gender classes for female students may promote stereotypical attitudes in female students and in some contexts less may be expected academically of female students in single gender classes (Sanders, 2006). It is suggested that female students are 'tamed and depoliticised' (Kenway & Willis, 1998) unless structures are in place that specifically scaffold aspirational, gender free social goals for female students (Stormquist, 2007). For the purposes of this study, this goal would be scaffolding female participation in studying ICT post 16 and beyond.

Whilst aggressively competitive teaching may take place in single gender schools for male students, teachers can tend to patronise female students in female students' schools. Consequently, the teaching and learning styles in female single gender schools may lead to their academic activities being less challenging in stereotypically 'male' subjects in particular (Lee and Lockheed, 1998) despite them being statistically more likely academically to achieve higher Levels or Grades in those subjects than their male peers (Ofsted, 2009, The Daily Telegraph, 2007).

5.6.2 Intentions

From the three TpB questions that specifically measured Intentions, The Kruskal-Wallis Test demonstrated no statistically significant differences between the intentions of female students in the single gender female students' school or mixed schools in only one instance Item: 26, 'I intend to study ICT'. The Kruskal-Wallis Test, however, demonstrated that the female students in the single gender school were found to have a more negative intention towards studying ICT post 16 in one response in comparison to the female participants in the mixed schools: 'I plan to study ICT beyond the post 16 level'. The obverse response, however, was made to the question 'I will make an effort to study ICT beyond the post 16 level.' The response to this question was more positive from the female students in the single sex school (See Table 9).

Table 9: Statistically Significant Intention to Studying ICT

Item	The Mixed School Mean Rank	The Single Sex School Mean Rank	χ^2	df	P
15. Likelihood of planning to study ICT at post 16	39.90	25.80	9.488	1	0.002
22. The effort to study ICT at post 16	20.95	34.30	8.610	1	0.003

In some cases, the female students in the single gender school hold attitudinal responses that suggest they believe studying ICT post 16 is more difficult, and both less likely and less positive than their female contemporaries in mixed schools. That the female students in the single gender school would be prepared to make more 'effort' to study ICT post 16, however, suggests that single sex groupings do benefit the academic achievements of female students if not necessarily, ultimately, in stereotypically 'male' subjects (Stromquist, 2007).

5.6.3 Normative Beliefs and the Motivation to Comply

The combination of motivation to comply and normative beliefs culminate in subjective norms (Stiff & Mongeau, 2003). Behaviours are more likely – in this study the likely behaviour to study ICT post 16 and beyond - if they are consistent with attitudes and if the normative climate supports those attitudes (Fekadu & Kraft, 2002). In a comparison of the normative beliefs and motivation to comply between the female students in the single gender school and in the mixed schools, only two of the TpB questions elicited statistically significant differences in mean scores: 'Generally speaking, how much you care what your teacher thinks you should do?'

and 'Generally speaking, how much you care what your close friends think you should do?' (See Table 10).

Table 10: Statistically Significant Attitudes to the Motivation to Comply

Item	The Mixed School Mean Rank	The Single Sex School Mean Rank	χ^2	df	p
27. Generally speaking, how much you care what your teacher thinks you should do?	42.18	22.83	18.586	1	0.000
29. Generally speaking, how much you care what your close friends think you should do?	39.25	26.13	8.545	1	0.003

The female ICT students in the mixed schools cared more about their teachers' opinion than their peers in the single gender school. As discussed previously the female students' desire to please their teachers was coupled with a belief that their teacher did not think they should study ICT post 16 and beyond. Consequently, the finding that the female students in the single gender school cared less about the opinion of their teacher is an ambiguous result with regard to their attitude to studying ICT post 16.

The female students in the single gender school, however, cared more what their close friends thought they should do. What is important with regard to this response is what do the female students in the single gender school perceive to be the opinions of their close friends with regard to ICT study beyond Key Stage 4? If they believe (as do their peers in mixed schools) that their close friends feel they should not study ICT post 16 and beyond, then it likely they will be further encouraged not to do so. Peer attitudes can have more impact on reinforcing gendered attitudes than teachers or the curriculum (Stromquist, 2007).

Once again, these responses reinforce the assertion that single gender classrooms are not the straightforward answer to eliminating gender stereotyping from the curriculum, Higher Education and the ICT industry (Sanders, 2005).

5.6.4 Control Beliefs and the Power of Control Factors

From the fourteen TpB questions that specifically measured control beliefs and the power of control factors in this study, The Kruskal-Wallis Test demonstrated no statistically significant differences between the attitudes of female students in the single gender school or mixed schools in eight Items: 41, 43, 44, 46, 47, 49, 50 and 51, (See Appendix 1). The beliefs of female students that they would be distracted and distanced from ICT study by part time work, other courses, falling behind or tiredness did not statistically differ between the single gender or mixed schools. The Kruskal-Wallis Test, however, did demonstrate that the female students in the single gender school were found to have statistically significant different negative attitudes to studying ICT post 16 in response to the question: 'If I had family obligations that placed unanticipated demands on my time, it would make it more difficult for me to study ICT beyond post 16'. The mean rank for female students taught in the single gender school responding that they 'Strongly Agree' was 35.12 in contrast to the female students taught in the mixed school whose mean rank was 21.20. The p value of 0 .002 is less than 0.05 and consequently there is no null hypothesis. This response suggests that, again, female students' attitudes to ICT in the single gender school were less positive than their peers in the mixed schools.

Teaching female students in single gender schools will only challenge stereotypical attitudes if the school designs practices and establishes a culture that is pro-actively responsive to gender equity to support female students to develop academic attitudes and aspirations that are less stereotypical of family and professional life (Jackson, 2002). The effect of single gender schools depends on how these schools are organised and how teachers are prepared to foster non-sexist environments (Stromquist, 2007). There can be no presumption that a single gender context will lead to beliefs free from sexist bias, beliefs and attitudes although this study did find, when the locus of intent was not on ICT, that female students in the single sex school did have some attitudes that were less stereotypical than their peers in mixed schools

Table 11 shows the control beliefs that were responded to more positively by female students in the single gender school in their responses to two questions: 'How often do you encounter unanticipated events that place demands on your time?' and 'How often do you fail to do the assignments of this course on time?'

Table 11: Statistically Significant Attitudes to Control Beliefs

Item	The Mixed School Mean Rank	The Single Sex School Mean Rank	χ^2	df	p
40. How often do you encounter unanticipated events that place demands on your time	23.20	34.15	6.155	1	0.013
45. How often do you fail to do the assignments of this course on time	20.53	35.49	11.018	1	0.001
42. How often do family obligations place unanticipated demands on your time	38.70	26.40	7.326	1	0.007
43. How often does work or employment place unanticipated demands on your time?	38.85	26.33	7.732	1	0.005

These questions, however, do not refer to ICT as the locus of intent. Item 45 refers to 'this course' but is referring to assignment completion rather than to ICT itself. These questions explore control beliefs regarding external factors that could affect any aspect of school life. In all the four Items in figure 11 it can be seen that the value of $p <$ than 0.05. A $\rho = < 0.05$ implies that there is a statistical difference in Attitudes to Control Beliefs of students in The Mixed School and The Single Sex School and that the difference has not occurred by chance. The female ICT students taught in the single gender environment demonstrated that they are sometimes more confident in their ability to control their time autonomously from external control factors (Younger et al., 2002) than their peers in mixed schools.

From frequent visits to a great number of both single and mixed gender schools in the South East of England, I perceive that the differing role models held in the disparate school contexts could account for these, sometimes, more liberating, attitudes. In mixed gender schools, welfare and pastoral roles are likely to be held by female staff, who will still predominate in traditional, stereotypically female subject areas: English, Food Technology, Dance and Textiles. These areas are suggestive of talk, domesticity, family and nurture. Whilst these roles are unlikely to be held by male teachers in female single gender schools, these school contexts frequently differ in that female teachers will hold disparate roles. Consequently, female students in single gender schools will have associations with female role models that go beyond that of nurture. These include female staff in charge of traditionally male dominated subject areas such as Maths and ICT, as well as women in charge of behaviour, timetabling, sport and site management. The importance of role models is acknowledged as pertinent in beginning to stop the attrition of women from the ICT and other traditionally male dominated careers. Joan Steitz (2006), in a paper for The Agora For Women In Science Commitment Charter concludes:

> We cannot expect to capture the interest and talents of girls and women for the scientific enterprise unless they can view their own participation as possible... Although there are fields where the numbers of undergraduate and graduate women are equivalent to those of men, a leaky pipeline robs us of their full participation. Our challenge now is to devise more effective practices in our Universities and other research venues for capturing and advancing women in the scientific hierarchy
>
> (Steitz, 2006:1).

Additionally, the importance of role models have been the subject of a large scale European research study, 'Women and ICT: Why women and girls are not attracted to ICT studies'. The researchers found that 52% of the respondents cited their biggest influence with regard to career choice to be female role models, whether in school or at home (Gras-Velazquez et al., 2009).

In mixed schools whilst female students gain strength through their group solidarity, they nevertheless remain the, often unconscious, victims of male students' language and they appear to accept the male construction of femininity (Davies, 2003) in their acceptance of external demands on their time. That female students in single gender schools are less bound by the abstract determiners of 'unanticipated events' or failing to complete assignments is therefore a tangible benefit of single gender education for female students, although this comparative mental freedom does not influence concrete demands on their time or attitudinal responses to studying ICT post 16.

As shown in Table 11 in response to the questions: 'How often do family obligations place unanticipated demands on your time?' and 'How often does work or employment place unanticipated demands on your time?' the female students in the mixed schools responded more independently than their peers in the single gender school. These control belief questions, however, are more concrete than the questions regarding 'unanticipated events' and completing assignments that the female students in the single gender school imply they are more confident in controlling. 'Family obligations' and 'employment' are specific demands that the female students in the single sex school felt would be more distracting than their peers in the mixed schools.

5.6.5 Perceived Behavioural Control

From the six questions that specifically measured perceived behavioural control, The Kruskal-Wallis Test demonstrated no statistically significant differences between the intentions of female students in the single gender female students' school or mixed schools in two Items: 19 and 23 (See Appendix 1). The female students in the single gender school were found to have more negative intentions to studying ICT post 16 in comparison to the female participants in the mixed schools in response to three questions: 'For me to study ICT in post 16 is... (Extremely Difficult/Extremely Easy', 'For me to study ICT is... (Extremely Bad/Extremely Good)' and 'I plan to study ICT at post 16 (Extremely Likely/Extremely Unlikely)'... In only one question, 'I will make an effort to study ICT beyond post 16... (Definitely will/Definitely will not) was there a statistically significant more positive result from the female students in the single gender school (See Table 12).

Table 12: Statistically Significant Perceived Behavioural Control to Studying ICT

Item	The Mixed School Mean Rank	The Single Sex School Mean Rank	χ^2	df	P
12.The Ease of studying ICT at post 16	37.98	26.76	6.179	1	0.013
14. How good would studying ICT at post 16 would be	39.50	26.00	8.841	1	0.003
15. I plan to study ICT beyond post 16	39.90	25.80	9.488	1	0.002
22. The effort to study ICT at post 16	20.95	34.30	8.610	1	0.003

From my observations in many mixed gender ICT classrooms, I would suggest the more positive attitudes demonstrated by the female students in the mixed schools, may be due to the actual experience female students have of working with male students in class, that their female peers in single sex groupings can only imagine.

Female students who participated in the semi-structured interviews were ambivalent in response to the question, 'Would you prefer to work in a mixed or single gender class?' Only 23% of the female students, 3 out of 13 responses, replied that they unreservedly would prefer to be taught in a single gender group whilst 9 of the 13 female students responded with less clarity. They all acknowledged that they felt the male students were in some way a distraction in lessons and held up the pace of learning. At the same time they all concurred that they enjoyed being taught with their male peers and that, without them, the lessons would not be so much 'fun'.

The imaginary 'clubhouse' of the male ICT classroom may be even more daunting and 'geeky' to female students in single sex schools, than the reality for female students in mixed schools. They are aware of their male peers' lack of ability, need for organisation and diversionary tactics that may be 'tedious' but less off putting than the male students imagined by their female peers in the single gender schools who see them as personifying 'nerd' culture (Margolis et al., 2000).

Negativity with regard to studying ICT in single gender classes is corroborated by earlier research. Volman (1990) found that female students taught in single gender classes were more likely to hold stereotypical attitudes towards ICT and perceive it as a 'male' subject. Similarly, Hughes et al. (1988) found that all-female groups performed computer tasks less well than in mixed gender groups because of female students' lower confidence levels. That the female students in the single gender school would be prepared to make more 'effort' to study ICT post 16, however, suggests that single sex groupings can benefit the academic achievements of female students although not necessarily in stereotypically 'male' subjects (Stromquist, 2007).

5.6.6 Direct Measures of Perceived Behavioural Control

As demonstrated in Table 13, only two of the TpB items measuring perceived behavioural control had statistically significant mean ranks and in both cases, once again, the students in the single gender school felt less positive regarding post 16 study of ICT. They presumed that not only would, 'People who are important to me' wish them not to study ICT but that they would have less autonomy to do so, 'Whether or not I study ICT beyond post 16 would be completely up to me'.

Table 13: Statistically Significant Perceived Behavioural Controls

Item	The Mixed School Mean Rank	The Single Sex School Mean Rank	χ^2	df	*P*
13.Most people who are important to me think that I should study ICT	46.38	22.56	27.71	1	0.000
16. Whether or not I study ICT post 16 is completely up to me	37.25	27.13	5.154	1	0.023

These attitudes suggest that the single gender school female students' antipathy towards studying ICT post 16 is rooted in beliefs determined beyond the secondary school classroom - rooted initially in their family's attitudes and consequently their up-bringing (Archer, 2004). Parents may well have, however subliminally, supported negative attitudes to technology in their own attitudes to technology and their choice of toys, computer games and books (Gras-Velazquez et al., 2009, Mitchell, 2005, Tenenbaum & Leaper, 2003).

Additionally, whilst female students may attend single gender secondary schools they will, in all likelihood, have attended mixed primary schools where the development of boy-oriented curriculum materials may have been a focus. The recent tendency to exemplify issues through these teaching approaches has dominated many classrooms (Martino & Meyenn, 2002). Therefore, promoting technology to engage male students across the curriculum has perpetuated narrowly defined masculine norms to the exclusion of females and schools have further entrenched inequity at the same time that they are attempting to redress it (Wallace, 2006). Female students leave primary school with their attitudes towards ICT further distilled by the 'boy-friendly' teaching models their, usually, female teachers, have relied upon. Those teachers may also have imbibed negative attitudes and beliefs from their prior experiences with regard to ICT (Cox, 2003) and not served as enthusiastic role models (Gras-Velazquez et al., 2009). The impact of positive role models can be exemplified by primary education in Malaysia where ICT is not perceived as a 'male' subject area. ICT participation from primary school is proactively taught as an educational norm by teachers and supported by parents. This has led to consistent equality of participation in ICT at university level for the last 20 years (Lagesen et al, 2005).

Single gender education can play a positive role in supporting achievement for either sex if designed with explicit gender transformational objectives (Stromquist, 2007). This means that preconditions have to be met and a conducive classroom environment established in which students are able to take opportunities to talk more openly about issues, exchange views without fear of embarrassment or of undermining their own image (Younger & Warrington, 2006.) As exemplified in this research, rather than challenge issues in less pressurised environments, single gender classrooms can perpetuate stereotypical attitudes to ICT if those attitudes are neither acknowledged nor challenged. Teachers should challenge these stereotypical responses to ICT (Sukhnandan et al., 2000) to enable female students to develop confidence in their own abilities and judgments in environments for learning that do acknowledge and confront the negative attitudes to ICT.

The analysis in this section of Chapter 5 has further addressed the third sub research question: Do female students in single and mixed gender schools differ in their behavioural, normative and control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)? The answer to this question is not equivocal, but this research study has found some evidence that female students in the mixed schools felt more positive towards studying ICT post 16 than their peers in the single gender school.

This reinforces the evidence that claims that single gender schools, particularly female students' schools, are not always effective in combating all elements of gender stereotyping (Sanders, 2006, Smithers & Robinson, 2006, Spielhofer et al., 2002). For example, the proportion of female students studying A' Level Physics has increased in the last fifty years when schooling switched primarily from single-sex to co-educational; selective to comprehensive. Over this period the number of single gender female students' schools fell from 1,380 to 226, while the proportion of A' Level Physics entries from female students increased by over half (from 14% to 23%). Whilst this rise can be attributed to many additional factors, it cannot be claimed that any higher proportion of female students studying the sciences in single gender schools is necessarily due to their being in a single gender school (Smithers & Robinson, 2006). Within all subject areas that have been traditionally male dominated, teachers must ask themselves how to bridge gender divides.

When given the opportunity to reflect on their own practice and pedagogy teachers may be surprised by the gendered tendencies emergent. All teachers should be able to consider their gendered beliefs and expectations in order to challenge them internally or at the very least minimise their effects on students (Francis, 2006, Cox, 2003). The gender of the teacher can have a negative impact on gender progress in ICT, if it is perceived that male teachers are *a priori* guilty and female teachers innocent. Female teachers are not exempt from concerns about gender bias because of their femaleness. Men and women are equally capable of gender bias and consequently the gender imbalance continues (Saunders, 2005). Teacher-based dynamics such as teacher attitudes and expectations and their interactions with students in the classroom, evince different patterns toward female and male students, generally to the disadvantage of the female. This dynamic could in part be an explanation for the negative attitudes female students in the single gender school hold towards ICT.

5. 7 Teacher Gender

This section of the chapter specifically addresses the fourth sub research question: What impact does teacher gender have on the beliefs of female students in single and mixed gender schools?

There is a cyclical, causational relationship between teacher behaviour, student achievement, student behaviour and student beliefs (Li, 1999). This relationship is ambiguous however, and research reflects this ambiguity. What is consistent with the TpB however, is that teacher behaviours towards students will be influenced, possibly even determined, by teacher beliefs. Just as female and male students have particular behavioural, normative and control beliefs, as the research undertaken in this study has exemplified, so do their female and male teachers (Cox, 2003). These beliefs, whether conveyed by verbal expectations, teaching styles or classroom organisation, in turn will impact on the beliefs, attitudes and behaviours of their students.

This research analyses the impact female ICT teachers have on the attitudinal responses made by ICT students. Research studies undertaken internationally over the last two decades have, like the research on the benefits of single gender education, been inconclusive on the importance of teacher gender (Sanders, 2006).

The importance of teacher gender in relation to male teachers has been of particular importance for researchers. The increasing gender imbalance in the school workforce and the continuing decline in the proportion of male to female teachers in both primary and secondary schools, has raised concerns that male role models are not available to male students. Policy has been implemented to begin to address this imbalance. For instance, The Training and Development Agency for schools (TDA) requested its providers to set recruitment targets to raise the number of men onto primary teaching training by 20% (TDA, 2002). This strategy assumes a traditional view of masculinity (Wallace, 2006) that further research does not support (Cushman 2008). Studies have shown that both female and male students reject the idea that the gender of the teacher matters and that the qualities and ability of the teacher, rather than their gender, is what matters to the students (Francis et al, 2006). The research undertaken in this study further reinforces Francis' research. Analysis of the participants' responses to The TpB questions in this study found little significant differences in the attitudinal beliefs of female and male students, regardless of teacher gender. There is also very little evidence as to whether a teacher's gender does or does not play a significant role in their students' attainment (mainly because it is very hard to measure a causal relationship between a teacher's gender and attainment, in the context of so many other competing variables). Qualitative research (Myhill & Jones, 2006) has demonstrated, however, that students often perceive female teachers as being influenced less by gender expectations than male teachers.

My observations have found this to be the case. It is understood (anecdotally) that female ICT teachers have higher expectations of all their students than male ICT teachers do. They are more likely to praise the speed and organisational skills that female students display in ICT and equally are more likely to give specific targets to male students to promote their task and coursework completion. I have, however, often observed that male students have more demands placed on them than their female peers. This possibly suggests that teachers have low expectations of male students' academic potential and as such reinforces their low achievement. These differing responses to male students, however, could be made for very differing reasons in ICT as teachers may expect more from male students so are more likely to vocalise their perceived under achievement.

Teachers' beliefs about the students they teach inevitably impacts on the students' own self-efficacy as demonstrated by previous research (Li, 1999) that suggests both female and male mathematics teachers believe their best students to be male due to their competitiveness and eagerness to answer questions. The closed questioning, which is dominant in mathematics lessons, suits male students' working styles, again reinforcing male students' self-efficacy in the subject and weakening that of female students. Li found that male students of lower academic ability than female students are labelled as 'able', whereas their brighter female peers described in terms of 'effort'. These gendered teacher attitudes mirror those of the ICT students in this research. Female students have significantly more positive attitudes to attainment and attendance, male students to implied comfort levels and further ICT study post 16.

Although Li's (1999) research found that female teachers in single gender schools were more likely to promote female students to opt for stereotypically 'male' areas of the curriculum, the results of this research study differ. In this study, the female students in the single gender school had less confidence in their teachers' opinion and by inference that they should study ICT post 16. This data result supports the research that suggests female students in single gender schools are more likely to hold beliefs that are stereotypically gender defined (Kenway & Willis, 1998, Lee & Lockheed, 1998).

The statistically significant overall findings, following the Chi-Square Test, demonstrated, however, that students of both gender believed that female teachers more positively thought that it was 'Very Likely' they should study ICT beyond post 16. This was in comparison to those students, of either gender, who were taught by male teachers: [χ^2 = 9.119; df =3; ρ= 0.028]. This result is in line with observed practice in the three schools that provide the sample in this study and in many other schools in the South East of England.

Female teachers tend to have more varied teaching styles; often organising opportunities for collaborative learning that facilitate the preferred work styles of female students as determined by this study. Their classes are frequently more student centred than teacher centred, with less teacher instruction, more student modelling and discussion.

My observations of gendered teaching styles are corroborated by research carried out by Lacey et al., (1998). Their study undertaken across departments in a US university, found differences in the way female and male lecturers delivered their classes:

> Women preferred a participatory classroom style in which the instructor is more involved in all steps. Women were reported more likely to involve the students in the coaching process than men. In addition, women were more likely to grade individual steps along the way then men [who] were more likely than women to play the dominant role outside of the classroom...Female professors contributed more to structured discussion and initiated more topics than the male professors
>
> (Lacey et al., 1998: 4-5).

I have frequently observed a difference between the teaching styles of female and male ICT teachers that impact on the comfort levels of the female students they teach. In contrast, male teachers appear more interested in the actual use of ICT relying on students working through tasks alone at their screens whereas female teachers plan and organise their lessons more imaginatively, as was found by Lacey's 1998 US research study.

The positive impact strong female role models can have in mixed ICT classrooms is evident from the research undertaken in this study. This demonstrates the positive impact female teachers can have on the beliefs of both female and male students (Myhill & Jones, 2006). Recent research undertaken with regard to female students' attitudes to working in the ICT industry in the UK, the Netherlands, France, Poland and Italy found that 52% of the participants cited as female role models both in school and at home as their biggest career choice influences (Gras-Velazquez et al., 2009). This positive impact is a factor for schools to consider in the work necessitated to promote female students' study of ICT post 16 and beyond into the ICT industry in order to eliminate the problem of 'pipeline shrinkage'.

5.8 Qualitative data analysis

A group of 30 students from one of the mixed schools, 13 female students and 17 male students, contributed to a semi-structured interview regarding their attitudes, beliefs and intentions towards studying ICT post 16. In parallel with the students who participated in the TpB questionnaire, the female students interviewed had higher end of Key Stage 3 results than their male peers did. Seventy eight percent of the female students were at L5 or above at the end of Key Stage 3 as opposed to 66% of their male peers. One of the female students had gained a Level 7. This was the highest end of Key Stage 3 result. Two of the male students were Level 3 at the end of Key Stage 3. These were the lowest results. The 18 questions that the students were asked (See Appendix 3) reflected the general areas of the TpB questionnaire although it consisted of 55 questions that built a detailed psychological comparison of the students' perceptions of and intentions towards ICT.

5.8.1 Work / Study Style Preference

When asked what it was about ICT lessons that they enjoyed, almost all of the students indicated that they enjoyed at least some aspects of the lessons. The male students, however, referred to working on the computers, with 82% of the male responses, 14 out of 17, mentioning this specifically.

> I like going onto the computers not listening when Sir talks to the whole class.

Only 23% of the female students, 3 students out of 13, referred to 'working on' the computer in relation to enjoyment. They were more likely to refer to the teacher or their friends in the class.

> I enjoy the lesson because there is no seating plan unless we misbehave. Sometimes the boys get moved but the girls can sit together which is not what happens in other classes. The teacher is nice.

The obverse was true for the question with regard to what was not enjoyable in the lessons. Male students only referred to 'working on' computers in two cases whilst the female students referred to 'working on' computers as a negative element in 77% of responses (10 out of 13 female students).

> I like some of the topics we cover in class but working at the computer all the time is very predictable. I also get really irritated when web sites I need to use are blocked for no reason.

In response to the question regarding how they liked to work there was a very clear gender divide. In 85% of the female responses the female students mentioned group work, working together or working with their friends as the best way of working (11 out of 13 responses)

> My friend who is in this class is good at ICT and can help me when we are allowed to work together. This is more fun and in a group we come up with better stuff.

41% of the male students (7 out of 17 responses), indicated they like to be with or near their friends but they were much more likely than their female peers to cite the computer itself as a factor in the way they like to work.

> Working with computers is great because it is easier than having to write and make notes all the time. I prefer computers because the lesson goes faster and I know what I am doing.

The Theory of Planned Behaviour Questionnaire found that female students had a greater preference for interactive and collaborative ways of working. This was mirrored in the verbal responses although it is also worth noting that almost half of the male students indicated that being with their friends is also a factor in preferred ways of working.

When asked the question, 'Would you prefer to work in a single or mixed gender class?' there was a consensus in the responses from the male students but less so from the female students' responses. 16 out of the 17 male students (94% of the respondents) overwhelmingly felt that although working in an all male environment would be 'a laugh' they preferred working in a mixed group as the girls 'got on' with work.

> The girls are better behaved and don't wind up the teacher by playing games. Because they work, we get on more. I don't think all boys would be a good idea in a school. There would be more fights too.

The female students, however, were more ambivalent, acknowledging the fun they had with the male students and how much they 'got on' with each other and were 'mates'. Nine of the 13 female students (70% of the respondents) mentioned that the male students were a distraction and slowed the pace of the lesson:

> I think without the boys we would get on much more quickly as the teacher would not have to stop and shout or go over work again and again. I do not like ICT really but I am quite good at it and know I could get a Distinction with a bit more help. I would not want to go to a girls' school though. I think it would be quite bitchy and not as much of a laugh.

Only 3 female students (23%) specifically replied they would like to be taught in an all female teaching group but just 1 student replied without any qualification that she would prefer to continue working with the male students.

5.8.2 What ICT means to you

The TpB questionnaire provided the students with a list of words to choose from with regard to what ICT meant to them, whereas the students interviewed were asked to provide associational verbal responses in an open-ended question – what words come to mind when you think of ICT. Overwhelmingly, in 15 out of 17 of the responses, 88% of the male students included games or playing games, often in great detail. Although 53% of the male students, 9 out of 17 responses, mentioned social networking sites, some of those students made the association negatively.

> I went on Bebo because my mate had a page but it was quite boring. It is a girl thing really. It is a waste of time. I cannot be bothered.

85% of the female students, 11 out of 13 responses, who made the main association with ICT as being the internet or networking sites, were positive in their enjoyment of the sites or longing to have one.

> Facebook means I never need to be bored! I can check up on my friends at any time although I often only spend a few minutes on the site and type a couple of messages. I love it!

Only 15% of the female students, 2 out of 13 respondents, made the association with ICT and games and they were very specific in the games they were referring to. Their association was not general gaming.

The students who participated in the TpB questionnaire were asked to rank 4 associations whereas the students interviewed were asked to respond as they chose. Only 5 of the male students and 4 of the female students went on to give additional associations other than with their first thoughts. Of those responses the male students all mentioned work, business or making money while one of the female students mentioned her aim to get a Distinction in the subject, 'as it is dull but quite easy' and the other three mentioned shopping, e-bay or web surfing to find information about school work or 'celebs'.

Again, these responses were generally in line with the data analysed from The TpB questionnaire. Male students were more likely to associate ICT with computers, games and work, whilst females predominantly made the association with use of the internet and communicating – particularly social networking sites.

5.8.3 Behavioural Beliefs

The students were asked two questions that reflected their behavioural beliefs. To the question, Would studying ICT after KS4 help you get a good career? female students tended, in 38% of replies, to suggest that whilst they were aware they needed to use ICT in their careers, the ICT industry itself would not be a choice.

> I want to be a fashion buyer for a big shop so I think I will need to be able to check out designers on the internet and make orders. ICT will be good for that.

> When I leave school, I want to be a primary school teacher. I know I will be showing the students work on the white board and teaching them how to show their work on power points. That will be fun!

Six female students out of 13, (46%) were quite forceful in their response that they would not want to have a career in the ICT industry at all.

> The thought of sitting in an office in front of a computer dealing with money and business is a nightmare to me! I want a job where I am dealing with people and solving their problems. Not solving ICT problems when the computer freezes!

Only two female students (15%) actually responded positively. Both, interestingly, cited female role models in their replies, in line with previous research that suggests female students are more likely to opt for ICT if they have positive female role models.

> My aunt works in ICT in the city. She has a great flat and a soft-top sports car. She is going to Australia for her holidays. She seems to enjoy her job and has a good social life too. She says she will fix me up with work experience so it is a career I am considering.
>
> I would like to be an ICT teacher. I had a great teacher in Year 9. She really made the lessons fun because we used to take it in turns to show our work. She let us choose music off the internet sometimes when we were working and showed us a lot of interesting things on the internet. I picked this course because of her and although she is not my teacher now she teaches 6th form ICT I think so I will hopefully be taught by her when I take my A' Levels.

From 82% of the male students (14 out of 17) there was a positive response to the 'good career' aspect of the question even when students were not actually considering ICT as a career option.

> I want to be a plumber but I know ICT would be a great job. I will need ICT to order parts and let customers know when I am coming. I helped my uncle set up his computer and I will be working with him.

Eight male students indicated that they might consider a job in ICT very positively (47%) and one had already decided the ICT degree he was going to apply for. Three students (18%) did not mention ICT at all in their response but in each case were overwhelmingly positive about their intended career rather than negative about ICT.

> I play with a youth team and if I stick at it could become a professional footballer. I want that to be my career.

The response with regard to the question 'would studying ICT post 16 lead to working with interesting people', produced even more polarised responses. Only the female student whose aunt works in ICT gave a positive response to the question based on the aunt's good social life and wide circle of friends at work. The student who wanted to be an ICT teacher repeated that she liked the teacher she hoped to have but that, 'the A' Level ICT students probably won't be my mates but I am not bothered about that'. Overwhelmingly, the male students responded that they would be interacting with interesting people if they studied ICT beyond Key Stage 4, regardless of their own intentions to do so or not.

5.8.4 Outcome Evaluations

The response to the first outcome evaluation question regarding having more opportunities to interact with your classmates and ICT teacher in ICT lessons produced superficially similar responses in that most students responded positively. The reasons however, were dissimilar. The female students linked interaction with work and learning, whereas, in most cases, the male students linked interaction with fun with friends and negative attention from teachers.

> It would be great to be allowed to play games in ICT with friends! It's not going to happen though! I definitely don't want the teacher to catch me playing games either!

18% of responses from male students (3 out of 17) indicated that they were happy with the level of interaction in the class, feeling that they got the right amount of help and support from each other and the teacher. The male students have higher comfort levels and generally feel happy with the attention they get in class, as they do with the dominant teaching style of working face to face on the computer.

> I always get help from my teacher. He comes over and shows me what to do. We are allowed to ask each for help too and that can be good.

In 85% of the responses from the female students (11 out of 13) wanted more interaction with both friends and the teacher in order to improve their learning.

> Sometime I think the teacher spends all his time getting the boys to stop playing games and being slow! I would like more help sometimes.
>
> If we were allowed to work in pairs, I know it would be more interesting and we would get more done.

This is in line with the female students' response to how they liked to work in class as discussed above and supports the results of the TpB questionnaire.

Students responded in a variety of ways to the question, Do you feel you are missing out by studying ICT? Their interpretations, however, fell into two different categories. Male students overwhelming responded that ICT was important and that they were not missing out. Female students, however, answered more literally with references to what their friends were doing in other option choices.

> Sometimes I wish I had done Food Tech instead of ICT. I thought it would be very old fashioned course, just cooking and designing packaging, but my friend finds it really interesting. They had to plan and throw a children's party and we went and ate the left over food at break. In ICT, we plan projects in the music industry but it's not real.

The differing length of responses was marked. The male students dealt with this question in seconds but the female students were much more reflective. Although six of the female students finally concluded they were not missing out, they spent time rationalising their decisions, weighing up the pros and cons of other option choices their friends had taken.

Many female students, however, answered the question, Do you ever find ICT lessons to be tedious and boring? much more directly. Out of the 13 female students interviewed 8 of them replied straightaway 'Yes' (62%). There then followed some qualification and explanations. Five of the respondents cited that the lessons were 'always the same' and three referred in some way to repetition. The other five female students all acknowledged that the lesson was 'sometimes' tedious and boring but went to some lengths to contextualise their response: 'but aren't all lessons though?', 'the teacher is nice, though, it's not his fault', 'some of my friends are in the class so that is not boring,' and 'it's my fault- I should not have taken it'.

Nine of the 17 male students replied very clearly that ICT was not tedious or boring (53%), describing it as: 'interesting', 'easy', 'a doss', 'the most useful of all my subjects'. The male students who stated it 'could be' tedious and boring were more specific in their answers and less apologetic than their female peers were. In their confidence with regard to the subject, they demonstrated higher ICT self-efficacy than the female students did. If any elements of the lesson were tedious or boring, they were external to their ability in ICT. They cited a particular unit as boring, that the teacher was 'useless', the school system too slow or that they were not allowed to sit next to friends.

All eight of the male students who stated that the lesson had tedious or boring aspects, however, gave examples of elements of the lessons they did not find tedious. These examples were directly associated with the subject, 'Any lessons where we are always on the computer or lap tops are more interesting than others,' rather than the female students' comments that were linked to friends or liking the teacher.

These responses were, again in line with the results of The TpB questionnaire where female students were significantly more likely to find ICT tedious and boring than their male peers.

5.8.5 Normative Beliefs

The female students who completed The TpB questionnaire were significantly more likely to think their referents did not want them to study ICT than their male peers. These results were mirrored in the verbal responses the students gave to questions regarding whether parents, close friends and their teacher think they should study ICT. Female students, however, were often more hesitant in their responses than their male classmates. Almost all of the male students were confident that their referents thought they should study ICT post 16 even if they had no intention to do so. Once again, this is indicative of both the male students' higher comfort levels and self-efficacy.

Only three of the female respondents replied that they believed all three groups of referents thought that they should study ICT, although only four replied with conviction that they would not want them to. The remaining six female students gave more hesitant, reflective responses.

> I don't think my parents would argue if I chose to study ICT in the 6th form but I think they would rather I studied better subjects like History or Geography. Using computers is something everyone can do and not so important.

> My friends probably won't study ICT next year so they would not want me to. We would rather be together.

> I know my teacher thinks I am quite good at ICT and he says I will get a Merit. I don't know what he thinks about me doing A' level though. He probably would think it is too hard for me. I don't know. I have not asked because I am not going to study ICT next year. I know my options already.

5.8.6 Control Beliefs and the Power of Control Factors

The TpB questionnaire results demonstrate that female students are significantly more likely to feel that unanticipated events will impact on their time and studies than their male peers. All students, however, were likely to be distracted by the more concrete family demands. Not surprisingly, these questions, when verbalised, produced personalised and detailed responses from the students. Generally, the responses did concur with the analysis of the TpB Questionnaire results. What was interesting was the female students' need to justify and quantify their response whilst their male peers were more direct.

Male students were usually very clear in what they perceived as control factors and the power of those factors.

> When I am at school, my parents would not expect me to have to help out with any problems at home. My gran went to hospital and I did visit but not in school time. My mum would not have let me miss school but I did miss two days for the funeral when she died. That's all though.
>
> What do you mean by unanticipated? If my family won the lottery, they may let me give up school! In my dreams! That won't happen.
>
> I sometimes have to help my dad sort out the garage but not often. It's up to me what I do.

The female students again were more tentative and reflective in their responses.

> When my mum was working on night shift, I had to help more at home. I did not miss school but sometimes I did my homework at lunchtime, which was not very good. It was only for a couple of months though.
>
> If my family need me, I would be there for them. They are always there for me and that's important. I might miss school if things at home were bad but it would have to be important.

The responses made to the series of control belief and power of control factor questions in the TpB questionnaire were unequivocal in their gendered responses, with female students falling into traditional patterns of obligation and responsibility that their male peers did not feel. The verbal responses given in the interviews were more complex and contextualised but, ultimately, female students indicated they felt more sensitive to the demands of both events and family than the male students.

5.8.7 Motivation to Comply

The results of the TpB questionnaire found that the female students cared more about what their parents, teachers, classmates and friends thought than their male peers.

The responses of the students in the interviews were varied and often very full. When carefully analysed, however, the results were in line with the TpB questionnaire. The female students cited more examples of instances where they cared what other people think, rather than the male students. Not all students were unequivocal however. Some male students differentiated between caring what their referents think but not doing what the referents want.

> I would not want to make my parents upset but really what I do is my choice and what they think does not really matter that much in the long run. It is up to me.
>
> My DT teacher really wanted me to do Resistant Materials and told my mum I could get an A* but I did not opt for it. She did not mind. She knows I would not have worked if she had forced me to do something I did not want to do.
> My friends would like me to play football all the time! I do not though!

Female students did not make this distinction between wanting to please, but not doing so! They felt it was important to care about other people's views and that pleasing other people was more important than their male peers' perceptions of doing so.

> I would not want to go against my parents. They will have to pay for me when I go to college so it would not be right. Luckily they are happy for me to go on to study Fashion but if they weren't I would have to think again.
>
> My friends are like me. They want to do well and get good jobs so we agree on that. Good friends would not want you to change. They would not be friends would they?
>
> I really like my English Teacher and she wants me to study A' Level English as she thinks I could get a B or even an A so I will. If I get really good grades my dad will be pleased with me.

Female students interviewed seemed no less positive with their choices and aims than their male peers did, but they had rationalised their choices with the opinions of others in ways that did not seem to have occurred to their male peers.

5.8.8 Intention

To the direct question, Do you intend to study ICT post 16? both female and male students gave direct responses, at least in the first instance. Female students, in 10 of the 13 respondents, replied directly 'No'. One respondent (who wants to be the ICT teacher) responded 'Yes' and two others, 'Possibly'. Of the 17 male students, 8 replied directly, 'Yes' and 6 replied 'Possibly'. Interestingly, of the 3 male students who replied, 'No' all three felt the need to qualify their response with comments such as, 'but it would be alright' and 'I wouldn't mind though'.

The 30 students interviewed had a range of attitudes and beliefs with regard to ICT and their external influences. Verbally they expressed attitudes that reflected the responses to the more comprehensive Theory of TpB and that schools must actively address if they are to change salient beliefs in order to encourage more female students to study ICT post 16 and beyond.

5.9 My Research Objectives

The overarching question this study addresses, from a post positivist paradigm, is: Are there gender differences in Behavioural, Normative and Control Beliefs and how do these differences affect the students' intention to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

The four accompanying sub questions are:

- Are there gender differences in ICT students' attainment and what impact does this have on their intent to study ICT post 16 and beyond?

- How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage' (Gras-Velazquez et al., 2009, Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).

- How do female students in single and mixed gender schools differ in their Behavioural, Normative and Control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

- What impact does teacher gender have on the beliefs of female students in single and mixed gender schools?

The results of The TpB questionnaire demonstrate a number of statistically significant differences in the planned behaviour and attitudes of female and male students with further differences between female students taught in mixed or single gender contexts. Female students have positive attitudes to achieving academically in ICT, for instance responding positively to the Behavioural Belief question, Item 31, 'Studying ICT post 16 would lead to me gaining a better understanding of ICT' would be very likely (see Appendix 2, Result 13) and their intention to regularly attend ICT lessons (See Figure 19). They hold, however, negative beliefs about not only their ability to succeed in the work place if they study ICT post 16 and beyond (see Figure 11). Additionally, they hold normative beliefs that those close to them would not support their further study (see Table 4) and control beliefs (see Table 6) that circumstances beyond their control would make it difficult for them to do so. In some belief areas, female students taught in single gender environments hold more negative intentions towards studying ICT post 16 than their peers in mixed gender school contexts (see Table 9). In all contexts, however, female role models have a positive impact on the beliefs of both female and male students (Gras-Velazquez et al., 2009, Myhill & Jones, 2006).

The statistical analysis and identification of the differences in attitudes female and male students hold are attitudes that may lead to behaviours detrimental to both the economy and society as a whole (Gras-Velazquez et al., 2009, The Women and Work Commission, 2009). Women missing from the technology design room to the boardroom diminish the value and unique talents women bring to that table (Desvaux & Devillard, 2009) We can no longer accept this as a normal expectation (Mitchell, 2005) and must recognise the situation as a cause for concern (Ofsted 2009, Ofsted 2004, Bell 2004).

6.0 Further Discussion

And if you are a female who is deciding what evolutionary road you want your children to follow, you will be looking for a wired IT professional who can install his own programmes (sic) without begging a complete techie stranger to cover up technological inadequacies. Knowledge is the ultimate power and power is a huge aphrodisiac

(Geekgirl, 2005)

That there are gender differences in behavioural, normative and control beliefs in the intent to study ICT post 16 as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980) has been established in this research study. The discussion in Chapter 6 aims to address the contributing factors to the lack of intent of female students to study ICT post 16 and beyond and to examine the range of strategies that can inform classroom practice in order to seek to increase the participation of female students post 16.

6.1 Implications for Professional Practice

Attitudinal gender disparity, as this study evidences through the analysis of The Theory of Planned Behaviour (TpB) questionnaire, has arisen in the use of computers and the Internet in education. This is because, despite computer-related technologies opening up dramatic new opportunities and challenges, research suggests that female students are excluded from the challenge. As currently taught in British schools, ICT reinforces both the gender and power imbalances of the past and present (Volman and Eck, 2002). Gender differences are still evident and female students continue to fail to play a full part in a technological world thirty years after the passing of the 1975 Sex Discrimination Act (Clegg et al., 2000). Students have equal opportunities offered to them as option choices at the end of Key Stage 3 but, statistically, those choices still reflect, in mixed gender schools, stereotypically gender orientated subjects. Scientific and technical subjects attract more male students and languages and the arts more female students (Ofsted, 2009, The Daily Telegraph, 2007, The Times, 2006, The Guardian, 2005, Ofsted, 1996). Female students can over-rate the difficulty of particular subjects (Gras-Velazquez et al., 2009, Arnot et al., 1998) and inevitably, under-participation of female students in these key subject areas excludes women from entering a wide range of training and employment opportunities (Aveling, 2002). ICT thus remains a male-dominated big business; profits having become the priority over ethics and social implications (Desvaux & Devillard, 2009, Gras-Velazquez et al., 2009, The Women and Work Commission, 2009).

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In order to change behaviours of female students to increase their participation in the study of ICT post 16 and beyond into Higher Education and the ICT industry, intervention must be directed at one or more of its determinants. Key to female students' under participation in ICT beyond Key Stage 4 are their beliefs regarding behavioural controls, attitudes and norms. The research findings presented in this study: that female students have statistically weaker intentions towards post 16 study of ICT, more negative attitudes to the subject and perceive those attitudes as perpetuating social norms, are indicative of the problems in British schools that must be addressed in order to circumvent the issue of 'pipeline shrinkage'. Interventions can produce changes in behavioural intentions that are, as evidenced in this study, negative towards ICT and, given adequate control over the behaviour, the new intentions are more likely to be carried out, ultimately guiding performance of the behaviour (Ajzen, 2006).

In general, the greater the relative weight of a given factor, the more likely it is that changing that factor will influence intentions and behaviour (Ajzen, 1971). Where attitudes toward the behaviour explains a great deal of variance in intentions, for instance the female students' seemingly contradictory intentions to succeed in the subject academically but opt out of further study of the subject, subjective norms and perceptions of behavioural control contribute relatively little. This is because intentions account for most of the variance in behaviour. Consequently, teachers ensuring that female students are aware of their own academic success and putting in strategies further to improve their attainment comparative to male students will be unlikely to have an impact on their intention to study ICT beyond GCSE.

It is, therefore, important to direct the intervention at behavioural, normative and control beliefs where there is the potential to make a difference in moving attitudes toward the behaviour more favourable, thus affecting intentions and behaviour. Following the analysis of the TpB questionnaire in this study, the intervention directed at behavioural beliefs should be focussed, ideally, at shifting beliefs towards the perception of ICT as a stimulating, interesting, worthwhile industry that is associated with friendship, career prospects and high salary. The relatively narrow remit of this study – the missed opportunities in our classrooms – leads the research toward finding specifically classroom interventions that focus on organisation, teaching styles and teacher gender.

Not all interventions, for instance interventions regarding normative beliefs external to the school environment, such as influences of family, are possible. A significant increase in a predictor can have a strong impact, however, so long as a given predictor is at a relatively low level prior to the intervention. On the other hand, a weak regression or path coefficient may correctly indicate that the predictor in question is not an important factor for the behaviour and population under consideration. In that case, even if it were changed, it would have little impact on behaviour. For instance, parental support for the further study of ICT post 16 at the end of GCSE will have little impact on an intention that was formed by 16 years of normed gender stereotyping and negative experiences in the classroom. It is reasonable to target an intervention at any one of the three major predictors in the TpB, behavioural controls, attitudes and norms (so long as there is room for change), but it may be more expedient to target predictors that account for significant variance in intention and behaviour (Ajzen, 2006). To change perceptions of behavioural control, attitudes and norms it is possible to attack the strength of some of the relevant beliefs, until the balance of beliefs shifts in the desired direction (Ajzen, 2006).

It is important for teachers to understand, however, that it is generally possible only with salient beliefs - beliefs that are readily accessible in memory and that can be articulated. These are beliefs classroom teachers can bring about. It is easier to produce change by introducing information designed to lead to the formation of new beliefs than it is to change existing beliefs; key if teachers are to have an impact on salient beliefs. Beliefs represent the information held about a behaviour, its likely consequences, the normative expectations of others and the likely impediments to its performance. Behavioural interventions can provide information that change some of these beliefs, or that lead to the formation of new beliefs. Only when these new beliefs accurately reflect reality can it be expected that the effect of the intervention will persist over time. Whether or not female students who study ICT at post 16 and beyond as a consequence of school intervention and its impact on their beliefs will revert to their previous behaviour after leaving full time education, is dependent on the variant factors at play beyond the classroom. Classroom teachers with targets to meet are not necessarily concerned with the performance of female students at Key Stage 4 or 5 given their academic strength. Schools do, however, have to recognise that attitudes are not reflected in this achievement and that it is female students' attitudes, not academic aptitude, that ultimately results in their under representation in the ICT industry.

The Theory of Planned Behaviour demonstrates that intentions to perform behaviours of different kinds can be predicted with accuracy from attitudes toward the behaviour, subjective norms and perceived behavioural control. These intentions, together with perceptions of behavioural control, account for considerable variance in actual behaviour. The results presented in this study allow teachers to understand the beliefs that are impacting upon their female students and that leads to their lack participation in post Key Stage 4 or Key Stage 5 study. Once teachers and schools decide which beliefs intervention will attempt to change, an effective intervention method must be developed, for instance, acknowledging and promoting working styles that benefit all learners and acknowledging the stereotypes that students themselves replicate and perpetuate (Ali, 2001). This is where teachers' experience and creativity is of importance, as the TpB cannot diagnose the intervention that will be most effective. What teachers and schools can do towards changing female students' salient beliefs and increasing post 16 study of ICT and beyond is discussed at length in the conclusion.

6.2 From Intentions to Behaviour

Interventions directed at behavioural, normative or control beliefs may succeed in producing corresponding changes in attitudes, subjective norms and perceptions of behavioural control - and these changes may further influence intentions in the desired direction. The intervention will still be ineffective, however, unless individuals are in fact capable of carrying out their newly formed intentions. It is therefore important that teachers ensure that there is a strong link from intentions to behaviour. When this relationship is weak, steps must be taken to strengthen it. One of the most effective means available is to induce schools to form an implementation intention, i.e., to form a specific plan detailing when, where and how the desired interventions will be performed (Gollwitzer, 1999). The formulation of such structured school interventions in groupings, staffing, teaching and learning styles, can support female students to participate in the study of ICT post 16 and beyond.

6.3 Classroom based Interventions following the Theory of Planned Behaviour Questionnaire Analysis

Gender equality in ICT entails an aspiration to work towards a society in which both women and men are able to fulfil their potential and live fulfilling lives but not on terms defined and determined by a patriarchal technological agenda, as is the case today. Women's experience is 'different'. They should have no need to participate in the ICT industry on male terms, suppressing their instinct to facilitate, support and empower in favour of competition and hierarchy (Pritchard & Deem, 1999).

The feminist definition of 'different' has historically been at variance - first wave feminists using the concept simply to note the disparity in gender experiences prior to a definition embracing the inequalities of women's experience in comparison to that of men (Letherby, 2003). 'Different' thus describes the dominance of men in a position to ensure that their particular way of being is recognised as being universal; the definition of excellence charged with masculine implications (Bourdieu & Wacquant, 2000). Post structural and post-modern approaches to the relationship between identity, agency and structure have signalled the impossibility of locating individuals' identities within tightly bounded categories. These categories are hierarchies of power that are easily identifiable structural edifices with abstracted ideals. The question which post-modern and poststructuralist feminism posed was the dilemma associated with promoting simultaneously both equality and difference. Issues of equality are expressed in understandings of socio-economic injustice rooted in the political-economic structure of society – the under representation of women in the ICT industry. Issues of difference are expressed in the cultural, symbolic injustice rooted in social patterns of representation, interpretation and communication – the normative beliefs that lead to female students' behaviours. Politically there are two 'remedies' for these injustices: redistribution and recognition.

- Redistribution addresses the ways in which disadvantage is sustained in the socio-economic sphere through exploitation, economic marginalization and deprivation by advocating a restructuring of the political economy through, for example, redistributing income, re-organising the division of labour and more democratic decision-making;
- Recognition addresses issues such as cultural domination, non-recognition and disrespect by encouraging cultural or symbolic change.

Thus, the degendering strategies in the economy are often counterposed to the regendering strategies to be found in the cultural sphere. In the context of this study, this is when the behaviour of female students in opting to study ICT post 16 and beyond, is counterposed to their attitudes. This contradiction is exposed clearly in the tensions between equal opportunity policies to remove gender as a segregating and allocatory device in the labour market counterposed by a commitment to work with, rather than against, gender difference by promoting, for example, either boy-friendly or girl-friendly schooling. Schools are expected to redistribute educational opportunities in the name of equality at the same time as recognising differences *between* the sexes and *within* each gender group. The overall goal from a liberal perspective is not to legitimise gender essentialisms but to use gender difference as a means of distributing educational opportunities, (Fraser, 1997).

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Similarly, businesses and companies are also keen, theoretically, to attract and retain women but do not address the issues within the workplace or in policy making that in fact render gender inequality as 'invisible' (Desvaux & Devillard, 2009, Gender in Technology, 2001). The emphasis has been on recognising the under-representation of women and gathering statistical data to document the 'problem' rather than on developing understanding of the inherent causes of the inequalities and the gendering of computer science itself (The World Bank, 2009, Gracia-Luque & Stein, 2005, Christie, 2002). This inequality goes beyond the structural and is more insidious in that ICT and its related industries have an established culture that is supportive and appealing to men. Women are expected to accept this definition of work culture if they are to be considered a 'real' player in the ICT industry (Faulkner et al, 2007). If what occurs in ICT classrooms continues to replicate this practice in industry, gender difference will perpetuate its self-fulfilling prophecy. In targeting underperformance, gender blindness (gender neutrality) is no longer possible and teachers must be encouraged to investigate, reflect and work constructively with assumed or observed learning differences (Arnot & Gubb, 2001). Female participation in ICT will only increase if gender differences in computer-related attitudes, interests and comfort levels are taken into account in teaching and learning.

6.3.1 Learning ICT, the way Female students 'see it.': Collaboration in the Classroom

In order to address the implications of The Theory of Planned Behaviour Questionnaire analysed in this study, it is important to address the problems inherent in our classrooms that lead female students to hold the behavioural beliefs regarding the subject that drive them out of the 'club house' of the ICT classroom to create 'pipeline shrinkage'. In the masculine world of ICT female students are supposed to learn it, the way men see it. Men have moved quickly to impose their own conceptual schemes on the experience of female students (Christie, 2002). These schemes do not help make sense of their experiences; they extinguish the experience (Flinders, 1997). As demonstrated by this study, establishing collaborative learning cultures as opposed to individual, competitive learning, is one important way that teachers can aim to affect female students' attitudes to ICT. If female students are ill at ease in the classroom, with low comfort levels, the attitudinal gender gap will be widened still further. Factors that lead to female students in ICT classes feeling isolated, disempowered and disinterested will entrench attitudes that impact upon intent and behaviour; the behaviour to opt out of ICT participation post 16 and beyond, from Higher Education and the ICT industry.

Highly competitive learning, in front of the screen, coupled with closed questioning and illicit game playing interludes, is at odds with female students' general preference for collaboration. The TpB Questionnaire and the semi-structured interviews in this study specifically addressed learning style preferences to inform classroom practice to support more positive female attitudes to ICT.

Collaborative group work can be organised as a way of 'decentralising' classroom communication so as to encourage more students to participate in and practice forms of academic discourse normally dominated by the, usually in ICT, male teacher (Cox, 2003, Barnes & Todd, 1995, Edwards & Westgate, 1994, Edwards & Mercer, 1987, Edwards & Furlong, 1978). In group work where students are encouraged to explore meanings collaboratively, there are clear differences in discourse structure between this collaborative learning and whole class instruction (Gipps, 2009, Sanders, 2006, Barnes & Todd, 1995, Edwards & Westgate, 1994). The absence of teacher led discussion means that there is no authoritative figure to dominate the discourse and consequently there are no clearly marked asymmetrical relationships; the lack of pre-allocated rights makes it necessary for students to negotiate the terms of their interaction as they go along. All students are given more opportunities to develop linguistically and cognitively in the discourse structure of collaborative group work, playing a part in enabling female students to contribute with more frequency and confidence (Westwood, 2006). Collaborative learning focuses on the problematic emotional, affective and relational worlds they inhabit, exploring the nature of friendship, confidence and their experiences of learning, (Cruddas & Haddock, 2003). Stereotypical roles can be reversed with equal intellectual content as female students give directions as well as follow them, ask questions as well as answering them. By emphasising and encouraging co-operative effort and by providing feedback, all students are able to perceive the value and benefits of talking and collaborative group work (Westwood, 2006, Bennett & Dunne, 1992, Galton & Williamson, 1992).

Turn taking managed locally through interaction in group discussions sets different expectations and patterns of working as speakers potentially have equal rights and joint ownership of interaction (Edwards, 1980). The patterns of interactions are therefore strikingly different from the kinds of discourse associated with the whole-class or transmission model of teaching. It is important that effective teachers know how to blend individual, small group and whole class teaching successfully. For example, problem solving and thinking skills are probably best enhanced through collaborative small group work, although an element of whole class teaching will be needed to explain the task and teach the students the skills necessary to complete collaborative group work (Stevens & Slavin, 1995, Hembree, 1992, Peterson, 1988). The question is not whether to plan whole class teaching or small group work, but how to incorporate both into schemes of work (Gipps, 2009, Westwood, 2006, Barnes & Todd, 1995, Galton, 1995, Galton & Williamson, 1992). It seems likely that teaching styles that counter poise teacher-led approaches with student centred learning remain the organisational and behavioural blend that will produce the highest learning gains (Westwood, 2006, Pollard et al, 1994, Johnson & Johnson, 1990, Croll & Moses, 1988).

Collaborative learning, the preferred learning style of the female students questioned in this study, however initially problematic for the teacher and male students, (Davies, 2003), can positively enhance female students' attitudes to ICT in their engagement with each other. They are able to define their learning issues and decide for themselves what is relevant for their learning (Dolmans et al., 2001). Moreover, both female and male students may benefit from the less competitive atmosphere

(Francis et al, 2006, Myhill & Jones, 2006, Westwood, 2006). Careful structuring of talk task, group composition and pedagogical style can produce positive discussions in which all students can fulfil academic goals but it remains important that teachers note the impact of gendered group dynamics and collaboration in order to improve the learning of all students, both female and male (Westwood, 2006, Davies, 2003). Web 2.0 technologies, with their impetus for complex networking and collaboration, should be increasingly introduced into teaching styles to further extend learning opportunities for all students and, crucially, enhance the attitudes of female students towards ICT (Luckin et al., 2008).

6.3.2 Single Sex grouping?

The attitudinal responses of female students taught in both single gender and mixed schools compared in this study, resulted in disparate findings. Female students in the single gender school held more positive attitudes to learning but their attitudes to ICT and their belief in the confidence their female teacher had in their ability to study ICT post 16 were less positive than the attitudes of their female peers taught in mixed schools.

Single gender grouping of students is promoted by those who argue that gender differences are rooted in biological differences between female and male students, centring on essentialist approaches. They maintain that such differences are genetically determined and evident from a very early age (Archer, 2004). It has been argued that there is a pressing need to embrace rather than ignore gender differences and develop gender-specific pedagogies to support learning (Sax, 2005). In recent years, however, the dominant discourse has been the 'problem' with underachieving male students and the preoccupation with their lack of engagement and poor behaviour. This discourse, combined with a continuing disregard for female students' learning and the presumption they will learn whatever teaching quality and mode of organisation they encounter, has systematically led to the failed potential to broaden participation for, and widen the experiences of, female students (Younger & Warrington, 2006, Francis, 2000).

There is an ongoing need to sustain, monitor and evaluate single gender teaching so that a classroom pedagogy can evolve that is accessible and opens up learning for all students, regardless of gender. Single gender education can play a positive role in supporting achievement for either sex if designed with explicit gender transformational objectives (Stromquist, 2007). Preconditions have to be met and a conducive classroom environment established in which students are able to take opportunities to talk more openly about issues, exchange views without fear of embarrassment or of undermining their own image and feel less pressure to perform and 'showboat' for the benefit of the other sex (Younger & Warrington, 2006.) The results found in this study suggest that rather than challenge issues in less pressurised environments, single gender classrooms can perpetuate stereotypical attitudes to ICT. Teachers should challenge these stereotypical responses to ICT (Sukhnandan et al., 2000) to enable female students to develop confidence in their own abilities and judgments in environments for learning away from the 'peacock behaviour' of male students (Kenway & Willis, 1998, Ball & Gewirtz, 1997) that perpetuate stereotypes in mixed classrooms.

Female students in the single gender classes who participated in this study were generally more confident regarding their own abilities and worth, willing and able to take responsibility for their own learning with a higher level of self-belief. They therefore, theoretically, gained a space to be safe from ridicule and were encouraged to speak up, free from male harassment (Younger & Warrington, 2002). The findings from The Theory of Planned Behaviour questionnaires in this study, however, suggests that whilst female students taught in the single gender school indeed have more positive attitudes to their potential as learners, they have less positive attitudes specifically towards ICT than their contemporaries in the mixed schools.

Thus, gender segregated education can be used for either emancipation or oppression (Kruse, 1996). Emancipation ideally will come about when senior managers within a school have offered strong and continuing support for an initiative and classroom teachers have developed a value system and sense of belief that single gender classes can benefit most students. Oppression will arise when male students' needs are given more weight than those of female students, when male students are exposed to ridicule and mockery if they fail to conform to the groups' dominant masculinity or if single gender classes exacerbate stereotypes, ironically devaluing female students (Younger & Warrington, 2006).

6.3.3 Gender role models

The issue of gender role models has long been a part of the discourse surrounding what constitutes successful learning and modelling. Historically, as currently, this was not an issue of too few female teachers, but too few male, as bemoaned in The Year Book of Education, 1963:

> No country should pride itself on its educational system if the teaching profession has become predominantly a world of women
>
> Langeveld, 1963 *cited by* Buren, 2001.

Forty years later there remains a governmental concern to recruit more male teachers in England and Wales where female teachers out number male teachers in both the primary sector (by 64%) and secondary sector (by 22%) in 2005 (Burghes, 2009). The need to re-introduce male authority is increasingly reiterated (The TDA, 2002). The discourse of the 'failing boy' and the fear of male working-class disaffection are implicated in present publicity campaigns rendering invisible the female primary school teacher (and her female students). The TDA publicity materials are gender-biased, defining men as an asset who will provide role models to re-engage male students in the 'curriculum of the dead' (Ball 1994). Women are increasingly seen as deficit as public beliefs and promotion patterns continue to reflect the historical themes that Langeveld (1963) drew on: themes that devalue female teachers and students whilst, affirming male authority and the interest of male students (Buren, 2001).

There is very little evidence, however, to support the notion that there is a 'problem' with male students because schools have become feminised (Francis et al, 2006, Ashley, 2002). When the underlying framework of the theory that male students need male role models at school and the 'attachment theory' is explored, it would seem that the gender of the teacher is not an issue. Male students will succeed at school provided they have a secure attachment to a principal carer at home. This carer is usually the mother, but can equally be the father. Where there is a secure maternal bond, the absence of a father at home again does not seem to be the problem that the 'Poor male students' discourse suggests it to be, although disruptive fathers or poor male role models in the home can have a negative effect. The nature of this duty of care is clearly more akin to caring about than caring for. It is primarily a function of management rather than a function of nurture or parent substitute (Bretherton, 1992).

Qualities approved of by male students themselves are the ability to 'sort things out and get on with it' rather than administer mother substitute care. Male students acknowledge that both males and females can 'sort things out and get on with it' (Ashley, 2002). They reject the suggestion that the gender of the teacher is an issue and one of the most consistent features of research is the explicit tendency of male students not to identify gender as a problem. There is little evidence that male students identify with male teachers, and there is no evidence to suggest they feel they would do better at school if taught more frequently by men (Ashley, 2002). In work and in caring, male students explicitly acknowledge that teacher quality is independent of gender, and by far the most important consideration. A competent woman is clearly preferred to an incompetent man. Furthermore, male teachers are not a homogenous group; each male teacher brings a different performance of masculinity to the classroom.

The belief that technology (or sport) is the way to secure male students' commitment to schooling can easily become a self-fulfilling prophecy that marginalises the many male students for whom ICT (or football) is not the singular priority and, paradoxically, those female students who might genuinely enjoy ICT (or football). The need is for teachers, of either gender, who will manage schools so that supportive peer relationships flourish, who understand that both female and male students enjoy a wide range of activities and who have appropriately high expectations for the inclusion of both female and male students in all such activities. There can never be gender equality if any one gender dominates another numerically in a sphere of employment. If we wish for more positive male representation in schools, then it is clear that there are criteria for good teachers that male and female recruits equally must meet (Ashley, 2002).

This study, however, demonstrates that more good female ICT teachers could make a difference in changing the perceived dominance of the masculine in ICT, not only for female students but for male students too. The TpB questionnaire results demonstrated that both male and female students were more likely to study ICT if their teacher was female. Male role models, however, continue to outnumber female role models. In the European Union and the United States, computing in schools started in male-dominated Mathematics and technology courses and departments and male teachers of information technology continue to outnumber female teachers in their roles and responsibilities (Clegg & McNulty 2001). Just as female students have often been found to be less confident than male students in using computers, studies have consistently found male teachers to be more self-confident in using computer technology and female teachers to rate their knowledge and skills lower on a self assessment scale (Volman and Eck, 2002). There are a greater number of female teachers who may use computers in their teaching but do not feel competent to manage or teach computer-related skills properly (Derbyshire, 2003). Female teachers' lower self-efficacy with regard to ICT competency is an issue that needs to be addressed whether explicitly in teacher education or implicitly in female teachers' own professional development (Cox, 2003).

Teachers given the opportunity to reflect on their own practice and pedagogy have been surprised by the gendered tendencies that emerge. All teachers should be able to consider their gendered beliefs and expectations in order to challenge them internally or at the very least minimise their effects on students (Francis, 2006, Cox, 2003).

The gender of the teacher can have a negative impact on gender progress in ICT, if it is perceived that male teachers are *a priori* guilty and female teachers innocent. Female teachers, however, are not exempt from concerns about gender bias because of their femaleness. Men and women are equally capable of gender bias and consequently the gender imbalance continues (Saunders, 2005). Teacher-based dynamics such as teacher attitudes and expectations and their interactions with students in the classroom evince different patterns toward female and male students, generally to the disadvantage of the female. Many teachers express the viewpoint that they treat female and male students equally and that their gender is irrelevant. This gender-blindness provides a false sense of objectivity and impartiality, often at variance with actual practice leading to gender bias subtler than visible discrimination that may result in unconscious behaviours that pay more attention to either one gender or the other. These behaviours may foster a sense of alienation and hinder personal and academic achievement. They introduce inequalities and hierarchies in the treatment individuals receive that are based on sex differences (Gras-Velazquez et al., 2009, Stromquist, 2007).

Male teachers, for instance, must ensure they are not encouraging a male 'clubhouse' ICT classroom, where they are tempted to become one 'of the lads,' tolerating sexist language and behaviour with regard to female students in mixed classes (Kenway & Willis, 1998). Female primary school teachers should not position themselves outside of classroom discourse in lessons involving ICT, deferring to male student 'experts' that leads to female students being marginalized in classrooms in the ensuing patriarchal discourse between eleven year olds (Cox, 2003 Singh,1997).

Both female and male teachers working together need to foster more reflective dialogue and debates regarding the construction of gender. Through conversations and dialogue with students, teachers need to raise awareness and promote discussions about acceptable male behaviour. They must raise critical questions about the performance of gender, challenge the privileged position of hegemonic masculinity and create safe, equitable places for all students (Greig, 2003).

For those female students who have the persistence to progress to study ICT post 16, the pattern of teachers differentiating in their approaches to them continues. Male students engage both male and female tutors in lengthy discussions whilst male tutors are more likely to talk less to women students at the same time as being more likely to interact physically with them by manipulating the mouse or using their keyboards. Female students, however, interact with each other more whilst female tutors encourage, through coaching, more interaction between all students (Clegg et al., 2000).

One of the most formative 'sites' for the construction of subjectivity for students is the school classroom and the relationships within it. These relationships include those of peer learner/peer learner (student/student) and authority figure/subordinate (teacher/student). Multiple subjectivities are constructed; positions of powerfulness in some discursive contexts and powerlessness in others. Students can be positioned as powerful within one particular discourse, for instance male students 'doing power' over female teachers or powerless, female students' power negated by the teaching style of the male teacher or, more positively, empowered by peer support (Walkerdine, 1990).

Peer influences play a significant but not easily visible gate-keeping role in reproducing gender ideologies. Peer interaction constitutes a major determinant in the gender socialisation process in schools; student constructions of their identities taking place not only in relation to teachers and the official curriculum but also in conversations with classmates, activities in the playground and through their engagement in related extracurricular activities. Peer interactions can also reinforce or contradict messages about gender emanating from the school curriculum but often, peer networks are more supportive of traditional gender arrangements than are teachers (Stromquist, 2007) and this can be detrimental to challenging stereotypical behaviour. Peer bonds at school give male students the feeling of well being necessary for effective functioning. Although the gender of the teacher seems to be of apparently minimal relevance, teachers have a duty of care in providing the back up to ensure peer bonds can flourish positively and not to the determent of other groups (Ashley, 2002).

Thus, positive, structured, peer group tutoring, a common practice in many schools, should be actively encouraged (Westwood, 2006). Key Stage 4 or 5 female students who are computer literate and ICT competent can formally and informally support younger female students in groups; 'pyramid' selling their competence, enthusiasm and aptitude as modelled by the Peer Assisted Student Support scheme (PASS) already launched in universities (Ali, 2001). Structured role model stories designed to influence outcome expectations, perceived norms or self-efficacy have been successfully used in Theory of Planned Behaviour interventions. Trainers have routinely worked interactively with groups to challenge preconceptions in order to address behaviour specific beliefs pragmatically. Whilst it is acknowledged that core beliefs - the fundamental beliefs, about the self - will not necessarily be changed in this context, the behaviour specific salient beliefs can be (Fishbein & Ajzen, 2005). That attitudes and behaviours relating to ICT do need to be changed in order to eliminate 'pipeline shrinkage' has been confirmed by the research undertaken in this study. Further action needs to be taken and research carried out to ensure the findings of this study have a positive effect on the participation of female students in the study of ICT post 16 and beyond.

7.0 The Conclusion

Can we thus, in the long run, change our discipline into one that is more attractive to a broader range of students, for example women?

(Chrisina Bjorkman, 2005)

7.1 Beyond the Research Questions

The research questions posed in this study sought to identify gender differences in attitudes and behaviours in ICT and its use through TpB questionnaires. This was in order to examine contributing factors to the intent to study ICT and suggest which of these factors might affect the attitudinal gender gap in order to inform classroom practice and increase the participation of female students post 16 and beyond.

Results following analysis of the 120 TpB questionnaires completed by students in 3 schools, show that the gender gap in student attitudes towards ICT remains in classrooms despite female students' academic achievements that nationally supersede those of their male peers. Closing the gender gap in female participation in ICT in post 16 study and beyond is clearly not about competency; that female students are as competent at ICT as male students is not in dispute. It is about complementary activity. Technology itself should support gender differences in work style preferences to reduce the gender divide (The World Bank, 2009, Gracia-Luque & Stein, 2005) but for this to happen, teachers need to recognise what gender based learning styles are and embed them into their lesson planning as a matter of course.

Unless teachers are proactive in ensuring female students have equal access to computers and teacher time they will step aside, lacking the aggressive persistence to progress (Gurian, 2002). Female students feel confident in some aspects of ICT, however, male students have long had greater access to computers in schools and dominated in computer related tasks and discussions. They dominate classroom discourse, make comments that are more spontaneous and ask more questions. Conversely, female students are more likely to take on the role of the uninitiated even when their knowledge and skill equals that of males, more often lacking confidence in computing and underestimating their computer-related competence. Male students' greater confidence may seem intimidating and excluding (Gras-Velazquez et al., 2009, Francis, 2006, Volman & Eck, 2002) and whilst not accepting male discourse as superior, female students position themselves within it. Their silence, although possibly indicative of their disparaging and dismissive attitudes to male discourse, still negates their voice if not recognised by the classroom teacher (Singh, 1997).

This study found that female students preferred to work in groups rather than independently, the norm in ICT classrooms as supported by a number of research projects carried out over the last twenty years (Sanders, 2006, Barnes & Todd, 1995, Edwards & Westgate, 1994, Edwards & Mercer, 1987). Collaborative learning involves the social and cultural perceptions of all participants. Talk is central to this process, as it is the secondary medium of interaction, which enables learners to make explicit what they know, understand and can do. Female students define their collaborative learning as, 'talking' about the assignment tasks, whereas male students refer to it as, 'finding out' about the tasks. Computers alter the structure of talk in the classroom and act as a focus for effective collaborative group work (Loveless, 2003, Wegerif and Scrimshaw, 1997).

Research focussing on classroom discourse (Nayak and Kehily, 1996) found that, for male students, difficulties presented by social constraints can be as difficult to negotiate as the tasks themselves. The language male students employ often restricts their freedom to experiment with words and ideas and they can be highly reticent to challenge peer pressure. When male students experiment verbally, they are sometimes able to enrich their work through intertextual references and humour, but this can have the potential to trivialise issues or to distract from the task as they adjust their behaviour in order to avoid attention being directed at them. Many male students have problems conforming to a macho stereotype, often the butt of homophobic teasing and exclusion from the main group (Nayak & Kehily, 1996). They can become emotionally isolated and victims of a male 'culture of cruelty' (Foster, 2001) that promotes a particular version of masculinity that ignores the existence of sexuality, promoting homophobia and misogyny (Wayne & Meyenn, 2001). This vigilant monitoring of deviation from male heterosexual norms exerts great social pressure and this process makes group work more difficult to negotiate for male students than for female students. It is through verbally articulated displays of seeming homophobia, that the dominant male students in school often set the mood of an anti-school, anti-female culture (Nayak & Kehily, 1996).

Male students frequently express both implicitly and explicitly, the view that conformity to educational expectations is feminine. Thus, it is much less problematic for female students to conform to school expectations in this respect. Moreover, the ways in which male students are expected by their peers to behave, is often counter to school expectations, requiring them to demonstrate very fine skills of dexterity in order to satisfy the conflicting pressures of their peers and the school. Female students' behaviour, however, gains approval not only from their peers, but also from the institution (Davies, 2003). When asked in the semi- structured interviews whether they would prefer to work in single gender ICT classes, the male students overwhelmingly responded that they preferred to work in mixed groups as the female students kept them on track, allowing the class to 'get on' and did not 'wind the teacher up'. Without their female peers, the male students felt that they would not learn as much and spend too much time off task, illicitly playing games. In response to the same question, the female students generally did not want, for social reasons, to be taught in single gender classes, but did acknowledge that if they did so they would get more work done. When responding to The Theory of Planned Behaviour question on the motivation to comply regarding the desire to please their teacher (see Appendix 2, result 35) female students had a statistically significant more positive response than the male students. These results confirm Davies' (2003) conclusion that female students' behaviour in the classroom is perceived not only as conformist but also 'right'. If male students, however, do not conform this may not be perceived in the same way by their peers.

As discussed at length in Chapter 5 of this study, the students questioned and interviewed had differing learning preferences and very different attitudes to traditional approaches to learning in ICT – working competitively in front of a computer screen. Male students are more willing to sacrifice deep understanding, which requires sustained effort, for correct answers achieved at speed (Riding & Rayner, 2005, Arnot et al., 1998). Female students, however, prefer to work collaboratively and consequently find it unproblematic to learn from Project Based Learning that entails tasks that are open-ended, process-based and related to realistic situations. This way of learning can enhance students', both female and male, intrinsic interest in subject matter and define the learning taking place. In order to do so, however, teachers must ensure familiar classroom rituals are not replicated – male students dominating, simplistic topics that do not warrant deep learning or over complex constant teacher input. Teachers need to consciously facilitate and plan for collaborative learning and teaching, ensuring them not to slip into the familiar solutions of teacher directed models of classroom organisation (Westwood, 2006, Dolmans et al., 2001).

The research evidence gathered in this study suggests that schools have yet to become major engines of gender transformation with regard to female students' attitudes to ICT. Gender socialisation today continues to refer to ongoing, multi level processes of social expectations, control and struggle that both sustain and subvert gender systems and their formations. Multiple institutions impact upon these gender formations, attitudes and beliefs beyond the context of the classroom: parental attitudes in the home, leisure habits, friendships, perceived earning power and the mass media are institutions that simultaneously shape and are shaped by individual agencies (Bourdieu, 1977). The classroom may not be the only major agent in teaching and reinforcing cultural expectations, but it is an opportunity not to be lost to work towards producing new and progressive identities for female students (Stromquist, 2007).

Gender differences cannot be dismissed. They must be recognised for the part they play in students' social and emotional worlds and the construction of their gender identities and performance (Desvaux & Devillard, 2009, Arnot, 2006). It is important for teachers to understand and see that behaviours and beliefs with regard to ICT are pervasive and systemic, not something occurring only in classrooms. This is partly to minimise blame and guilt, but also partly to help teachers achieve an accurate understanding of the scope of the issue. It also helps to bring them a little further along the path of being willing to consider gender as an explanation of why female students tend not to participate in the study of ICT post 16 (Saunders, 2005). The role that they play in challenging these constructions is therefore critical as, left un-challenged, teachers' attitudes in the class room, both in their methodology and relationships with students' learning, are a factor in the complex process whereby female students learn from an early age that the world of ICT is unequivocally associated with dominant masculinity.

7.2 A Political Need

Both women and men should have equal opportunities in education and employment, therefore, politically it is important to identify gender differences in attitudes and behaviours in ICT to provide some form of affirmative action. One well researched approach to finding out individuals' motivation is through the Theory of Planned Behaviour (TpB). Gender disparity exists in the ICT industry workforce and the lack of female participation in ICT, post 16 and beyond in the UK is a cause for concern (Desvaux & Devillard, 2009, Gras-Velazquez et al., 2009, Ofsted, 2009, The Women and Work Commission, 2009, The World Bank, 2009, Bell 2004, Ofsted 2004, Alexander, 2001).

> If we could persuade as many women as men to go into IT, we would have done a lot to overcome many current skill shortages. Women can and do excel at the technical stuff; women are also strong on key employability skills, such as communication skills, team working, business awareness, that are so vital to IT jobs
>
> (Alexander, 2001).

The TpB survey has produced data concerning the gender differences in attitudes and behaviours in the use of ICT, examining the contributing factors to the intent to study

ICT in order to inform classroom practice pragmatically and to increase the participation of female students.

Women continue, in their declining participation in the ICT industry (Gras-Velazquez et al., 2009, Arnot, 2002, Panteli et al., 1999, Taylor and Mounfield, 1994), to define themselves primarily as belonging to a given group outside the dominant white male, heterosexual, capitalist culture. These identities revolve around a 'subject position,' a key identity marker defined in this specific situation by, in this case, gender. Moreover, one of the key insights of post-modernism is that power is everywhere, including schools. Power saturates all social spaces and relations. Hence, multiple forms of resistance open up along every line of identity that is controlled or normalised (Best & Kellner, 1991).

Post-modern theory seeks to give voice to the silenced minorities, to represent individual experiences in whatever context, illuminating the social world, rather than seeking to subsume them in totalising metanarratives. This post-modern approach to research has sought to draw out and represent female students' experiences and their understanding of those experiences through deconstructing the experiences themselves.

The post positivist paradigm adopted for this study both values and encourages different approaches, encouraging insights that extend beyond the realm of measurable, discoverable facts and interrogating taken-for-granted assumptions about the ways in which science is understood (Agger,1991). Consequently, the TpB robustly explores female students' attitudes to studying ICT in this study, in order to uncover potentially oppressive assumptions and taken for granted definitions. Postmodernism supports an understanding of the roots of oppression and the misuse and exertion of power, but it does not necessarily provide us with an answer as to how to progress (Wright, 2005). Neither, necessarily, does The TpB. Key recommendations for working towards changing the attitudes of female students towards studying ICT can be formed, however, following the analysis of targeted TpB questions focussing on specific attitudes and intents.

7.3 Limitations of the Study

This research has verified that interventions must be directed towards female students' salient beliefs in order to successfully affect the attitudes that impact upon their intentions. That many of their behavioural, attitudinal and normative beliefs are entrenched before Key Stage 4 is a situation that is beyond the scope of this study. From early childhood, female students are part of a culture that sows the seeds for the intentions and behaviours they will carry out years later. Whether or not the female students' salient beliefs can be changed to the extent that they will override the weight of these prior established beliefs (Ajzen, 1971) is not a given factor in this study.

Whatever the objectives of teachers who, through, teaching styles, role models and positive image reinforcement, aim to encourage female students to study ICT post 16 and beyond, not all interventions will make the desired impact. This study has limitations in its focus on students who are already studying at Key Stage 4. The Theory of Planned Behaviour cannot diagnose the intervention that will be most effective and when the interventions should ideally take place.

Both further data gathering and analysis at Key Stage 2, Key Stage 3, post 16 and beyond would give teachers valuable further information. This research, whilst comprehensive in the rich, triangulated data it provides, has not charted female students' individual developments or the significance of those changes (Cohen et al., 2007). An ongoing, longitudinal study may be more accurate in highlighting where female students' attitudes and beliefs are less entrenched against ICT. By identifying attitudes and beliefs earlier, more positive effective interventions could be introduced in order to not only change salient beliefs but also to strengthen positive attitudes before the dominant masculinity of classroom ICT culture is entrenched.

7.4 Contribution to Knowledge and Further Research

This study has investigated and reported the beliefs, attitudes and intention of female students to study ICT post 16 and beyond, irrespective of their socio-economic backgrounds or ethnicity. Triangulated with a series of semi-structured interviews, The Theory of Planned Behaviour was used to help provides a comprehensive picture of the beliefs, attitudes and intentions of the participants in this study in order to make an original contribution to knowledge.

Prior to this study no research had been undertaken that identified the behavioural, normative and control beliefs of female students with regard to the subject of ICT in order to address, rather than acknowledge, the continuing problems of gender imbalance in female participation in ICT, post 16. Prior research has focussed on the impact of redistributive polices that seek to readdress the gender imbalance in the ICT industry from within. What has not been addressed, until this study, are the beliefs that female students hold that lead to their lack of participation in ICT post 16 and beyond into Higher Education and the ICT industry. This study identifies that there are gender differences in the behavioural, normative and control beliefs that female students hold towards ICT. These are the beliefs that ultimately lead to the attrition of women from the ICT industry. Significantly, this study has examined the differences in these beliefs in order to pragmatically inform classroom practice and increase the participation of female students at post 16. Only by understanding and acknowledging that female students hold beliefs regarding ICT that may lead them to under participate in post 16 ICT study can schools construct learning and teaching environments that begin to challenge and change those beliefs. If these beliefs, attitudes and intentions that potentially deter female students from the uptake of ICT post 16 and beyond, are highlighted to teachers, pragmatic strategies and the recommendations that are proposed in this study can be put into place to address the problem.

Aveling (2002) describes ICT University Departments as having a 'dominant masculinity.' Despite feminist scholarship's place in academia, there has been little feminist research that challenges the norm of that 'masculinity' within schools and university ICT departments. There is little reflective attention given to the attrition of women from both the uptake of the study of ICT and the ICT industry. Historically men have dominated academic settings and created a male 'scientific' culture characterised by the masculine and grounded in academic machismo (Letherby, 2003). That this dominance should be challenged in our classrooms is essential if women are to fully participate in the ICT industry (Mitchell, 2005) and this study begins to take up that challenge, making a contribution to knowledge in its pragmatic, action research based, recommendations to teachers, schools, The Department for Education and the Government.

Further research should explore the post 16 destinations of female students who were taught and mentored by female ICT professionals in secondary school learning environments specifically constructed to facilitate learning styles that appeal to female students comparative to the destinations of female students who were taught by male teachers in traditional ICT learning environments. Learning environments that either, consciously or unconsciously, create the 'club house' 'locker room' atmosphere of ICT classrooms, dominated by male teachers for male students, engaged in competitive, 'independent' learning (Strok, 1992, Margolis & Fisher, 2002, Webster, 2005). Additionally, more research needs to take place to monitor closely the impact of single sex groupings in both single gender and mixed schools, tracking further study and destinations over a period of time.

Furthermore, all control beliefs and factors that constitute the normative beliefs that lead to behavioural intent, warrant further research in order to understand fully the factors that lead to female students' under participation in post 16 study of ICT and beyond. In the meantime, schools and classroom teachers can actively work towards a more equitable world by being aware that the demands of the curriculum and expectations of teachers, course specifications, role models and learning styles influence the attitudes and intentions of female students.

More study on how the comfort levels of female students correlates with post 16 uptake of ICT is pertinent. Replications of this study including, at least the top TpB predictors, should be undertaken to find out whether these are important over and above factors in ICT classrooms that lead to the under participation of female students in the study of ICT post 16. In order to study the effect of comfort level, studies that investigate differing ICT class sizes and differing teaching/learning styles should be undertaken in the newly created, 'flagship' Academies. Additionally, research should be conducted that investigates why the female students who chose to pursue ICT post 16 did so. This would probably necessitate an intense qualitative research effort and could include influences even back into childhood and personality traits such as confidence, conscientious and perseverance as well as work style preference.

7.5 Recommendations

Teachers

Teachers can begin to address the issue of under representation of female students in the study of ICT post 16 following a recognition and an understanding that students' ability in a subject is not the primary factor in subject option choice and post 16 study and that gendered option choices remain a socially (and internationally) divisive cause for concern. Teachers have to understand that female students have gendered beliefs and attitudes regarding the subject, acknowledging that many of their female students (and some male) find the subject boring, tedious, 'nerdy' and alienating. By recognising the problem teachers can pragmatically work towards solutions in order to circumvent the attitudes female students hold with regard to ICT. Teachers must actively strive towards creating new norms in ICT classrooms that can change female students' salient beliefs regarding the subject. This can be undertaken in a number of ways.

Teachers' function as role models is key and their impact as both positive and negative role models must be consciously acknowledged. How teachers both apply and refer to ICT in their classrooms, whatever their subject area, can change salient beliefs if female students perceive them as being enthusiastic and engaged by the subject. What is important with regard to role models is not necessarily knowledge but the attitudes of the teachers themselves. Teachers must make the benefits of further study and career pathways in ICT overt and real, dispelling the 'anorak' stereotype in constant and multifaceted information, images, anecdotes and modelling. Another practical change teacher can effect in order to encourage change the salient beliefs of female students is in the selection of materials.

The materials teachers select should reflect all gender interests, destroying stereotypes explicitly, and in turn, all students should be central to their own learning in lessons – modelling, interacting, presenting and demonstrating, in a variety of ways and situations. Female students' ability in the subject must be highlighted and their male peers' higher self-efficacy actively contextualised and moderated in order to enhance female students' normative control beliefs.

To maximise learning for all students in ICT classrooms, teachers also need to ensure that they actively incorporate a variety of learning preferences, work and teaching styles into their lessons. Student centred learning requires focussed planning and review but doing so will lead to lessons where the dominant focus is not on the traditional masculinisation of the subject that constitutes competitive learning in front of a computer screen. This teaching style alienates not only most female students but also some male students. ICT should instead be a focus for interaction in the classroom and its capacity for collaboration and demonstration maximised in every lesson. It is the teacher's job to harness the capacity of ICT to offer a wide variety of sophisticated and dynamic interaction opportunities to support problem solving, investigation, experimentation and hypothesising.

Planning should incorporate flexible use of Web 2.0 and Mobile Technologies that have the potential to facilitate interaction, discussion and collaboration in ways that many teachers have not considered. This is a relatively new environment for some teachers and every opportunity must be taken to embed the use of these emergent technologies into environments that are free from social norms that are in any way 'traditional', whether in presumptions of the expert/novice model of education or in gender expectations. Female students' direct and specific experiences in using mobile technology- blogging, wiki spaces, social networking and sharing information- should be harnessed directly and systematically. Teachers must focus on the positives of an e-environment – the collaboration and opportunities to explore material never before possible in a classroom and move away from the model whereby students are limited in their ICT experiences which, to students, is reductivist. Students are able to multi-task confidently using technology but have been reduced to using this skill subversively in the classroom, surfing the internet and game playing. Web 2.0 technologies foster multi-skilled use in the classroom and therefore remove female students from the stereotypical 'hacker' culture where their male peers' misuse of ICT has often detracted from their own learning. If embraced by teachers the celebration of Web 2.0 and mobile technologies will place female students in a learning environment where their skills and preferred ways of working can be at the centre of learning not on the periphery. When this is the case it is more likely that female students' salient beliefs with regard to ICT will be changed, leading, consequently, to more post 16 participation in ICT study.

Schools

Overarching school policy is also an important factor in creating an ethos and culture conducive to changing female students' salient beliefs. Schools must recognise that the impetus of the league tables should not drive all educational policy and practice. In order to address stereotypical post 16 option and career choices that still predominate in the UK, leading to pipeline shrinkage in ICT, it is essential that schools actively promote a culture where this social norm is robustly and pragmatically challenged.

Student progress in ICT (and in all subjects where stereotypical gendered option choices are the contextual norm) must go beyond evaluating success in relation to academic achievement at the end of a Key Stage. The current educational focus on Assessing Pupil Progress (APP) highlights the importance of a structured approach to in-school assessment that aims to ensure teachers make judgements about their students' attainment to develop and refine their understanding of student progression in their subject across Key Stages. APP is particularly pertinent to this study as, if it is fully implemented in schools; female students' lack of participation in the study of ICT post-16 will be highlighted. This should inform curriculum planning to match teaching to all students' needs.

Of primary importance, therefore, is rigorously analysing post 16 option choice and destination data when evaluating teaching and learning. Accountability is the answer and if Leadership Teams require destination data to be part of departmental review, teachers will more systematically reflect and act upon their teaching styles and methods in the light of those option choices and destinations.

Importantly the impact of Key Stage 4 Vocational Diploma Courses must be closely monitored with regard to post 16 option choice. The initial popularity of the courses for female students must not, through their potential lack of challenge, lead to a further decrease in the number of female students opting to study ICT post 16. Female students are attracted to the course content and its strong coursework bias but find it as 'tedious' and 'boring' as the GCSE courses it replaced due to its delivery and the low expectations made of them as participants in their learning environments.

Schools should investigate opportunities to establish mentoring programmes in order to provide female students with female role models who are involved with further study of ICT or work in the ICT industry. Role models can include peer mentoring and modelling with classes or the school community; non-teachers or external representatives from industry or business who provide work experience opportunities or participate in assemblies; subject enhancement days; special projects; discussion forums; blogs and video blogs. Self-efficacy is very important with regard to option and career choice and there is a link between self-confidence and female role models, who include their mothers and other female family members. If they are enthusiastic with regard to ICT, this can be an important influence. Introducing Family Learning with a focus on enjoying ICT and its career opportunities can be a positive way for schools to support female students' potential post 16 option choices.

Opportunities offered to engage female students by using Web 2.0 and Mobile technologies in the classroom must be embraced by schools through investment and training. Not to do so will be an opportunity missed given these technologies' power to change salient beliefs with regard to ICT as the use of Web 2.0 and Mobile technologies in the classroom can motivate female students in their capacity to build on their enthusiasm for net working and interaction, both in and out of school. Virtual Learning Environments, school web sites and e-portfolios can all build on collaborative learning between home, school, students, parents and teachers. Through a range of technologies that include blogging, pod casting, instant messaging, multi-player gaming and wikis, new associations and beliefs can be created with regard to the subject. The culture of the classroom created by Web 2.0 and Mobile technologies should be radically different but this will only be possible if schools ensure that creating e-environments are part of their school development plans.

Schools should also investigate opportunities to establish single sex teaching groups to address negative attitudes to ICT and technology held by female students in a more robust manner. These classes, however, should be rigorously monitored to ensure that attitudes to the subject are being enhanced. Staffing of single sex groups is key as staff who have high self-efficacy themselves, with regard to ICT, are likely to affect the, salient beliefs of their students.

The use of cross-curricular ICT is important and, again, positive role models and the implementation of learning and teaching styles that challenge salient beliefs regarding ICT can be utilised. Integrating ICT for instance into areas where communication and discussion are central to the curriculum, such as foreign languages or English teaching provides ongoing positive uses of ICT for female students.

Schools must recognise the relationship between academic achievements and post 16 option choices and beyond is weak. The attitudes of not only female students but also male students, staff and parents must be challenged if schools are going to change effectively the attitudes that female students currently hold that lead, ultimately, to pipeline shrinkage.

The Department for Education

I concur with the recommendation of The Women and Work Commission (2009) that the Department for Education needs to make breaking down gender stereotypes a much higher priority. Gender equality issues should be considered as a matter of course across all their initiatives and policies. Ideally, this should include a national strategy that is accountable to Ofsted with specific targets and goals for tackling stereotypes. This should include, with regard to both schools and the careers service, destination and employment outcomes for female students.

It is also important that impact projects to support the underachievement of boys are monitored more closely in order to ensure that they do not have negative effects on the attitudes and beliefs of female students across all Key Stages.

The Training and Development Agency

All Post Graduate Certificate of Education and Graduate Teacher Training programmes should be actively encouraged to include courses and assignments that focus on inspiring methods to support female student teachers' emergent interest in either teaching ICT or developing cross-curricular ICT across all subject areas and key stages, including the creative use of Web 2.0 and Mobile technologies. Courses should include specifically gender-focussed material to address overtly the attitudes and beliefs student teachers hold with regard to ICT in order to break the cycle of stereotypical, negative attitudes that are currently reinforced in classroom contexts. Trainee teachers must be made aware of the ongoing concerns with regard to gender stereotyping and post 16 option choices that must be addressed by their teaching, not perpetuated. Tutors and mentors should be encouraged to ensure that trainee teachers meet the cluster of inclusion and wellbeing Qualified Teacher Status Standards robustly.

The Government

The Government should actively support and publicise redistributive initiatives such as The European Commission Code of Practice (2009). The Government should work with both the private and public sectors, both in legislative and non-legislative ways, to promote best practice and look at what more the public sector can do on a local level to provide the links between women looking for work and employers, including work experience opportunities for female students and teachers. Appropriate use of existing laws and regulations should be actively enforced in order to address persistent discrimination, such as lack of opportunities for flexible working hours and return to work training. More women in the ICT industry with positive attitudes to their place of work will affect young women and their families in both providing positive role models and supporting positive beliefs and attitudes with regard to ICT.

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Appendix I

Questionnaire

YEAR 11 GCSE
Theory of planned Behaviour Questionnaire

Dear Year 11 Students,

Thank you if you agree to participate in this study that is part of my work at The University of Greenwich. I am researching how students' feelings about GCSE ICT may influence Post-16 option choices and the factors that are important to students in order to succeed in ICT. My results will be explained to you and your teachers when the work is completed.

Your individual responses to this questionnaire will be kept confidential in a database, and will be destroyed after the data is gathered and analysed. Everything is anonymous: even the name of your school is not used!

Participation is optional. If you fill in this questionnaire then this means you have consented to help with my University research.

Please read the questions carefully and be as honest and accurate as you possibly can so that the data given to the researcher can be relied upon to analyse this subject.

Thank you for your participation.

Maurice Nyangon

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HOW TO SCORE YOUR QUESTIONNAIRE

Many questions in this survey make use of rating scales with 4 places; you are to circle the number that best describes your opinion. For example, if you were asked to rate "The Teaching of KS4 ICT at your school" on such a scale, the 4 places should be interpreted as follows:

The Teaching of KS4 ICT at your school

Very Bad 1 2 3 4 **Very Good**

If you think the Teaching of KS4 ICT at your school is very good, then you would circle the *number 4*, as follows:

The Teaching of KS4 ICT at your school:

Very Bad 1 2 3 4 **Very Good**

OR If you think the Teaching of KS4 ICT at your school is good, then you would circle the *number 3*, as follows:

The Teaching of KS4 ICT at your school:

Very Bad 1 2 3 4 **Very Good**

OR If you think The Teaching of KS4 ICT at your school is bad, then you would circle the *number 2*, as follows.

The Teaching of KS3 ICT at your school is:

Very Bad 1 2 3 4 **Very Good**

OR If you think the Teaching of KS4 ICT at your school is very bad, then you would circle the *number 1*, as follows:

The Teaching of KS4 ICT at your school:

Very Bad 1 2 3 4 **Very Good**

In making your ratings, please remember the following points:

*** BE SURE TO ANSWER ALL QUESTIONS – DO NOT OMIT ANY.**

*** NEVER CIRCLE MORE THAN ONE NUMBER ON A SINGLE SCALE.**

Section 1 [Background Data]

KS3 ICT Level: ____________________

Gender: (Circle one)		
Your Gender	Male	Female
The Gender of your teacher:	Male	Female

Your Work / Study Style Preference: (Circle one)			
Observation and note taking (Visual learners)	Hearing, discussion and Listening (Auditory learners)	By doing practical work (Kinaesthetic learners)	Touching and working silently on the computer (Tactile learners)

Section 2: What ICT means to you

What words come to mind when you hear the term 'ICT'? List 4 words.

1. Computers
2. Internet
3. Games
4. Money
5. Boredom
6. Work
7. Business
8. Fun

Section 3: Outcome Evaluations

1. For me to gain a better understanding of the subject matter in my ICT course would be:

Extremely Bad 1 2 3 4 **Extremely Good**

2. For me to do well and get a high grade in my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

3. For me to have an opportunity to interact with the teacher and other students in my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

4. For me to miss being with my friends in the same class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

5. For me to keep up with my studies in my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

6. For me to develop good study habits, self-discipline and a feeling of self-satisfaction would be:

Extremely Bad 1 2 3 4 **Extremely Good**

7. My missing out on activities outside of my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

8. My getting information and explanations regarding materials to be covered on tests in my ICT class is:

Extremely Bad 1 2 3 4 **Extremely Good**

9. My being subjected to tedium and boredom is:

Extremely Unlikely 1 2 3 4 **Extremely**

Likely

10. Getting part time work is more likely due to studying this subject:

Extremely Unlikely 1 2 3 4 **Extremely**

Likely

[Past Behaviour: Self-Report]

11. During the past 2 Terms, what percentage of meetings of this class have you attended?

During the past 2 Terms, I have attended about ____ % of the meetings of this class.

Section 4

[Direct Measures of Perceived Behavioural Control, Subjective Norm, Attitude, and Intention]

12. For me to study ICT in Post 16is:

Extremely difficult 1 2 3 4 **Extremely easy**

13. Most people who are important to me think that:

I should not study ICT in Post 16 1 2 3 4 **I should**

14. For me to study ICT in Post 16is:

Extremely Bad 1 2 3 4 **Extremely Good**

15. I plan to study ICT beyond the Post 16level:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

16. Whether or not I study ICT in Post 16is completely up to me:

Strongly disagree 1 2 3 4 **Strongly agree**

17. Most of the students in this class with whom I am acquainted intend to study ICT in Post 16:

Definitely false 1 2 3 4 **Definitely true**

18. For me to study ICT in Post 16is:

Extremely worthless 1 2 3 4 **Extremely valuable**

19. I am confident that if I wanted to I could to study ICT in Post 16

Definitely false 1 2 3 4 **Definitely true**

20. It is expected of me that I study ICT in Post 16:

Definitely false 1 2 3 4 **Definitely true**

21. For me to study ICT in Post 16would be:

Extremely unpleasant 1 2 3 4 **Extremely pleasant**

22. I will make an effort to study ICT beyond the Post 16level:

I definitely will not 1 2 3 4 **I definitely will**

23. For me to study ICT in Post 16is:

Impossible 1 2 3 4 **Possible**

24. Most people whose opinions I value would approve of my studying ICT in Post 16:

Strongly disagree 1 2 3 4 **Strongly agree**

25. For me to study ICT in Post 16is:

Boring 1 2 3 4 **Interesting**

26. I intend to study ICT in Post 16:

Strongly disagree 1 2 3 4 **Strongly agree**

[Motivation to Comply]

27. Generally speaking, how much do you care what the teacher of this course thinks you should do?

Not at all 1 2 3 4 **Very Much**

28. Generally speaking, how much do you care what your parents think you should do?

Not at all 1 2 3 4 **Very Much**

29. Generally speaking, how much do you care what your close friends think you should do?

Very Much 1 2 3 4 **Not at all**

30. Generally speaking, how much do you care what your classmates think you should do?

Very Much 1 2 3 4 **Not at all**

[Behavioral Beliefs]

31. To study ICT in Post 16will help me to gain a better understanding of the subject matter of this course:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

32. To study ICT in Post 16will help me to do well and get a good career in the future:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

33. To study ICT in Post 16will give me an opportunity to interact with more interesting people:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

34. To study ICT in Post 16will cause me to miss my friends:

Extremely Likely 1 2 3 4 **Extremely Unlikely**

35. To study ICT in Post 16will help me to keep up with my peers' earning power:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

36. To study ICT in Post 16will help me to develop good study habits, self-discipline and a feeling a self-satisfaction:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

37. To study ICT in Post 16will make me miss out on activities outside college:

Extremely Likely 1 2 3 4 **Extremely Unlikely**

38. To study ICT in Post 16will help me to improve my intellectual powers:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

39. To study ICT in Post 16will subject me to tedium and boredom:

Extremely Likely 1 2 3 4 Extremely Unlikely

[Control Beliefs]

40. How often do you encounter unanticipated events that place demands on your time?

Very frequently 1 2 3 4 **Very rarely**

41. How often do you feel ill, tired or listless?

Very frequently 1 2 3 4 **Very rarely**

42. How often do family obligations place unanticipated demands on your time?

Very frequently 1 2 3 4 **Very rarely**

43. How often does work or employment place unanticipated demands on your time?

Very frequently 1 2 3 4 **Very rarely**

44. How often do other courses place heavy demands on your time?

Very frequently 1 2 3 4 **Very rarely**

45. How often do you fail to do the assignments of this course on time?

Very frequently 1 2 3 4 **Very rarely**

[Power of Control Factors]

46. If I encountered unanticipated events that placed demands on my time, it would make it more difficult for me to study ICT beyond the Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

47. If I felt ill, tired, or listless, it would make it more difficult for me to study ICT beyond the Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

48. If I had family obligations that placed unanticipated demands on my time, it would make it more difficult for me to study ICT in Post 16:

Strongly disagree 1 2 3 4 **Strongly agree**

49. If work or employment placed unanticipated demands on my time, it would make it more difficult to study ICT in Post 16:

Strongly disagree 1 2 3 4 **Strongly agree**

50. If other classes placed heavy demands on my time, it would make it more difficult for me to study ICT beyond the Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

51. If I failed to do the assignments for this course on time, it would make it more difficult for me to study ICT in Post 16:

Strongly disagree 1 2 3 4 **Strongly agree**

[Normative Beliefs]

52. The teacher of this course thinks that I should study ICT in Post 16:

Extremely unlikely 1 2 3 4 **Extremely likely**

53. My parents think that I should study ICT beyond the Post 16level:

Extremely unlikely 1 2 3 4 **Extremely likely**

54. My close friends think that I should study ICT in Post 16:

Extremely unlikely 1 2 3 4 **Extremely likely**

55. My classmates think that I should study ICT in Post 16:

Extremely unlikely 1 2 3 4 **Extremely likely**

Ethnicity

Please tick the ethnic group that you think best applies to you

White

- [ ] British
- [ ] Irish
- [ ] Traveller of Irish Heritage
- [ ] Gypsy/Roma
- [ ] Any other White background

Mixed

- [ ] White and Black Caribbean
- [ ] White and Black African
- [ ] White and Asian
- [ ] Any other mixed background

Asian or Asian British

- [ ] Indian
- [ ] Pakistani
- [ ] Bangladeshi
- [ ] Any other Asian background

Black or Black British

- [ ] Caribbean
- [ ] African
- [ ] Any other Black background

[ ] **Chinese**

[ ] **Any other ethnic background**

[ ] **I do not wish an ethnic background category to be recorded**

POST 16GCE

Theory of planned Behaviour Questionnaire

Thank you if you agree to participate in this study that is part of my work at The University of Greenwich. If you fill in this questionnaire then this means, you have consented to help with my University research. I am researching how students' feelings about GCSE ICT may influence Post-16 option choices and the factors that are important to students in order to succeed in ICT. My results will be explained to you and your teachers when the work is completed.

Your individual responses to this questionnaire will be kept confidential in a database, and will be destroyed after the data is gathered and analysed. Everything is anonymous; even the name of your school is not used!

Please read the questions carefully and be as honest and accurate as you possibly can so that the data given to the researcher can be relied upon to analyse this subject.

Thank you for your participation.

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HOW TO SCORE YOUR QUESTIONNAIRE

Many questions in this survey make use of rating scales with 4 places; you are to circle the number that best describes your opinion. For example, if you were asked to rate "The Teaching of Post 16ICT at your school on such a scale, the 4 places should be interpreted as follows:

The Teaching of Post 16ICT at your school is:

Very Bad	1	2	3	4	**Very Good**

If you think the Teaching of Post 16ICT at your school is very good, then you would circle the *number 4*, as follows:

The Teaching of Post 16ICT at your school is:

Very Bad	1	2	3	4	**Very Good**

OR If you think the Teaching of Post 16ICT at your school is good, then you would circle the *number 3*, as follows:

The Teaching of Post 16ICT at your school is:

Very Bad	1	2	3	4	**Very Good**

OR If you think The Teaching of Post 16ICT at your school is bad, then you would circle the *number 2*, as follows.

The Teaching of Post 16ICT at your school l is:

Very Bad	1	2	3	4	**Very Good**

OR If you think the Teaching of KS4 ICT at Your school is very bad, then you would circle the *number 1*, as follows:

The Teaching of Post 16ICT at your school is:

Very Bad	1	2	3	4	**Very Good**

In making your ratings, please remember the following points:

*** BE SURE TO ANSWER ALL QUESTIONS – DO NOT OMIT ANY.**

*** NEVER CIRCLE MORE THAN ONE NUMBER ON A SINGLE SCALE**

Section 1 [Background Data]

GCSE ICT Grade: ____________________

Gender: (Circle one)		
Your Gender	Male	Female
The Gender of your teacher:	Male	Female

Post 16Courses:	
1.	2.
3.	4.

Your Work / Study Style Preference: (Circle one)			
Observation and note taking (Visual learners)	Hearing, discussion and Listening (Auditory learners)	By doing practical work (Kinaesthetic learners)	Touching and working silently on the computer (Tactile learners)

Section 2: What ICT means to you

What words come to mind when you hear the term 'ICT'? List 4 words.	
5. Computers	5. Boredom
6. Internet	6. Work
7. Games	7. Business
8. Money	8. Fun

Section 3 [Outcome Evaluations]

1. For me to gain a better understanding of the subject matter in my ICT course would be:

Extremely Bad 1 2 3 4 **Extremely Good**

2. For me to do well and get a high grade in my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

3. For me to have an opportunity to interact with the teacher and other students in my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

4. For me to miss being with my friends in the same class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

5. For me to keep up with my studies in my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

6. For me to develop good study habits, self-discipline and a feeling of self-satisfaction would be:

Extremely Bad 1 2 3 4 **Extremely Good**

7. My missing out on activities outside of my ICT class would be:

Extremely Bad 1 2 3 4 **Extremely Good**

8. My getting information and explanations regarding materials to be covered on tests in my ICT class is:

Extremely Bad 1 2 3 4 **Extremely Good**

9. My being subjected to tedium and boredom is:

Extremely Unlikely 1 2 3 4 **Extremely**

Likely

10. Getting part time work is more likely due to studying this subject:

Extremely Unlikely 1 2 3 4 Extremely Likely

[Past Behaviour: Self-Report]

11. During the past 2 Terms, what percentage of meetings of this class have you attended?

During the past 2 Terms, I have attended about ____ % of the meetings of this class.

Section 4

[Direct Measures of Perceived Behavioural Control, Subjective Norm, Attitude, and Intention]

12. For me to study ICT beyond Post 16level would be:

Extremely difficult 1 2 3 4 **Extremely easy**

13. Most people who are important to me think that:

I should not study ICT beyond Post 16level 1 2 3 4 **I should**

14. For me to study ICT beyond Post 16level would be:

Extremely Bad 1 2 3 4 **Extremely Good**

15. I plan to study ICT beyond Post 16level:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

16. Whether or not I study ICT beyond Post 16level would be completely up to me:

Strongly disagree 1 2 3 4 **Strongly agree**

17. Most of the students in this class with whom I am acquainted intend to study ICT beyond Post 16level:

Definitely false 1 2 3 4 **Definitely true**

18. For me to study ICT beyond Post 16level is:

Extremely worthless 1 2 3 4 **Extremely valuable**

19. I am confident that if I wanted to I could to study ICT beyond Post 16level:

Definitely false 1 2 3 4 **Definitely true**

20. It is expected of me that I study ICT beyond Post 16level:

Definitely false 1 2 3 4 **Definitely true**

21. For me to study ICT beyond Post 16level would be:

Extremely unpleasant 1 2 3 4 **Extremely pleasant**

22. I will make an effort to study ICT beyond Post 16level:

I definitely will not 1 2 3 4 **I definitely will**

23. For me to study ICT beyond Post 16level is:

Impossible 1 2 3 4 **Possible**

24. Most people whose opinions I value would approve of my studying ICT beyond the Post 16level:

Strongly disagree	1	2	3	4	**Strongly agree**

25. For me to study ICT beyond Post 16level is:

Boring	1	2	3	4	**Interesting**

26. I intend to study ICT beyond Post 16level:

Strongly disagree	1	2	3	4	**Strongly agree**

[Motivation to Comply]

27. Generally speaking, how much do you care what the teacher of this course thinks you should do?

Not at all	1	2	3	4	**Very Much**

28. Generally speaking, how much do you care what your parents think you should do?

Not at all	1	2	3	4	**Very Much**

29. Generally speaking, how much do you care what your close friends think you should do?

Very Much	1	2	3	4	**Not at all**

30. Generally speaking, how much do you care what your classmates think you should do?

Very Much	1	2	3	4	**Not at all**

[Behavioral Beliefs]

31. To study ICT beyond Post 16level will help me to gain a better understanding of the subject matter of this course:

Extremely Unlikely	1	2	3	4	**Extremely Likely**

32. To study ICT beyond Post 16level will help me to do well and get a good career in the future:

Extremely Unlikely	1	2	3	4	**Extremely Likely**

33. To study ICT beyond Post 16level will give me an opportunity to interact with more interesting people:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

34. To study ICT beyond Post 16level will cause me to miss my friends:

Extremely Likely 1 2 3 4 **Extremely Unlikely**

35. To study ICT beyond Post 16level will help me to keep up with my peers' earning power:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

36. To study ICT beyond Post 16level will help me to develop good study habits, self-discipline, and a feeling a self-satisfaction:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

37. To study ICT beyond Post 16level will make me miss out on activities outside college:

Extremely Likely 1 2 3 4 **Extremely Unlikely**

38. To study ICT beyond Post 16level will help me to improve my intellectual powers:

Extremely Unlikely 1 2 3 4 **Extremely Likely**

39. To study ICT beyond Post 16level will subject me to tedium and boredom:

Extremely Likely 1 2 3 4 **Extremely Unlikely**

[Control Beliefs]

40. How often do you encounter unanticipated events that place demands on your time?

Very frequently 1 2 3 4 **Very rarely**

41. How often do you feel ill, tired or listless?

Very frequently 1 2 3 4 **Very rarely**

42. How often do family obligations place unanticipated demands on your time?

Very frequently 1 2 3 4 **Very rarely**

43. How often does work or employment place unanticipated demands on your time?

Very frequently 1 2 3 4 **Very rarely**

44. How often do other courses place heavy demands on your time?

Very frequently 1 2 3 4 **Very rarely**

45. How often do you fail to do the assignments of this course on time?

Very frequently 1 2 3 4 **Very rarely**

[Power of Control Factors]

46. If I encountered unanticipated events that placed demands on my time, it would make it more difficult for me to study ICT beyond Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

47. If I felt ill, tired, or listless, it would make it more difficult for me to study ICT beyond Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

48. If I had family obligations that placed unanticipated demands on my time, it would make it more difficult for me to study ICT beyond Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

49. If work or employment placed unanticipated demands on my time, it would make it more difficult to study ICT beyond Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

50. If other classes placed heavy demands on my time, it would make it more difficult for me to study ICT beyond Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

51. If I failed to do the assignments for this course on time, it would make it more difficult for me to study ICT beyond Post 16level:

Strongly disagree 1 2 3 4 **Strongly agree**

[Normative Beliefs]

52. The teacher of this course thinks that I should study ICT beyond Post 16level:

Extremely unlikely 1 2 3 4 **Extremely likely**

53. My parents think that I should study ICT beyond Post 16level:

Extremely unlikely 1 2 3 4 **Extremely likely**

54. My close friends think that I should study ICT beyond Post 16level:

Extremely unlikely 1 2 3 4 **Extremely likely**

55. My classmates think that I should study ICT beyond Post 16level:

Extremely unlikely 1 2 3 4 **Extremely likely**

Ethnicity

Please tick the ethnic group that you think best applies to you

White

- [ ] British
- [ ] Irish
- [ ] Traveler of Irish Heritage
- [ ] Gypsy/Roma
- [ ] Any other White background

Mixed

- [ ] White and Black Caribbean
- [ ] White and Black African
- [ ] White and Asian
- [ ] Any other mixed background

Asian or Asian British

- [ ] Indian
- [ ] Pakistani
- [ ] Bangladeshi
- [ ] Any other Asian background

Black or Black British

- [ ] Caribbean
- [ ] African
- [ ] Any other Black background

[ ] **Chinese**

[ ] **Any other ethnic background**

[ ] **I do not wish an ethnic background category to be recorded**

Appendix 2

Field Descriptors and Results of the TpB Questionnaire

	Name	Type	Width	Decimals
1	ID	Numeric	8	0
2	School	Numeric	20	0
3	Gender	Numeric	20	0
4	TeacherGe	Numeric	20	0
5	KS3ICTGra	Numeric	15	0
6	GCSEICTG	String	8	0
7	Ethnicity	Numeric	10	0
8	StudyStyle	Numeric	20	0
9	Q1	Numeric	8	0
10	Q2	Numeric	8	0
11	Q3	Numeric	8	0
12	Q4	Numeric	8	0
13	Q5	Numeric	8	0
14	Q6	Numeric	8	0
15	Q7	Numeric	8	0
16	Q8	Numeric	8	0
17	Q9	Numeric	8	0
18	Q10	Numeric	8	0
19	Q11	Numeric	8	0
20	Q12	Numeric	8	0
21	Q13	Numeric	8	0
22	Q14	Numeric	8	0
23	Q15	Numeric	8	0
24	Q16	Numeric	8	0
25	Q17	Numeric	8	0
26	Q18	Numeric	8	0
27	Q19	Numeric	8	0
28	Q20	Numeric	8	0
29	Q21	Numeric	8	0
30	Q22	Numeric	8	0
31	Q23	Numeric	8	0
32	Q24	Numeric	8	0
33	Q25	Numeric	8	0
34	Q26	Numeric	8	0
35	Q27	Numeric	8	0
36	Q28	Numeric	8	0
37	Q29	Numeric	8	0
38	Q30	Numeric	8	0
39	Q31	Numeric	8	0
40	Q32	Numeric	8	0
41	Q33	Numeric	8	0
42	Q34	Numeric	8	0
43	Q35	Numeric	8	0

	Name	Type	Width	Decimals
44	Q36	Numeric	8	0
45	Q37	Numeric	8	0
46	Q38	Numeric	8	0
47	Q39	Numeric	8	0
48	Q40	Numeric	8	0
49	Q41	Numeric	8	0
50	Q42	Numeric	8	0
51	Q43	Numeric	8	0
52	Q44	Numeric	8	0
53	Q45	Numeric	8	0
54	Q46	Numeric	8	0
55	Q47	Numeric	8	0
56	Q48	Numeric	8	0
57	Q49	Numeric	8	0
58	Q50	Numeric	8	0
59	Q51	Numeric	8	0
60	Q52	Numeric	8	0
61	Q53	Numeric	8	0
62	Q54	Numeric	8	0
63	Q55	Numeric	8	0

	Label
1	N/A
2	The Schools
3	Your Gender
4	The Gender of your Teacher
5	Key Stage 3 ICT Grades
6	Key Stage 4 ICT Grades
7	Ethnicity
8	Prefered Learning Style
9	Gaining a better understanding
10	Gaining a hight ICT grade
11	Interacting with teacher & students
12	Missing my friends in the class
13	Keeping up with ICT studies
14	Developing good study habits
15	Missing out on activities outside ICT class
16	Information on ICT test material
17	Subjection to tedium and boredom
18	Gaining part time work due to ICT
19	Percentage of attendance
20	Ease of studying ICT Post 16
21	Views of people important to me
22	Studying ICT Post 16
23	Planning to study ICT Post 16
24	Is studying ICT Post 16 up to me
25	ICT class intentions
26	Worth of studying ICT Post 16
27	Confidence of ablility to study ICT at Post 16
28	Expectation that I study ICT at Post 16
29	How pleasant would it be to study ICT at Post 16
30	Effort to study ICT at Post 16
31	Possibility of studying ICT at Post 16
32	Approval of People I value to my studying ICT at Post 16
33	Interst level of studying ICT at Post 16
34	My intention to study ICT at Post 16
35	How much I care with regard to my teacher's opinion
36	How much I care with regard to my parents' opinion
37	How much I care with regard to my friends' opinion
38	How much I care with regard to my classmates' opinion
39	How will studying ICT at Post 16 help me to understand the su
40	Studying ICT at Post 16 will help me career wise
41	Studying ICT at Post 16 will give me more opportunities to inte
42	Studying ICT at Post 16 will cause me to miss my friends
43	To study ICT in Post 16 will keep up with peers' earing capacit

	Label
44	Development of good study habits
45	Missing out on activities outside University or college if I study
46	Improvement of my intellectual powers
47	Studying ICT at Post 16 will be tedious and boring
48	How often are there unanticipated demands on my time
49	How often do I feel ill or tired
50	How often do family make unanticipated demands on my time
51	How often does work make unanticipated demands on my tim
52	How often does the course make unanticipated demands on
53	How often do I fail to complete assignments
54	Would unanticipated demands make it more difficult to study I
55	Would illness or tiredness make it more difficult for me to stud
56	Would family demands make it more difficult for me to study I
57	Would work make it more difficult to study ICT in Post 16
58	Would other classes make it more difficult to study ICT at Post
59	Failure to complete assignments on time would make it more
60	My teacher thinks I should study ICT at Post 16
61	My parents think I should study ICT at Post 16
62	My close friends think I should study ICT at Post 16
63	My classmates think I should study ICT at Post 16

	Values	Missing	Columns	Align	Measure
1	None	None	8	Right	Scale
2	{1, The Leigh Technology Aca	None	8	Right	Nominal
3	{1, Male}...	None	9	Right	Nominal
4	{1, Male}...	None	12	Right	Scale
5	None	None	10	Right	Scale
6	{1, A}...	None	11	Right	Nominal
7	{1, Black}...	None	16	Right	Nominal
8	{1, Observation and note taki	None	9	Right	Nominal
9	{1, Extremely Bad}...	None	8	Right	Scale
10	{1, Extremely Bad}...	None	8	Right	Scale
11	{1, Extremely Bad}...	None	8	Right	Scale
12	{1, Extremely Bad}...	None	8	Right	Scale
13	{1, Extremely Bad}...	None	8	Right	Scale
14	{1, Extremely Bad}...	None	8	Right	Scale
15	{1, Extremely Bad}...	None	8	Right	Scale
16	{1, Extremely Bad}...	None	8	Right	Scale
17	{1, Extremely Unlikely}...	None	8	Right	Scale
18	{1, Extremely Unlikely}...	None	8	Right	Scale
19	None	None	8	Right	Scale
20	{1, Extremely difficult}...	None	8	Right	Scale
21	{1, I should not}...	None	8	Right	Scale
22	{1, Extremely Bad}...	None	8	Right	Scale
23	{1, Extremely Unlikely}...	None	8	Right	Scale
24	{1, Strongly Disagree}...	None	8	Right	Scale
25	{1, Definitely false}...	None	8	Right	Scale
26	{1, Extremely Worthless}...	None	8	Right	Scale
27	{1, Definitely False}...	None	8	Right	Scale
28	{1, Definitely False}...	None	8	Right	Scale
29	{1, Extremely unpleasant}...	None	8	Right	Scale
30	{1, I definitely will not}...	None	8	Right	Scale
31	{1, Impossible}...	None	8	Right	Scale
32	{1, Strongly disagree}...	None	8	Right	Scale
33	{1, Boring}...	None	8	Right	Scale
34	{1, Strongly disagree}...	None	8	Right	Scale
35	{1, Not at all}...	None	8	Right	Scale
36	{1, Not at all}...	None	8	Right	Scale
37	{1, Very Much}...	None	8	Right	Scale
38	{1, Very Much}...	None	8	Right	Scale
39	{1, Extremely Unlikely}...	None	8	Right	Scale
40	{1, Extremely Unlikely}...	None	8	Right	Scale
41	{1, Extremely Unlikely}...	None	8	Right	Scale
42	{1, Extremely Likely}...	None	8	Right	Scale
43	{1, Extremely Unlikely}...	None	8	Right	Scale

	Values	Missing	Columns	Align	Measure
44	{1, Extremely Unlikely}...	None	8	Right	Scale
45	{1, Extremely Likely}...	None	8	Right	Scale
46	{1, Extremely Unlikely}...	None	8	Right	Scale
47	{1, Extremely Likely}...	None	8	Right	Scale
48	{1, Very frequently}...	None	8	Right	Scale
49	{1, Very Frequently}...	None	8	Right	Scale
50	{1, Very Frequently}...	None	8	Right	Scale
51	{1, Very frequently}...	None	8	Right	Scale
52	{1, Very Frequently}...	None	8	Right	Scale
53	{1, Very frequently }...	None	8	Right	Scale
54	{1, Strongly disagree}...	None	8	Right	Scale
55	{1, Strongly disagree}...	None	8	Right	Scale
56	{1, Strongly Disagree}...	None	8	Right	Scale
57	{1, Strongly Disagree}...	None	8	Right	Scale
58	{1, Strongly Disagree}...	None	8	Right	Scale
59	{1, Strongly Disagree}...	None	8	Right	Scale
60	{1, Extremely Unlikely}...	None	8	Right	Scale
61	{1, Extremely Unlikely}...	None	8	Right	Scale
62	{1, Extremely Unlikely}...	None	8	Right	Scale
63	{1, Extremely unlikely}...	None	8	Right	Scale

1. Mann-Whitney U Test *Key Stage 3 ICT Grades

Case Processing Summary

Ranks

	Gender	N	Mean Rank	Sum of Ranks
Key Stage 3 ICT Grades	Male	60	49.83	2990.00
	Female	60	71.17	4270.00
	Total	120		

Test Statistics(a)

	Key Stage 3 ICT Grades
Mann-Whitney U	1160.000
Wilcoxon W	2990.000
Z	-3.793
Asymp. Sig. (2-tailed)	.000

a Grouping Variable: Gender

2. Gender * Key Stage 4 ICT Grades

Case Processing Summary

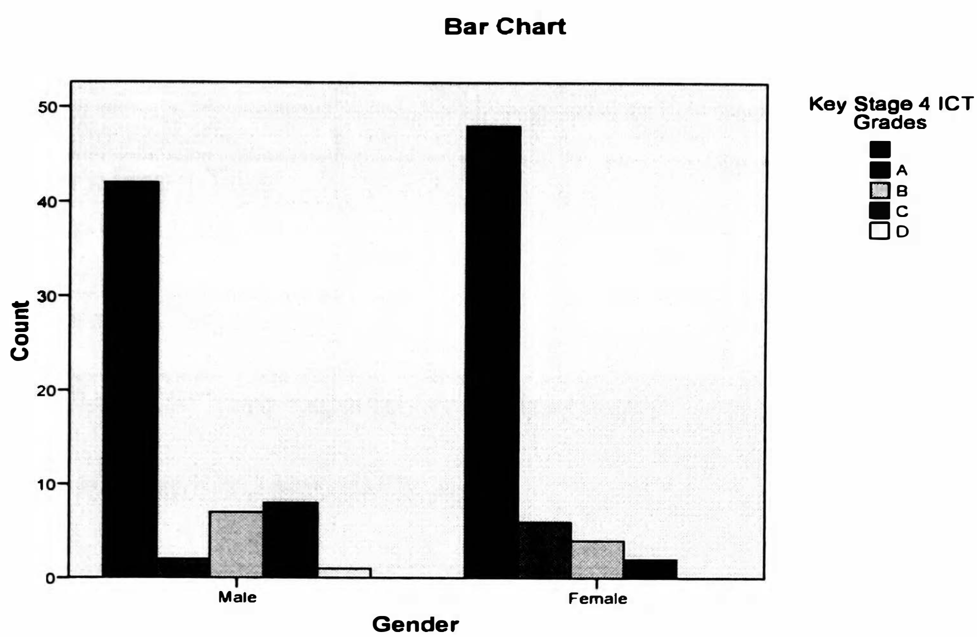
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Key Stage 4 ICT Grades	30	100.0%	3	.0%	30	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.018(a)	3	.009
Likelihood Ratio	1.563	3	.007
N of Valid Cases	120		

a 4 cells (40.0%) have expected count less than 5. The minimum expected count is .50.

Key Stage 4 ICT Grades



3. Gender * Preferred Learning Style

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Preferred Learning Style	120	100.0%	0	.0%	120	100.0%

Symmetric Measures

		Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.	Exact Sig.
Interval by Interval	Pearson's R	-.607	.062	-8.296	.000(c)	.000
Ordinal by Ordinal	Spearman Correlation	-.613	.063	-8.429	.000(c)	.000
N of Valid Cases		120				

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.
c Based on normal approximation.

4. What ICT Means to You

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	14.189 (a)	7	.048	.046		
Likelihood Ratio	14.740	7	.039	.050		
Fisher's Exact Test	14.032			.047		
Linear-by-Linear Association	.218(b)	1	.640	.669	.335	.028
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.
b The standardized statistic is .467.

Sections 3 & 4: The TpB Questions

5. Gender * Interacting with teacher & students

Statistically Significant Outcome Evaluations

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Interacting with teacher & students	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	12.278(a)	3	.006	.006		
Likelihood Ratio	12.618	3	.006	.007		
Fisher's Exact Test	12.299			.006		
Linear-by-Linear Association	8.430(b)	1	.004	.005	.002	.001
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.50.
b The standardized statistic is 2.904.

6. <u>Gender * Missing out on activities outside ICT class</u>

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Missing out on activities outside ICT class	120	100.0%	0	.0%	120	100.0%

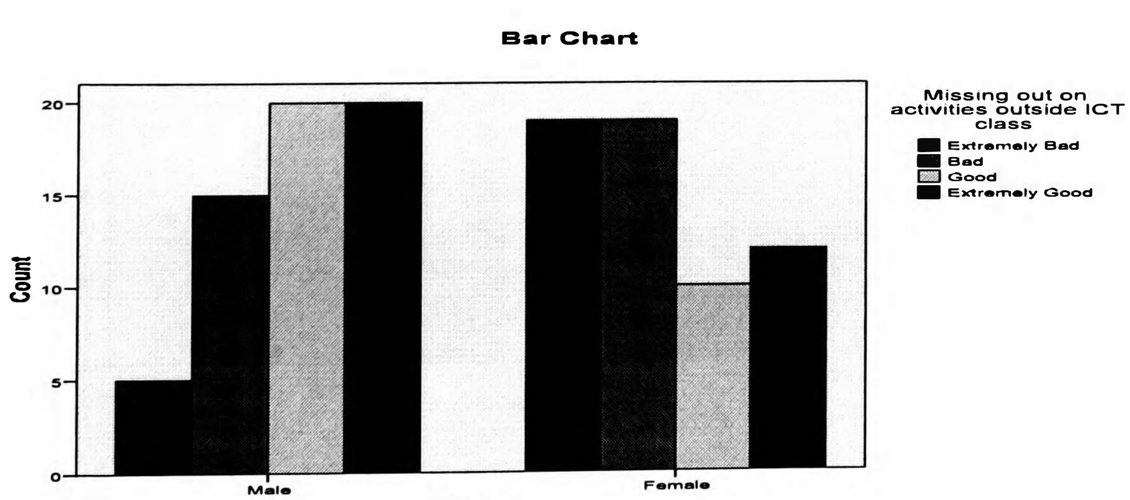
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.971(a)	3	.003	.003		
Likelihood Ratio	14.599	3	.002	.003		
Fisher's Exact Test	14.069			.003		
Linear-by-Linear Association	11.240(b)	1	.001	.001	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.00.

b The standardized statistic is -3.353.

Missing out on Activities



7. Gender * Missing my friends in the class

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Missing my friends in the class	120	100.0%	0	.0%	120	100.0%

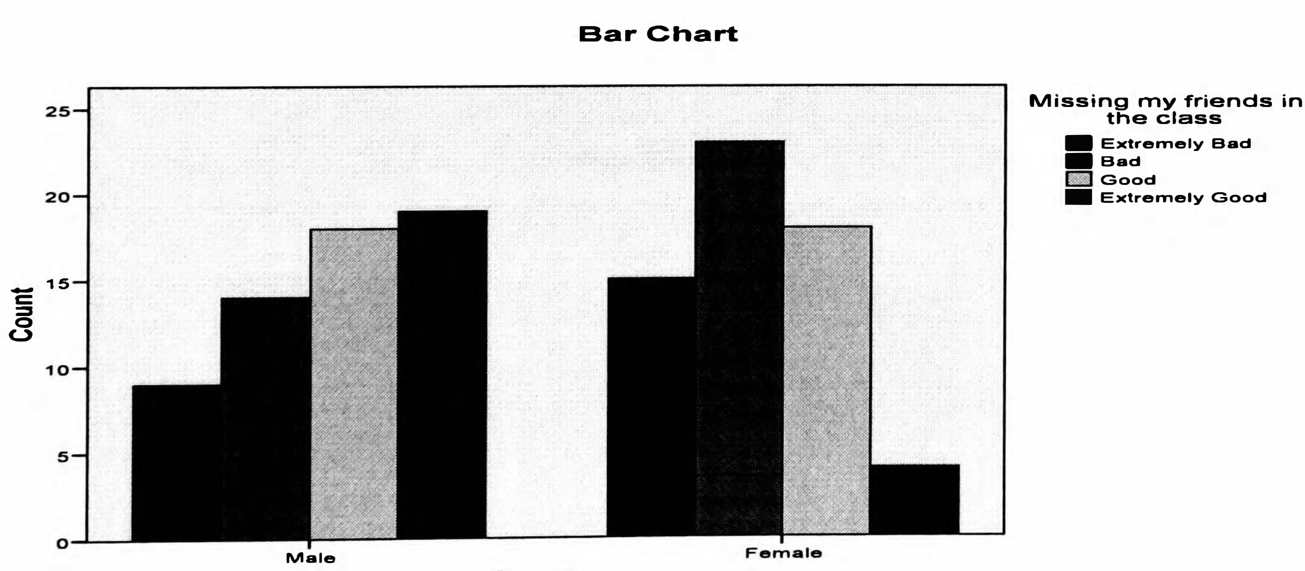
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.472(a)	3	.004	.003		
Likelihood Ratio	14.358	3	.002	.003		
Fisher's Exact Test	13.769			.003		
Linear-by-Linear Association	10.367(b)	1	.001	.002	.001	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.50.

b The standardized statistic is -3.220.

Missing my friends in the class



8. Gender * Subjection to tedium and boredom

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Subjection to tedium and boredom	117	97.5%	3	2.5%	120	100.0%

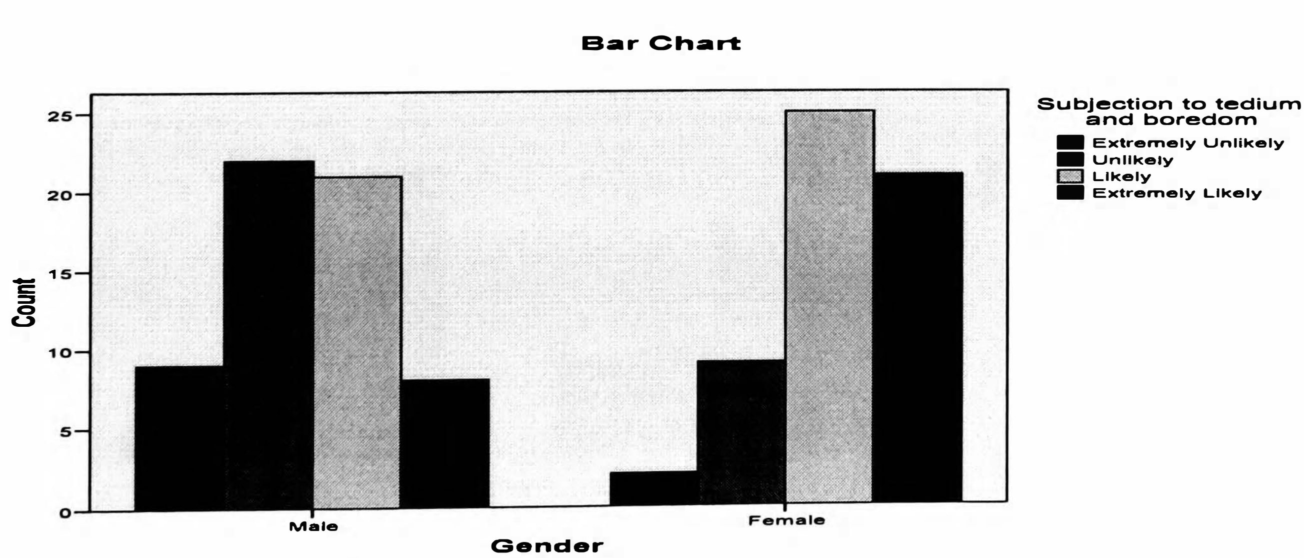
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	16.015(a)	3	.001	.001		
Likelihood Ratio	16.754	3	.001	.001		
Fisher's Exact Test	15.948			.001		
Linear-by-Linear Association	15.532(b)	1	.000	.000	.000	.000
N of Valid Cases	117					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.36.

b The standardized statistic is 3.941.

Subjection to tedium and boredom



9. Gender * Keeping up with ICT studies

Case Processing Summary

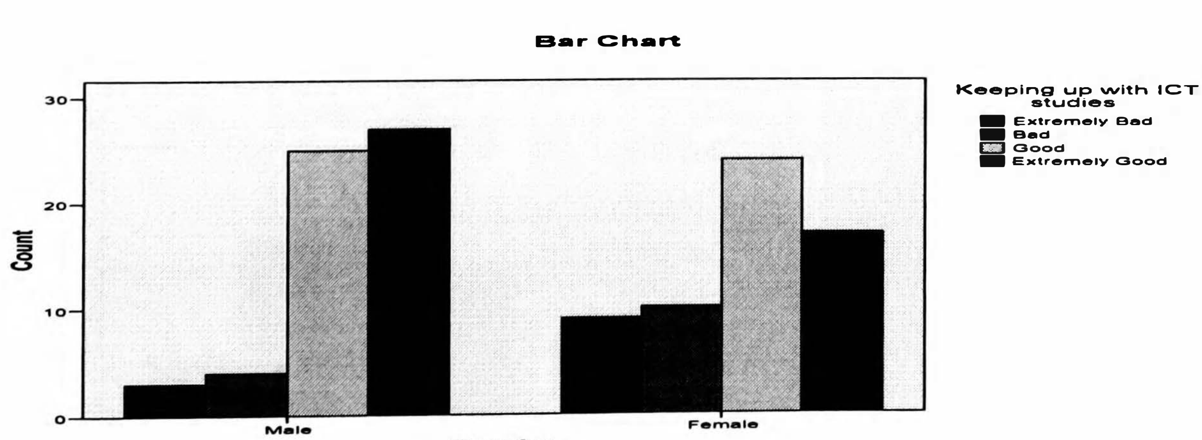
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Keeping up with ICT studies	119	99.2%	1	.8%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	7.857(a)	3	.049	.049		
Likelihood Ratio	8.101	3	.044	.050		
Fisher's Exact Test	7.681			.050		
Linear-by-Linear Association	7.382(b)	1	.007	.006	.004	.002
N of Valid Cases	119					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.95.
b The standardized statistic is -2.717.

Keeping up with ICT Studies



10. Gender * Developing good study habits

Case Processing Summary

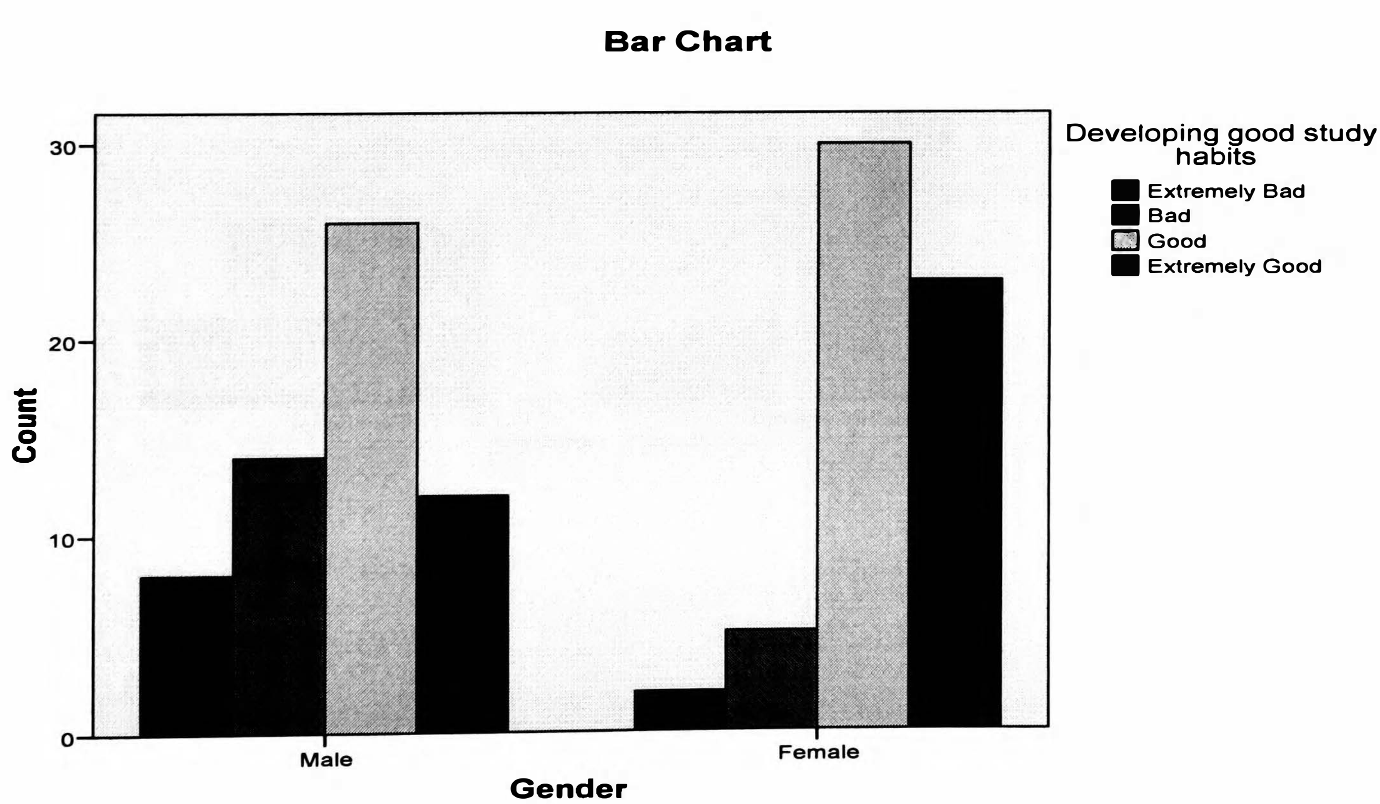
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Developing good study habits	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	11.606(a)	3	.009	.008		
Likelihood Ratio	12.096	3	.007	.009		
Fisher's Exact Test	11.431			.009		
Linear-by-Linear Association	10.818(b)	1	.001	.001	.001	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.
b The standardized statistic is 3.289.

Developing Good Study Habit



11. Gender * Information on ICT test material

Case Processing Summary

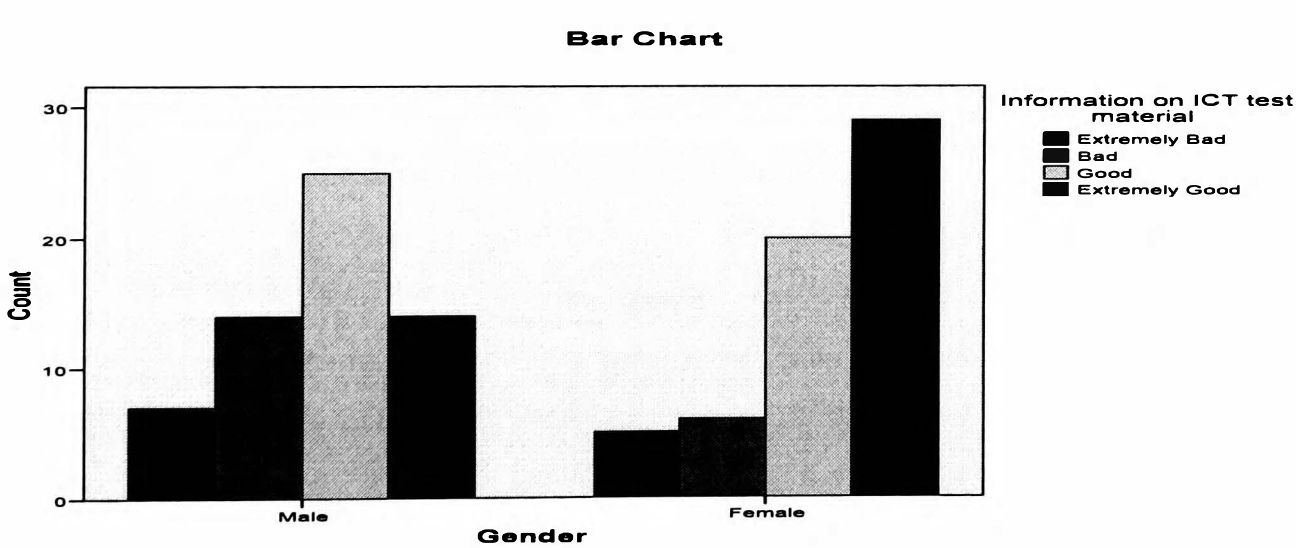
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Information on ICT test material	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	9.321(a)	3	.025	.024		
Likelihood Ratio	9.527	3	.023	.025		
Fisher's Exact Test	9.278			.025		
Linear-by-Linear Association	6.513(b)	1	.011	.013	.007	.003
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.
b The standardized statistic is 2.552.

Information on ICT test material



12. Gender * Gaining part time work due to ICT

Case Processing Summary

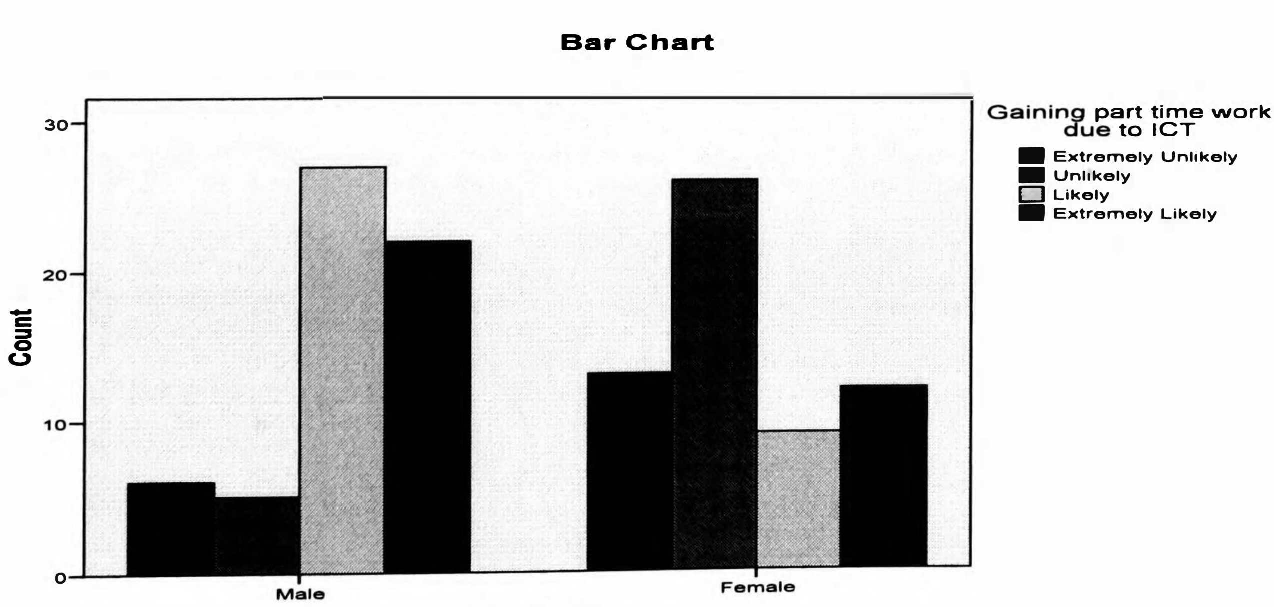
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Gaining part time work due to ICT	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	28.746(a)	3	.000	.000		
Likelihood Ratio	30.628	3	.000	.000		
Fisher's Exact Test	29.588			.000		
Linear-by-Linear Association	15.354(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.50.
b The standardized statistic is -3.918.

Gaining Part Time work due to ICT



Outcome Evaluations of no statistical significance

13. <u>Gender * Gaining a better understanding of ICT</u>

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Gaining a better understanding of ICT	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.570(a)	3	.666	.683		
Likelihood Ratio	1.578	3	.664	.683		
Fisher's Exact Test	1.590			.683		
Linear-by-Linear Association	1.488(b)	1	.223	.264	.132	.039
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.

b The standardized statistic is -1.220.

14. Gender * Gaining a high ICT grade

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Gaining a high ICT grade	119	99.2%	1	.8%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.721(a)	3	.868	.873		
Likelihood Ratio	.724	3	.868	.873		
Fisher's Exact Test	.759			.888		
Linear-by-Linear Association	.120(b)	1	.729	.789	.399	.067
N of Valid Cases	119					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.43.

b The standardized statistic is .346.

Direct Measures of Perceived Behavioural Control

Statistically Significant Direct Measures of Perceived Behavioural Control

15. <u>Gender * Ease of studying ICT Post 16</u>

Case Processing Summary

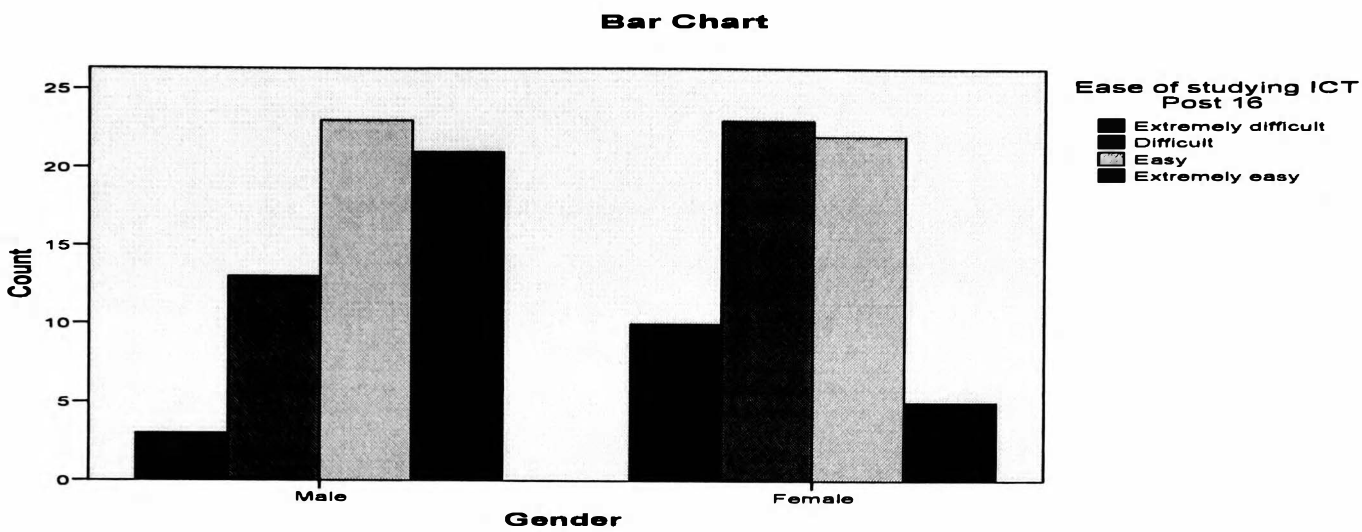
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Ease of studying ICT Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	16.415(a)	3	.001	.001		
Likelihood Ratio	17.400	3	.001	.001		
Fisher's Exact Test	16.618			.001		
Linear-by-Linear Association	15.375(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.
b The standardized statistic is -3.921.

Ease of Studying ICT Post 16



16. Gender * Interest level of studying ICT at Post 16

Case Processing Summary

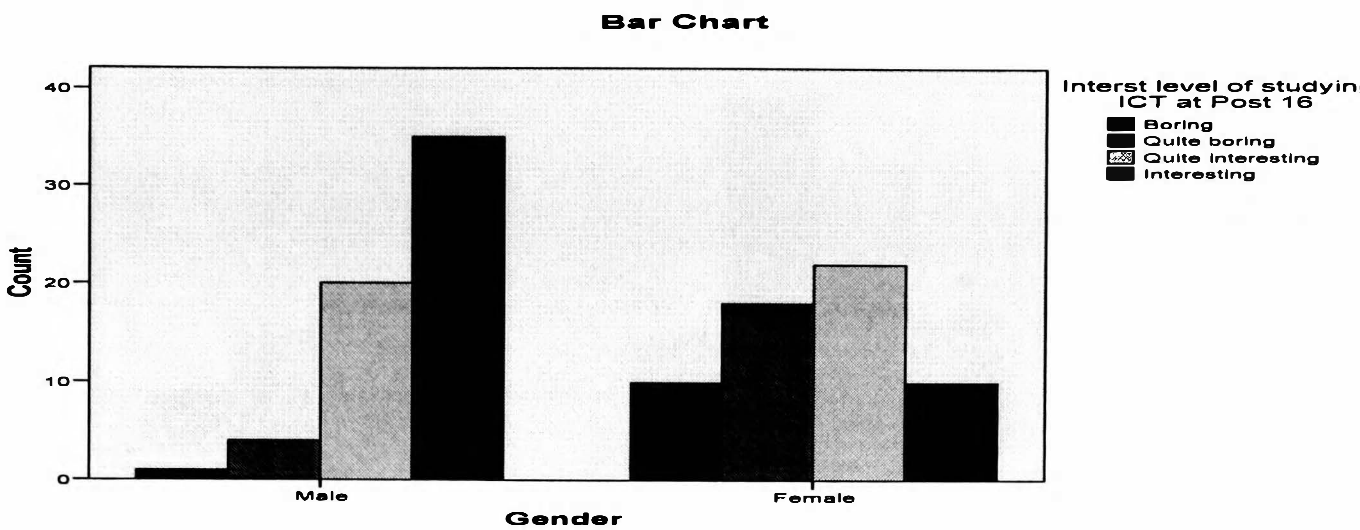
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Interest level of studying ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	30.257(a)	3	.000	.000		
Likelihood Ratio	32.989	3	.000	.000		
Fisher's Exact Test	31.224			.000		
Linear-by-Linear Association	29.029(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.50.
b The standardized statistic is -5.388

Interest Level of Studying ICT Post 16



17. Gender * How pleasant would it be to study ICT at Post 16

Case Processing Summary

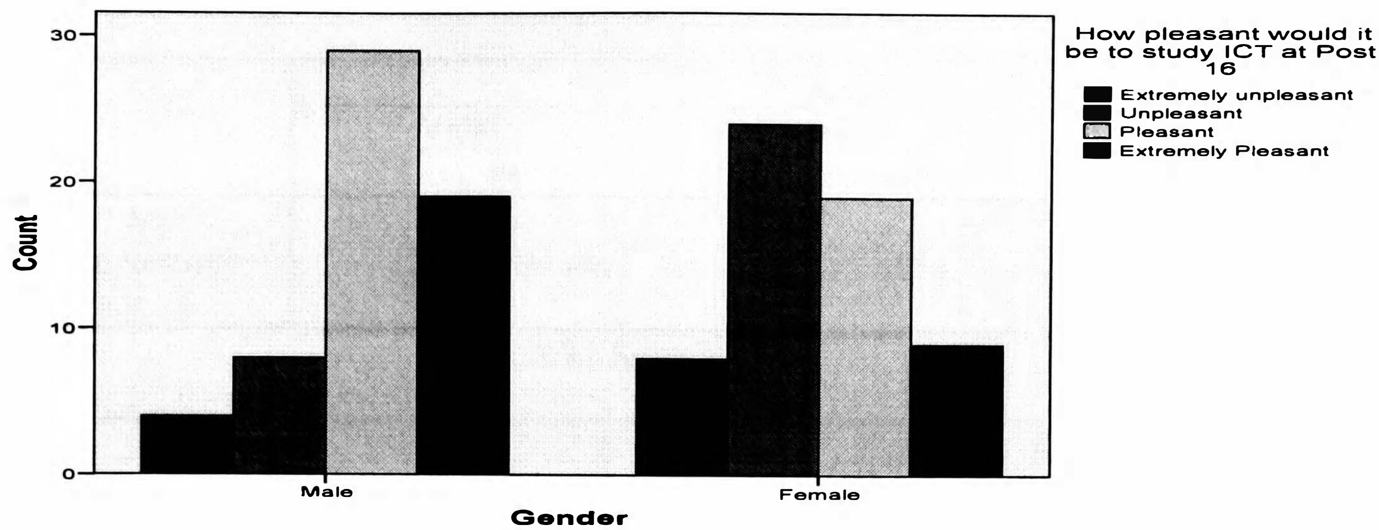
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How pleasant would it be to study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	14.988(a)	3	.002	.001		
Likelihood Ratio	15.481	3	.001	.002		
Fisher's Exact Test	14.994			.002		
Linear-by-Linear Association	11.298(b)	1	.001	.001	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.
b The standardized statistic is -3.361.

Bar Chart



18. The Possibility of studying ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Possibility of studying ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	18.918(a)	3	.000	.000		
Likelihood Ratio	20.206	3	.000	.000		
Fisher's Exact Test	19.421			.000		
Linear-by-Linear Association	14.513(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.
b The standardized statistic is -3.810.

19. Gender * My intention to study ICT at Post 16

Case Processing Summary

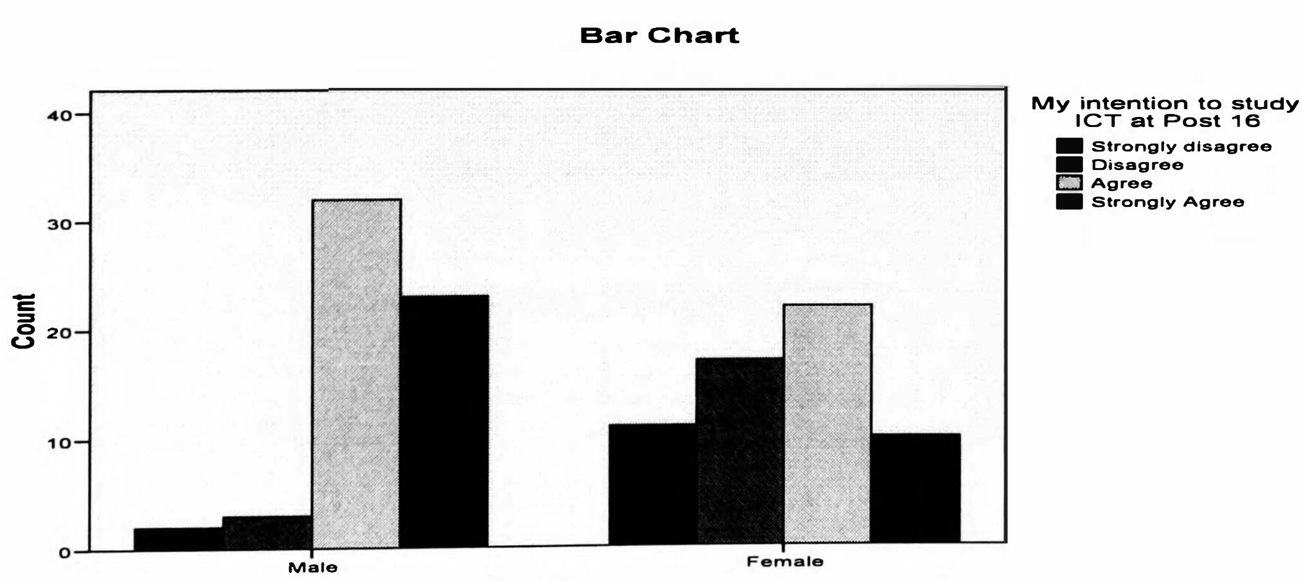
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * My intention to study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	23.004(a)	3	.000	.000		
Likelihood Ratio	24.802	3	.000	.000		
Fisher's Exact Test	23.439			.000		
Linear-by-Linear Association	19.385(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.
b The standardized statistic is -4.403.

Intention of Studying ICT at Post 16



20. Gender * Approval of People I value to my studying ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Approval of People I value to my studying ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	26.160(a)	2	.000	.000		
Likelihood Ratio	27.568	2	.000	.000		
Fisher's Exact Test	26.852			.000		
Linear-by-Linear Association	21.480(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.50.
b The standardized statistic is -4.635

21. Gender * Confidence of ability to study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Confidence of ability to study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	28.954(a)	3	.000	.000		
Likelihood Ratio	31.940	3	.000	.000		
Fisher's Exact Test	29.971			.000		
Linear-by-Linear Association	26.272(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.50.
b The standardized statistic is -5.126.

Behavioural, Normative and Control Beliefs

22. Gender * How will studying ICT at Post 16 help me to understand the subject better

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How will studying ICT at Post 16help me to understand the subject better	118	98.3%	2	1.7%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	11.030(a)	3	.012	.011		
Likelihood Ratio	11.311	3	.010	.012		
Fisher's Exact Test	10.950			.011		
Linear-by-Linear Association	6.468(b)	1	.011	.011	.007	.003
N of Valid Cases	118					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.90.
b The standardized statistic is 2.543.

23. Gender * Development of good study habits, self-discipline and a feeling of self-satisfaction

Case Processing Summary

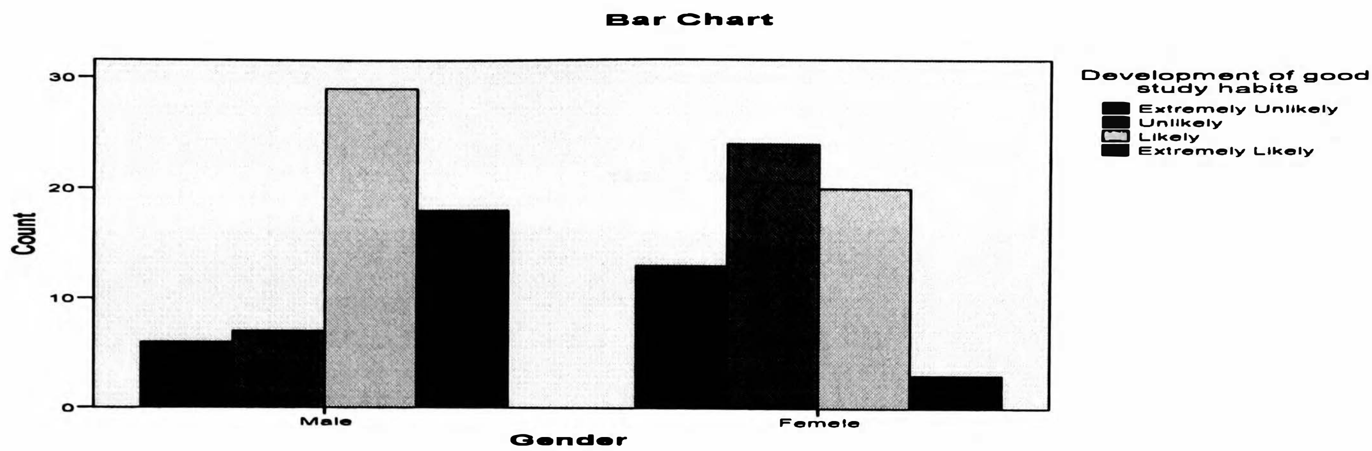
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Development of good study habits, self-discipline and a feeling of self-satisfaction	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	24.269(a)	3	.000	.000		
Likelihood Ratio	26.048	3	.000	.000		
Fisher's Exact Test	24.916			.000		
Linear-by-Linear Association	19.286(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.50.
b The standardized statistic is -4.392.

Development of good study habits



24. Gender * Studying ICT at Post 16 will be tedious and boring

Case Processing Summary

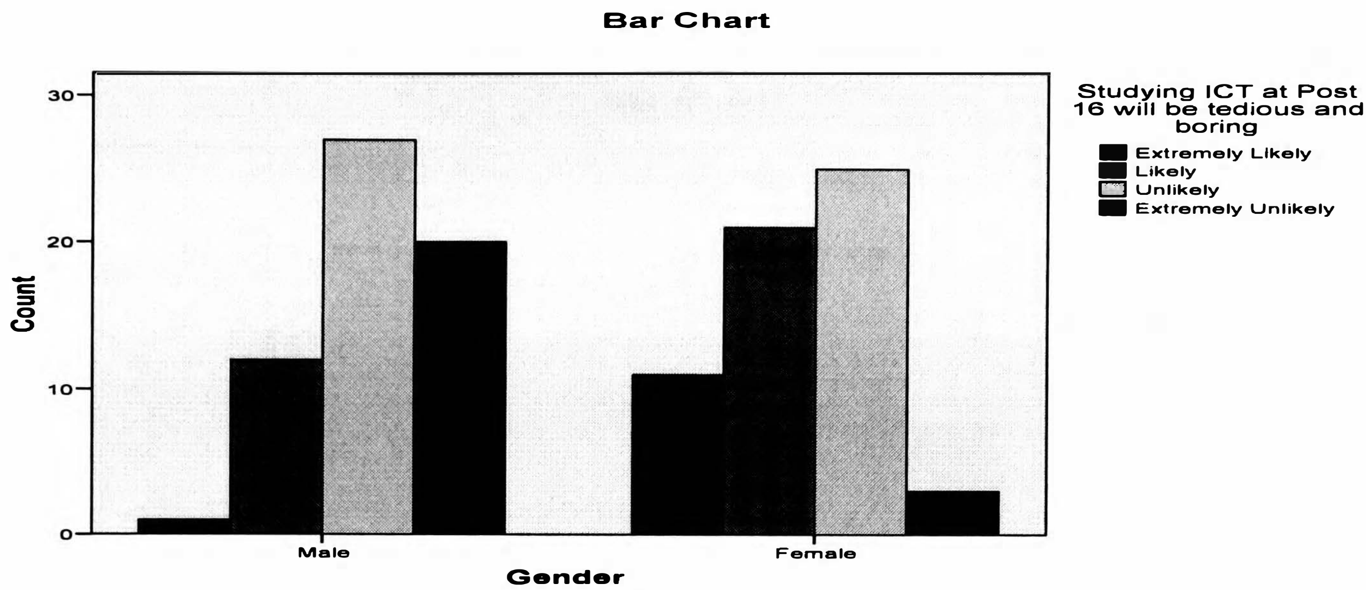
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Studying ICT at Post 16will be tedious and boring	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	23.430(a)	3	.000	.000		
Likelihood Ratio	26.387	3	.000	.000		
Fisher's Exact Test	24.575			.000		
Linear-by-Linear Association	22.236(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.
b The standardized statistic is -4.716.

<u>Studying ICT at Post 16 will be tedious and boring</u>



25. Gender * Improvement of my intellectual powers

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Improvement of my intellectual powers	120	100.0%	0	.0%	120	100.0%

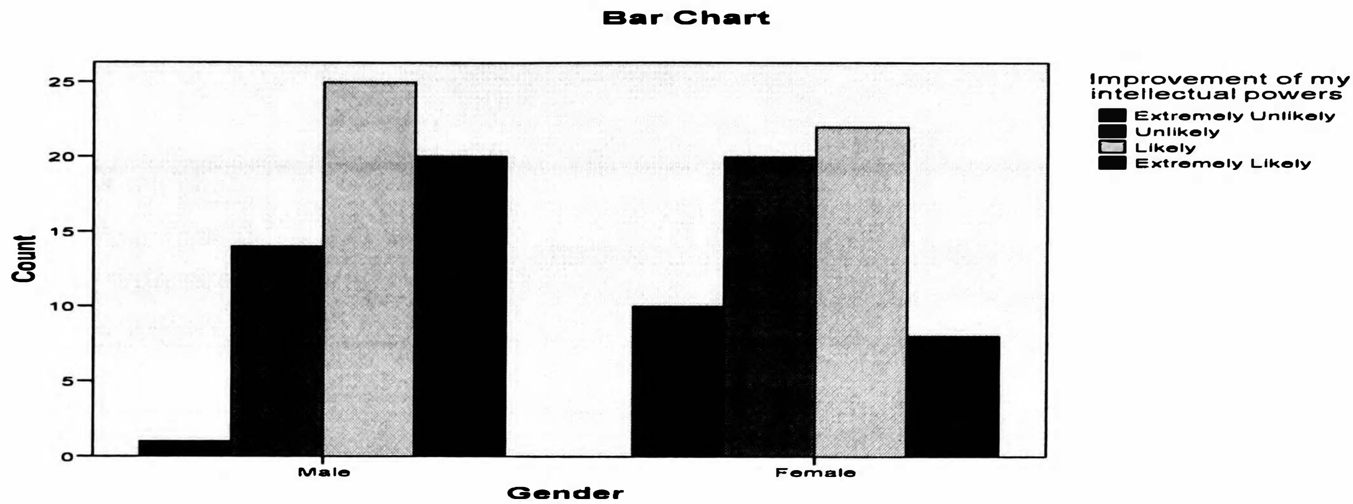
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	(a)	3	.003	.003		
Likelihood Ratio	15.116	3	.002	.002		
Fisher's Exact Test	13.980			.003		
Linear-by-Linear Association	12.921(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.50.

b The standardized statistic is -3.595.

<u>Studying ICT at Post 16 will improve my intellectual powers</u>



26. Gender * Studying ICT at Post 16 will cause me to miss my friends

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Studying ICT at Post 16will cause me to miss my friends	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.281(a)	3	.004	.003		
Likelihood Ratio	13.802	3	.003	.004		
Fisher's Exact Test	13.299			.004		
Linear-by-Linear Association	12.279(b)	1	.000	.001	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

b The standardized statistic is -3.504.

27. Gender * To study ICT in Post 16 will keep up with peers' earning capacity

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * To study ICT in Post 16will keep up with peers' earning capacity	120	100.0%	0	.0%	120	100.0%

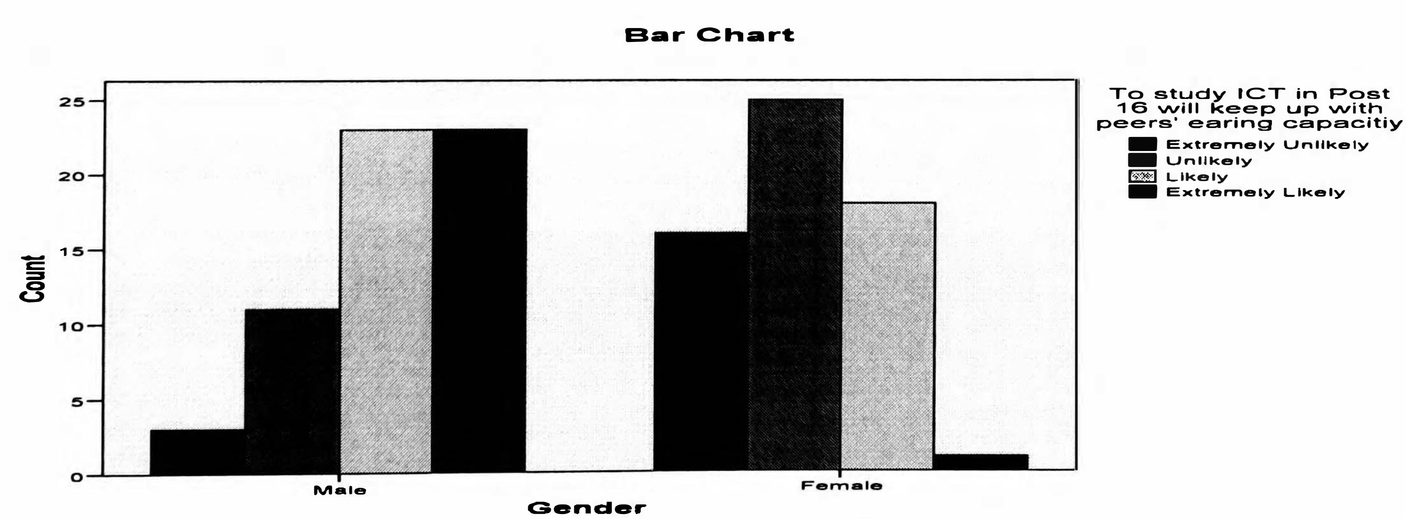
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	35.116(a)	3	.000	.000		
Likelihood Ratio	40.925	3	.000	.000		
Fisher's Exact Test	38.525			.000		
Linear-by-Linear Association	33.100(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.50.

b The standardized statistic is -5.753.

Studying ICT at Post 16will enable me to keep up with my peers' earning capacity



28. Gender * Missing out on activities outside University or college if I study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Missing out on activities outside University or college if I study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	18.069(a)	3	.000	.000		
Likelihood Ratio	18.609	3	.000	.000		
Fisher's Exact Test	17.956			.000		
Linear-by-Linear Association	15.150(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.00.
b The standardized statistic is -3.892.

29. Gender * How often are there unanticipated demands on my time

Case Processing Summary

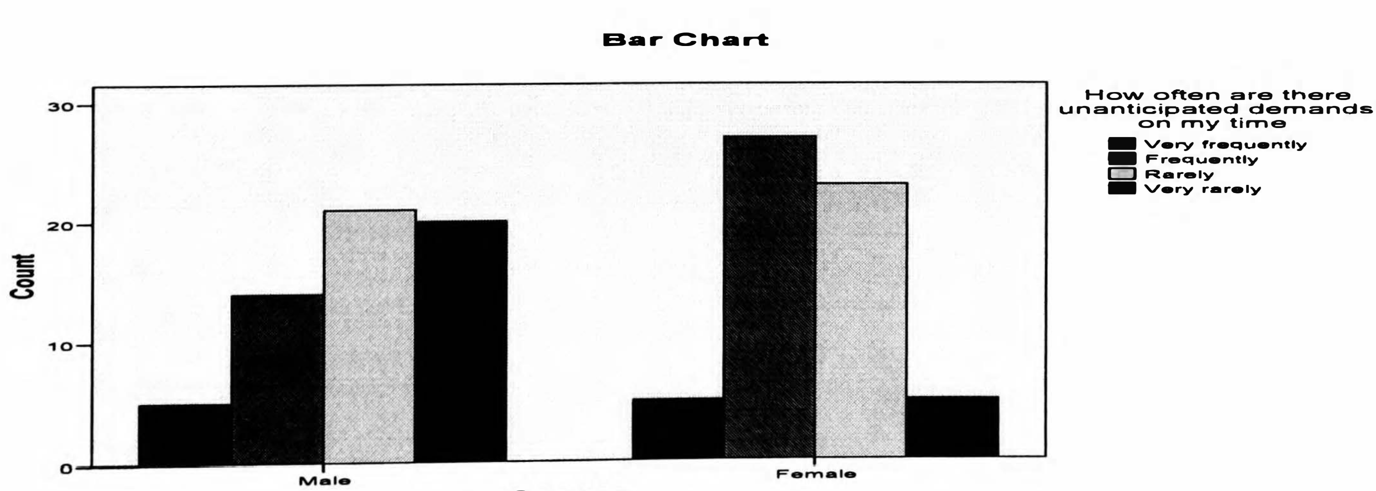
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How often are there unanticipated demands on my time	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.213 (a)	3	.004	.003		
Likelihood Ratio	13.922	3	.003	.004		
Fisher's Exact Test	13.474			.003		
Linear-by-Linear Association	8.167(b)	1	.004	.005	.003	.001
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.
b The standardized statistic is -2.858.

<u>How often are there unanticipated demands on my time?</u>



30. Gender * How often do I feel ill or tired

Case Processing Summary

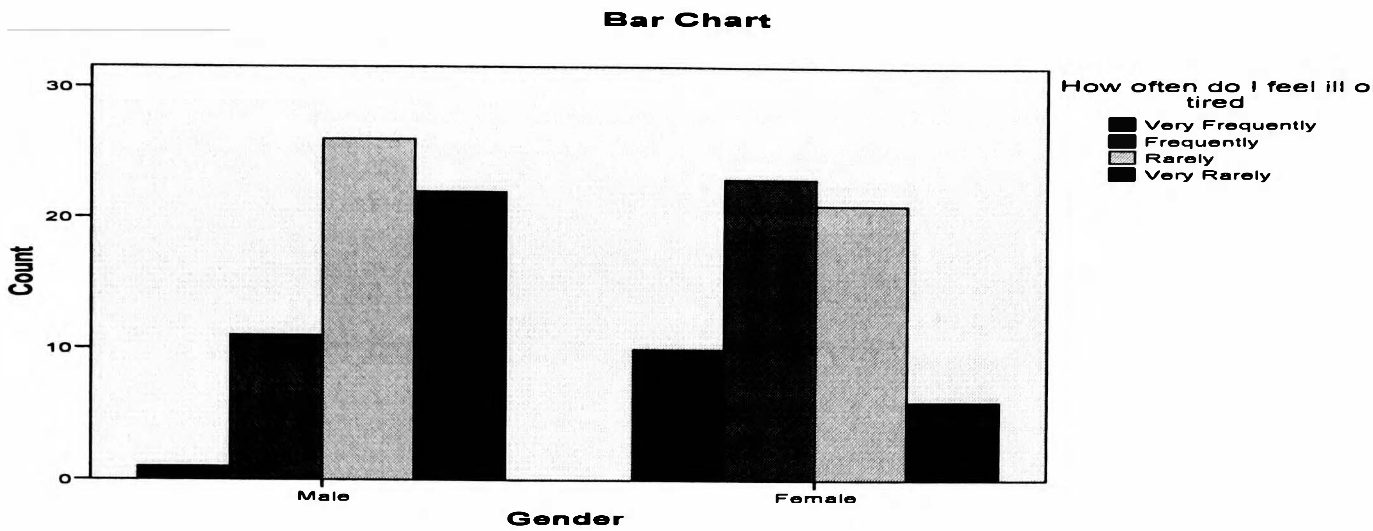
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How often do I feel ill or tired	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	21.274(a)	3	.000	.000		
Likelihood Ratio	23.128	3	.000	.000		
Fisher's Exact Test	21.698			.000		
Linear-by-Linear Association	21.096(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.50.
b The standardized statistic is -4.593.

How often do I feel ill or tired?



31. Gender * How often do family make unanticipated demands on my time

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How often do family make unanticipated demands on my time	120	100.0%	0	.0%	120	100.0%

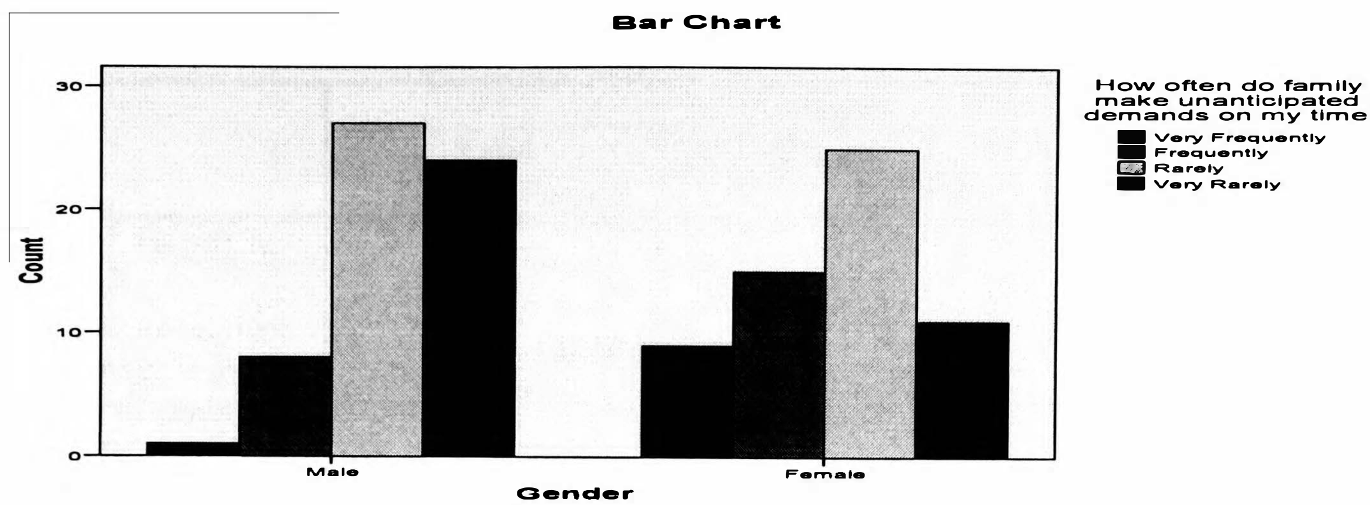
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.436(a)	3	.004	.003		
Likelihood Ratio	14.549	3	.002	.004		
Fisher's Exact Test	13.492			.003		
Linear-by-Linear Association	13.186(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.

b The standardized statistic is -3.631.

How often do family make unanticipated demands on my time



32. Gender * Would unanticipated demands make it more difficult to study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Would unanticipated demands make it more difficult to study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	24.440(a)	3	.000	.000		
Likelihood Ratio	26.524	3	.000	.000		
Fisher's Exact Test	25.058			.000		
Linear-by-Linear Association	24.023(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.
b The standardized statistic is 4.901.

33. Gender * Failure to complete assignments on time would make it more difficult to study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Failure to complete assignments on time would make it more difficult to study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

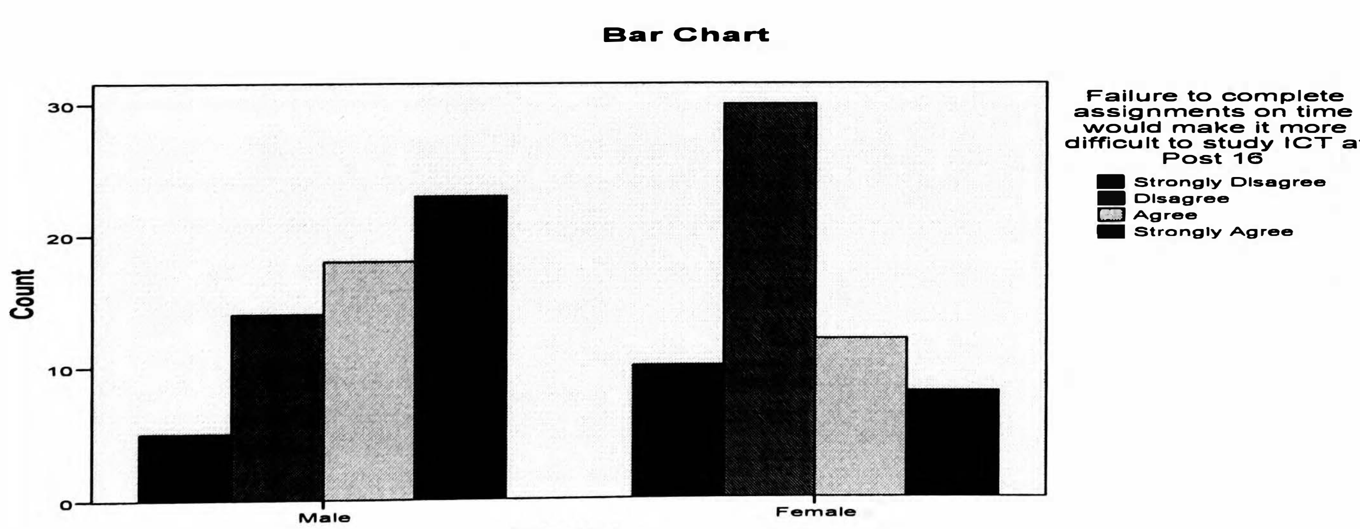
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	15.943(a)	3	.001	.001		
Likelihood Ratio	16.433	3	.001	.001		
Fisher's Exact Test	15.954			.001		
Linear-by-Linear Association	13.939(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

b The standardized statistic is -3.734.

Failure to complete assignments on time would make it more difficult to study

ICT at Post 16



34. Gender * How much I care with regard to my parents' opinion

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How much I care with regard to my parents' opinion	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	8.348(a)	3	.039	.040		
Likelihood Ratio	8.487	3	.037	.044		
Fisher's Exact Test	8.293			.040		
Linear-by-Linear Association	5.987(b)	1	.014	.018	.009	.004
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

b The standardized statistic is 2.447.

35. Gender * How much I care with regard to my teacher's opinion

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How much I care with regard to my teacher's opinion	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.322(a)	3	.004	.003		
Likelihood Ratio	13.934	3	.003	.004		
Fisher's Exact Test	13.261			.004		
Linear-by-Linear Association	13.048(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.

b The standardized statistic is 3.612.

36. Gender * How much I care with regard to my friends' opinion

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How much I care with regard to my friends' opinion	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	16.609(a)	3	.001	.001		
Likelihood Ratio	18.089	3	.000	.001		
Fisher's Exact Test	17.168			.001		
Linear-by-Linear Association	13.989(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

b The standardized statistic is -3.740.

37. Gender * How much I care with regard to my classmates' opinion

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * How much I care with regard to my classmates' opinion	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	27.255(a)	3	.000	.000		
Likelihood Ratio	30.354	3	.000	.000		
Fisher's Exact Test	28.541			.000		
Linear-by-Linear Association	26.882(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

b The standardized statistic is -5.185.

Normative Beliefs

38. Gender * My classmates think I should study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * My classmates think I should study ICT at Post 16	114	95.0%	6	5.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	4.332(a)	3	.228	.223		
Likelihood Ratio	4.361	3	.225	.226		
Fisher's Exact Test	4.291			.223		
Linear-by-Linear Association	3.274(b)	1	.070	.076	.043	.014
N of Valid Cases	114					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.53.

b The standardized statistic is -1.809.

39. Gender * My teacher thinks I should study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * My teacher thinks I should study ICT at Post 16	118	98.3%	2	1.7%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	3.172(a)	3	.366	.376		
Likelihood Ratio	3.260	3	.353	.372		
Fisher's Exact Test	3.106			.376		
Linear-by-Linear Association	2.023(b)	1	.155	.162	.092	.027
N of Valid Cases	118					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.41.

b The standardized statistic is -1.422.

40. Gender * My parents think I should study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * My parents think I should study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

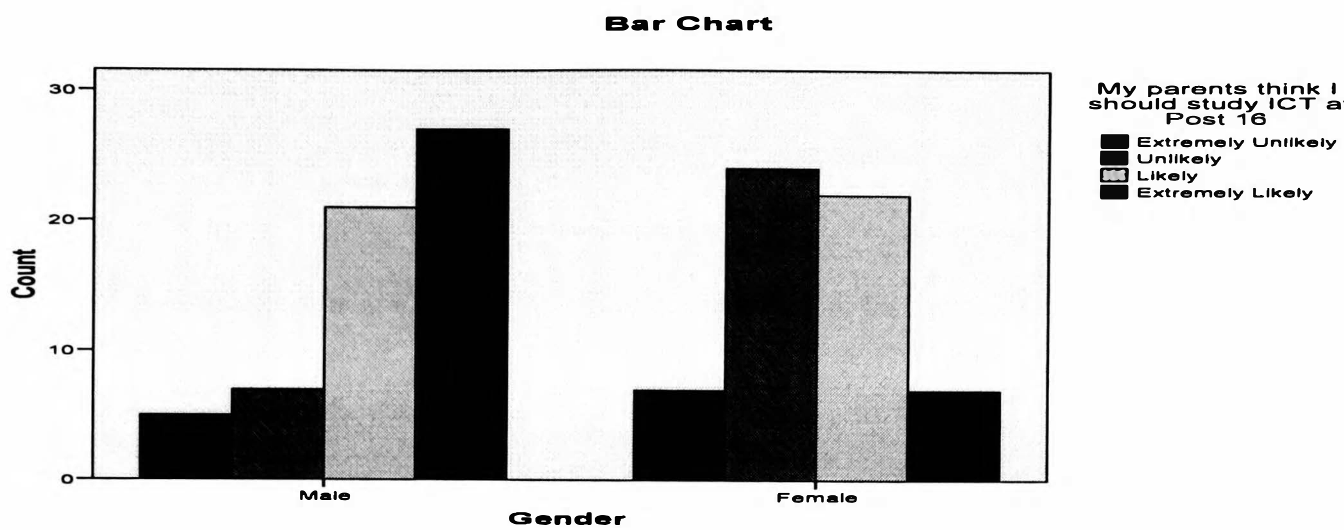
Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	21.444(a)	3	.000	.000		
Likelihood Ratio	22.775	3	.000	.000		
Fisher's Exact Test	22.065			.000		
Linear-by-Linear Association	15.248(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.

b The standardized statistic is -3.905.

My parents think I should study ICT at Post 16



41. Gender * My close friends think I should study ICT at Post 16

Case Processing Summary

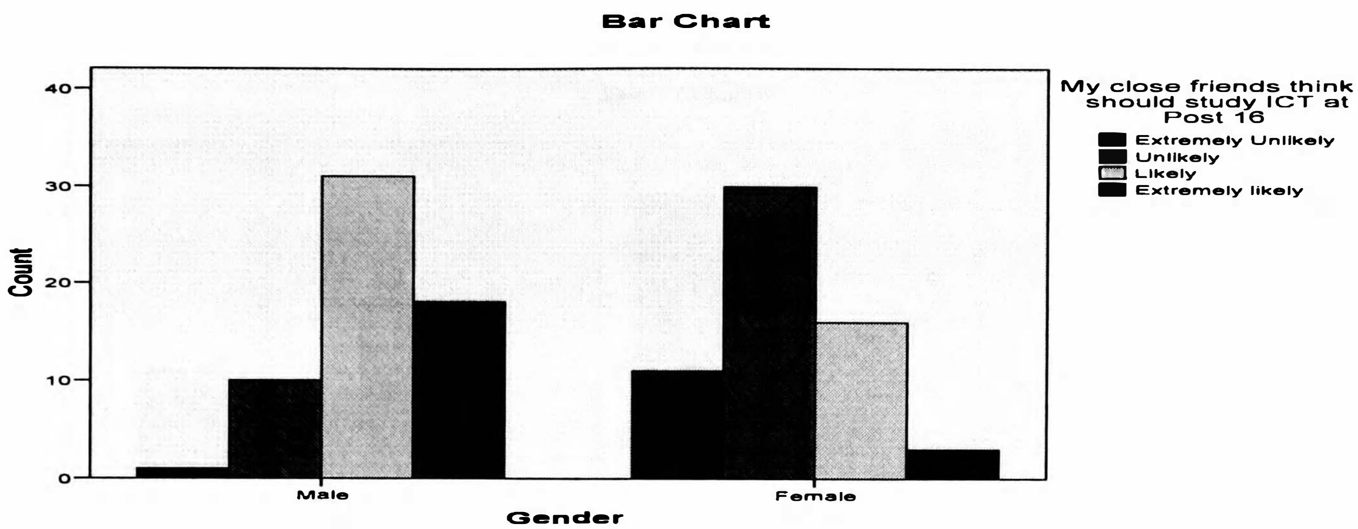
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * My close friends think I should study ICT at Post 16	120	100.0%	0	.0%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	33.835(a)	3	.000	.000		
Likelihood Ratio	36.976	3	.000	.000		
Fisher's Exact Test	34.927			.000		
Linear-by-Linear Association	32.052(b)	1	.000	.000	.000	.000
N of Valid Cases	120					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.
b The standardized statistic is -5.661.

My close friends think I should study ICT at Post 16



Past Behaviour

42. Gender * Percentage of Attendance

Case Processing Summary

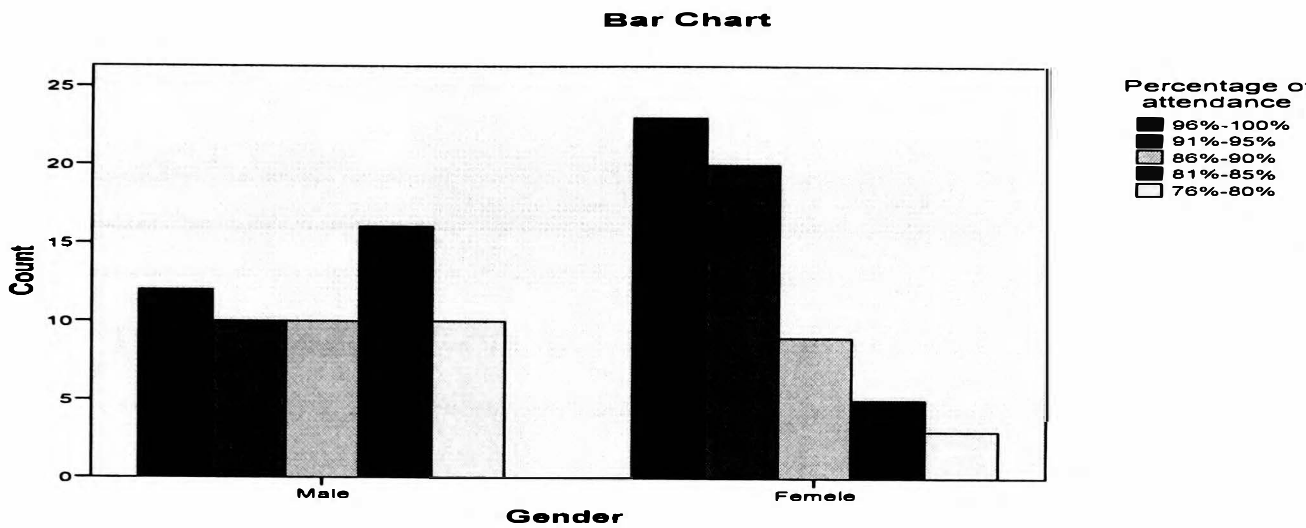
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * Percentage of attendance	118	98.3%	2	1.7%	120	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	16.345(a)	4	.003	.002		
Likelihood Ratio	16.969	4	.002	.003		
Fisher's Exact Test	16.236			.002		
Linear-by-Linear Association	14.241(b)	1	.000	.000	.000	.000
N of Valid Cases	118					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.39.
b The standardized statistic is -3.774.

Perceived attendance to ICT lessons



The Impact of Single Sex ICT Classrooms: Differing TpB responses from Female Students in Single Sex and Mixed School

Outcome Evaluations

43. The Kruskal-Wallis Test - Gaining a Better Understanding of ICT

Ranks

	The Schools	N	Mean Rank
Gaining a better understanding	Mixed Schools	20	39.90
	Single Sex School	40	25.80
	Total	60	

Test Statistics(a,b)

	Gaining a better understanding
Chi-Square	9.868
df	1
Asymp. Sig.	.002

44. The Kruskal-Wallis Test - Gaining a High ICT Grade

Ranks

	The Schools	N	Mean Rank
Gaining a high ICT grade	Mixed Schools	20	40.78
	Single Sex School	39	24.47
	Total	59	

Test Statistics(a,b)

	Gaining a high ICT grade
Chi-Square	13.131
df	1
Asymp. Sig.	.000

45. The Kruskal-Wallis Test - Missing My Friends

Ranks

	The Schools	N	Mean Rank
Missing my friends in the class	Mixed Schools	20	37.70
	Single Sex School	40	26.90
	Total	60	

Test Statistics(a,b)

	Missing my friends in the class
Chi-Square	5.659
df	1
Asymp. Sig.	.017

a Kruskal Wallis Test
b Grouping Variable: The Schools

Direct Measures of Perceived Behavioural Control

46. The Kruskal-Wallis Test - Most people who are important to me think I should or should not study ICT

Ranks

	The Schools	N	Mean Rank
Most people who are important to me think I should or should not study ICT	Mixed Schools	20	46.38
	Single Sex School	40	22.56
	Total	60	

Test Statistics(a,b)

	Most people who are important to me think
Chi-Square	27.071
df	1
Asymp. Sig.	.000

47. The Kruskal-Wallis Test - Is Studying ICT up to me?

Ranks

	The Schools	N	Mean Rank
Is studying ICT Post 16up to me?	Mixed Schools	20	37.25
	Single Sex School	40	27.13
	Total	60	

Test Statistics(a,b)

	Is studying ICT Post 16up to me?
Chi-Square	5.154
df	1
Asymp. Sig.	.023

a Kruskal Wallis Test
b Grouping Variable: The Schools

48. The Kruskal-Wallis Test - Effort to study ICT at Post 16

Ranks

	The Schools	N	Mean Rank
Effort to study ICT at Post 16	Mixed Schools	19	20.95
	Single Sex School	40	34.30
	Total	59	

Test Statistics(a,b)

	Effort to study ICT at Post 16
Chi-Square	8.610
Df	1
Asymp. Sig.	.003

a Kruskal Wallis Test
b Grouping Variable: The Schools

49. The Kruskal-Wallis Test - Ease of studying ICT at Post 16

Ranks

	The Schools	N	Mean Rank
Ease of studying ICT Post 16	Mixed Schools	20	37.98
	Single Sex School	40	26.76
	Total	60	

Test Statistics (a,b)

	Ease of studying ICT Post 16
Chi-Square	6.179
Df	1
Asymp. Sig.	.013

a Kruskal Wallis Test
b Grouping Variable: The Schools

50. The Kruskal-Wallis Test - Studying ICT at Post 16

Ranks

	The Schools	N	Mean Rank
Studying ICT Post 16would be Extremely Good	Mixed Schools	20	39.50
	Single Sex School	40	26.00
	Total	60	

Test Statistics(a,b)

	Studying ICT Post 16
Chi-Square	8.841
Df	1
Asymp. Sig.	.003

a Kruskal Wallis Test
b Grouping Variable: The Schools

51. The Kruskal-Wallis Test - Planning to Study ICT at Post 16

Ranks

	The Schools	N	Mean Rank
Planning to study ICT Post 16is Extremely Likely	Mixed Schools	20	39.90
	Single Sex School	40	25.80
	Total	60	

Test Statistics (a,b)

	Planning to study ICT Post 16
Chi-Square	9.488
Df	1
Asymp. Sig.	.002

a Kruskal Wallis Test
b Grouping Variable: The Schools

52. The Kruskal-Wallis Test - Would family demands make it more difficult for me to study ICT at Post 16

Ranks

	The Schools	N	Mean Rank
Would family demands make it more difficult for me to study ICT at Post 16	Mixed Schools	20	21.20
	Single Sex School	40	35.15
	Total	60	

Test Statistics(a,b)

	Would family demands make it more difficult for me to study ICT at Post 16
Chi-Square	9.565
df	1
Asymp. Sig.	.002

a Kruskal Wallis Test
b Grouping Variable: The Schools

53. The Kruskal-Wallis Test - How **often are there unanticipated demands on my time?**

Ranks

	The Schools	N	Mean Rank
How often are there unanticipated demands on my time	Mixed Schools	20	23.20
	Single Sex School	40	34.15
	Total	60	

Test Statistics(a,b)

a Kruskal Wallis Test
b Grouping Variable: The Schools

54. The Kruskal-Wallis Test - How often do family make unanticipated demands on my time

Ranks

	The Schools	N	Mean Rank
How often do family make unanticipated demands on my time	Mixed Schools	20	38.70
	Single Sex School	40	26.40
	Total	60	

	How often are there unanticipated demands on my time
Chi-Square	6.155
Df	1
Asymp. Sig.	.013

Test Statistics(a,b)

	How often do family make unanticipated demands on my time
Chi-Square	7.326
Df	1
Asymp. Sig.	.007

a Kruskal Wallis Test
b Grouping Variable: The Schools

55. The Kruskal-Wallis Test - How often does work make unanticipated demands on my time

Ranks

	The Schools	N	Mean Rank
How often does work make unanticipated demands on my time	Mixed Schools	20	38.85
	Single Sex School	40	26.33
	Total	60	

Test Statistics(a,b)

	How often does work make unanticipated demands on my time
Chi-Square	7.732
Df	1
Asymp. Sig.	.005

a Kruskal Wallis Test
b Grouping Variable: The Schools

56. The Kruskal-Wallis Test - How often do I fail to complete assignments

Ranks

	The Schools	N	Mean Rank
How often do I fail to complete assignments	Mixed Schools	20	20.53
	Single Sex School	40	35.49
	Total	60	

Test Statistics(a,b)

	How often do I fail to complete assignments
Chi-Square	11.018
Df	1
Asymp. Sig.	.001

a Kruskal Wallis Test
b Grouping Variable: The Schools

57. The Kruskal-Wallis Test - How much I care with regard to my friends' opinion

Ranks

	The Schools	N	Mean Rank
How much I care with regard to my friends' opinion	Mixed Schools	20	39.25
	Single Sex School	40	26.13
	Total	60	

Test Statistics(a,b)

	How much I care with regard to my friends' opinion
Chi-Square	8.545
df	1
Asymp. Sig.	.003

a Kruskal Wallis Test
b Grouping Variable: The Schools

58. The Kruskal-Wallis Test - My Teacher thinks I should study ICT Post 16

Ranks

	The Schools	N	Mean Rank
My teacher thinks I should study ICT at Post 16	Mixed Schools	20	42.18
	Single Sex School	38	22.83
	Total	58	

Test Statistics(a,b)

	My teacher thinks I should study ICT at Post 16
Chi-Square	18.586
df	1
Asymp. Sig.	.000

a Kruskal Wallis Test
b Grouping Variable: The Schools

Teacher Gender

59. The Gender of your Teacher * My teacher thinks I should study ICT at Post 16

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
The Gender of your Teacher * My teacher thinks I should study ICT at Post 16	58	96.7%	2	3.3%	60	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	9.119(a)	3	.028	.026		
Likelihood Ratio	8.966	3	.030	.043		
Fisher's Exact Test	8.365			.035		
Linear-by-Linear Association	5.275(b)	1	.022	.026	.014	.008
N of Valid Cases	58					

a 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.48.
b The standardized statistic is 2.297.

Appendix 3

The Semi-Structured Interview Questions

Work / Study Style Preference

- What do you enjoy about ICT lessons?
- What do you not like about ICT lessons?
- How do you most like to work?
- Would you prefer to work in a single or mixed gender class?

What ICT means to you

- What words come to mind when you think of ICT?
- How would you describe the feeling of being in an ICT classroom?

Behavioural Beliefs

- Would studying ICT after KS4 help you get a good career?
- Would studying ICT after KS4 give you opportunities to interact with more interesting people?

Outcome Evaluations

- Would you like to have more opportunities to interact with your classmates and ICT teacher in ICT lessons?
- Do you feel you are missing out by studying ICT?
- Do you ever find ICT lessons to be tedious and boring?

Normative Beliefs

- Do your parents think you should study ICT post 16?
- Do your close friends think you should study ICT post 16?
- Does your teacher think you should study ICT post 16?

Control Beliefs

- How often do you encounter unanticipated events on your time?
- How often are there unanticipated family demands on your time?

Power of Control Factors

- If you encountered unanticipated events would it be more difficult to study ICT Post 16?
- If you encountered unanticipated family obligations would it be more difficult to study ICT post 16?

Motivation to Comply

- Do you care what other people think? If so, who?

Intention

- Do you intend to study ICT post 16?

Appendix 4

Interview Transcript: Female Student 1

Work / Study Style Preference

- ***What do you enjoy about ICT lessons?***

I enjoy the lesson because there is no seating plan unless we misbehave. Sometimes the boys get moved but the girls can sit together which is not what happens in other classes. The teacher is nice. I like being with friends in lessons and sometimes we can work together which is much better than just sitting staring at the screen!

- ***What do you not like about ICT lessons?***

I think I said it already! I don't like just staring at the screen all lesson. At home when I am doing my homework I can listen to music and go on MSN of Facebook when I am working but in class there is no break in most ICT lessons. Boring!

- ***How do you most like to work?***

Well not just on the computer! I don't mind being on the computer in some lessons but not all lesson. If we can do group work or work in pairs on presentations and posters that is fine though. That is how we work in some other lessons and I like those lessons a lot more.

- ***Would you prefer to work in a single or mixed gender class?***

In ICT I must admit it would be better in some ways to work with just my friends and other girls because the teacher would not have to tell the boys not to play games. The boys are a laugh though and we are together for all lessons apart from PE so I am used to it.

What ICT means to you

- ***What words come to mind when you think of ICT?***

Facebook! All my friends are on Facebook but we are not allowed to access it at school which is irritating because sometimes we even discuss homework on Facebook. At break and lunch time we could look at photos together if we were allowed to. Most of the time we probably wouldn't bother (I don't spend much time on it in comparison to some girls) but it is silly not to have the option to.

- ***How would you describe the feeling of being in an ICT classroom?***

I must admit I sometimes feel very bored and wish I was somewhere else! Anywhere! I think this is because the lessons do not really vary very much. In Geography for instance we might mark each other's work, spend time discussing a situation with the teacher, work on laptops go up to the whiteboard to label a diagram and then put the diagram into our books. That is more interesting because it is more varied. We also sometimes go outside or on trips.

Behavioural Beliefs

- ***Would studying ICT after KS4 help you get a good career?***

  The thought of sitting in an office in front of a computer dealing with money and business is a nightmare to me! I want a job where I am dealing with people and solving their problems. Not solving ICT problems when the computer freezes! I want to be a lawyer or a social worker- something where I can really meet lots of people and not just sit in an office.

- ***Would studying ICT after KS4 give you opportunities to interact with more interesting people?***

Interesting people would not want to work in ICT would they if you think about it? I do not think being an ICT teacher though is really working in ICT. I think of working with ICT as working in business or designing games, which must be the most boring job in the world with the most boring people ever! Can you imagine what the sort of men are like who invent computer games?

Outcome Evaluation

- ***Would you like to have more opportunities to interact with your classmates and ICT teacher in ICT lessons?***
- Sometime I think the teacher spends all his time getting the boys to stop playing games and being slow! I would like more help sometimes. He is nice though and can be helpful. Some of the boys are really good at ICT but some aren't at all but they think they are so great! My friend is top of the class and I always try and work with her obviously!
- ***Do you feel you are missing out by studying ICT?***

Yes! I could be at home watching Murder She Wrote! Not really. I would never bunk school because of ICT! I won't miss out because I will get a Merit in this Diploma and I might even get a Distinction. I suppose in one way I am missing out on some of the other Technology Subjects. My friends love Textiles and are allowed to listen to music in the lessons and went to the V&A to see a costume exhibition that looked brilliant. We would never go on an ICT trip. Can you imagine it? Too boring for words!?

- ***Do you ever find ICT lessons to be tedious and boring?***

Well – how many times have I used the word boring already? (Laughs). So - Yes, Yes, Yes. But it's my fault- I should not have taken the subject. I did not really think. The Diploma sounded great – all about the music industry and boy bands but it's not really about those things. It's really about spread sheets and how to make them, not so much how to use them. It is my fault though.

Normative Beliefs

- ***Do your parents think you should study ICT post 16?***

Well they know I want to be a lawyer or social worker so they would be really surprised! They know I want to take Sociology, History and French if I get good enough GCSE grades which I think I will. They want me to do what will help me at University and that is obviously not ICT is it?

- ***Do your close friends think you should study ICT post 16?***

My friends probably won't study ICT next year so they would not want me to. We would rather be together. They are nearly all doing Sociology. My friend who is really good at ICT wants to do A' Level ICT but she would be amazed if I did. She would laugh.

- ***Does your teacher think you should study ICT post 16?***

I have no idea! I am sure he would say that is fine as he is really nice but he never talks about A' Level at all. He mainly talks about course work deadlines and reminds the boys not to play games. He knows I am not very interested in the subject I think but he gives me good marks and encourages me to go for a Distinction – which I probably will.

Control Beliefs

- ***How often do you encounter unanticipated events on your time?***

Well, I sometimes have to show visitors around the school because I am a Prefect and that means having to miss lessons and catch up but I always do. I would rather miss ICT than some other subjects like Maths or English because those teachers really teach you every lesson. In ICT it is more like you teach yourself or ask your friends or the teacher when you need it.

- ***How often are there unanticipated family demands on your time?***

Quite often I have to babysit my sister who is Year 6. This could be anytime really. There is no set pattern to it.

Power of Control Factors

- ***If you encountered unanticipated events would it be more difficult to study ICT post 16?***

I would never study ICT Post 16! If I am still a Prefect in the 6th form showing visitors around that will always make study more difficult.

- ***If you encountered unanticipated family obligations would it be more difficult to study ICT post 16?***

If I have to babysit then I have to – I can't tell my parents I'm not! My sister would not stop me studying though. She could do her own work or watch TV. If she was a baby it would be different and that would make it difficult to study. I am lucky she is not a baby then aren't I!

Motivation to Comply

- ***Do you care what other people think? If so, who?***

My friends are like me. They want to do well and get good jobs so we agree on that. Good friends would not want you to change. They would not be friends would they? I care about them and they care about me. Of course I care about my parents and what they think. Everyone does really. We might argue about some things but I know they care about me and I want them to be pleased with me. If they are not it is very difficult to do things and get on. So my answer to the question is yes I do care. I think everyone does really but they pretend not to be cool. But it is only pretending.

Intention

- ***Do you intend to study ICT post 16?***

I think I have answered this already? No. I would not like to study ICT next year but I do want to do well this year and my teacher is nice.

Appendix 5

Interview Transcript: Male Student 1

Work / Study Style Preference

- ***What do you enjoy about ICT lessons?***

I like going onto the computers not listening when Sir talks to the whole class. ICT gives us a break from the hard work in other lessons. On the computer you can relax more when you work. It is more interesting.

- ***What do you not like about ICT lessons?***

Sometimes the boys cannot sit together but to be fair that is only if we have been playing games or talking or messing about with each other's work. I really like ICT. It is probably my favourite subject after PE.

- ***How do you most like to work?***

I like to get on with my work on the computer and try different programmes and look at different sites. It would be better if we could listen to music at the same time.

- ***Would you prefer to work in a single or mixed gender class?***

Definitely not! It might be a laugh just to be with other boys but I think the girls make us get on more. They do their homework and that makes the teacher make us do it much more. We all get on and it is a relaxed lesson. My mates at a boys' school wish they could be with girls!

What ICT means to you

- ***What words come to mind when you think of ICT?***

When I think of ICT, I think of games I suppose but they are not the big deal I thought they were. I play games to relax and unwind but when I was younger I spent all my birthday and Christmas money on games. I would never do that now but I do play games when I am relaxing or doing my homework. I listen to music all the time on my laptop at home. When I get a job I will be using ICT all the time I suppose. I would like to work in a job that is relaxed with music, not suits!

- ***How would you describe the feeling of being in an ICT classroom?***

It is a good feeling I suppose because it is easier than other lessons and we are on the computer for most of the lesson getting on. If we can sit together, we have a laugh too but we do get moved if we mess around. I would rather be in ICT than most other lessons because we can get on.

Behavioural Beliefs

- ***Would studying ICT after KS4 help you get a good career?***

It would help you stand out at interviews wouldn't it? If I study ICT at college I will be able to get a better job and earn more much younger.

- ***Would studying ICT after KS4 give you opportunities to interact with more interesting people?***

I don't really know anyone who works in ICT but working on computers is interesting so I suppose so. I would not worry about the people but I would want mates at college and a relaxing atmosphere at work.

Outcome Evaluations

- ***Would you like to have more opportunities to interact with your classmates and ICT teacher in ICT lessons?***

I always get help from my teacher. He comes over and shows me what to do. We are allowed to ask each for help too and that can be good. Sir knows a lot about IT and has taught me lots of new stuff. He can be a good laugh.

- ***Do you feel you are missing out by studying ICT?***

I don't really understand the question? What do you mean? [Is there anything you think you are missing because you chose to do ICT?] Oh- right. No. I'm not missing out on anything. I always knew I would choose ICT from Year 7.

- ***Do you ever find ICT lessons to be tedious and boring?***

No. The lessons aren't boring. Having to get the coursework done is boring but this is the same in all lessons and it is worse when the coursework has to be handwritten.

Normative Beliefs

- ***Do your parents think you should study ICT post 16?***

Definitely. They have always spent money on ICT for me and when I go into the 6th form they are going to get me a new laptop.

- ***Do your close friends think you should study ICT post 16?***

It's not really up to them is it? I don't know what they think but some of them have said they are going to choose ICT in the 6th form so I suppose so.

- ***Does your teacher think you should study ICT post 16?***

Yes – I think so. I'll ask him!

Control Beliefs

- ***How often do you encounter unanticipated events on your time?***

I can't think of anything. I don't know really.

- ***How often are there unanticipated family demands on your time?***

My brother sometimes needs picking up from junior school when my gran is busy with my granddad but that is only about once a month. He waits around the gate and then we go home. If I have a match he comes back to school with me, it's only 10 minutes away. Once I forgot to get him and my parents went mad. I won't do that again. He was alright though.

Power of Control Factors

- ***If you encountered unanticipated events would it be more difficult to study ICT post 16?***

No. Definitely not.

- ***If you encountered unanticipated family obligations would it be more difficult to study ICT post 16?***

No – I would study what ever I want. I am sure my parents and my gran and granddad would sort it for me and my brother, whatever it was.

Motivation to Comply

- ***Do you care what other people think? If so, who?***

I would not want to make my family upset but really what I do is my choice and what they think does not really matter that much in the long run. It's up to me. As long as I earn good money and do not get into trouble I don't think they are bothered. The more qualifications I get will make them happy but really it's up to me.

Intention

- ***Do you intend to study ICT post 16?***

Yes. I will enjoy it and it is more of a laugh than some other subjects. I am going to take Media too because that uses ICT all the time too. I don't know what else yet.

Appendix 6

Research Ethics Committee Application Form (Plus Supporting Guidance Notes and Information)

learning discussion observation
experimentation
testing Research study
technology intelligence exploration
at the University of Greenwich
determination analysis reflection

UNIVERSITY OF GREENWICH

RESEARCH ETHICS COMMITTEE

APPLICATION FORM
(PLUS SUPPORTING GUIDANCE NOTES AND INFORMATION)

July 2007

the
UNIVERSITY
of
GREENWICH

SECTION 1: DETAILS OF APPLICANT(S)

1. Applicant

Surname: Nyangon	Forename: Maurice	Title: Mr
School/Department The University of Greenwich School of Education		Tel: 02083319539
Campus Avery Hill		Fax: 02083319504
Home address Cobham Manor The West Wing Water Lane Thurnham Kent ME14 3LU		
Home Tel	E-mail m.nyangon@gre.ac.uk	
Title of Research: The ICT Gender imbalance in Schools and beyond: Missed Opportunities		

2. Other workers and departments/institutions involved

3. Project Supervision

Name of Research Supervisor & their contact information ***Neil Hall*** ***Francia Kinchington***
Programme of Study (if applicable) EdD

4. Signature of relevant persons

I undertake to carry out research involving human participants in accordance with those Principles of the Declaration of Helsinki which are attached (see Appendix 6) and any research involving animals in accordance with the appropriate code of practice (details of which are given in the Guidelines for Applicants – see Annex VII). In the case of a research degree, I confirm that approval has been given by the Research Degrees Committee. I agree to conform to the requirements of the Data Protection Act 1998 and Freedom of Information Act 2000.

Signature of applicant	Date
I have discussed this project with the applicant and I approve it	
Signature of Supervisor	Date
I have discussed this project with the applicant and I approve it	
Signature of Director of Research or Head of School	Date

Please answer these questions for ALL the investigators involved

5. State your professional qualifications in the field of study B.Ed – The University of Nairobi MSc – The University of Greenwich - June 2000 Computer and Information Systems *Project: Design and Implementation of a Stock Database System.*	
6. State your current membership of professional, or other, bodies which set ethical standards of behaviour or practice such as the British Psychological Society, Nursing and Midwifery Council, and medical Royal Colleges etc. N/A	
7. Who is your employer (where is your payslip issued from)? The University of Greenwich School of Education & Training Avery Hill Campus Bexley Road Eltham SE9 2PQ 020 8331 8234 020 8331 7919	
8. Are you a member of a medical protection organisation? Are you a member of any other protection organisation? Are you provided with insurance by any professional organisation? *(please state which organisation in each case)* The National Association of Teachers in Further and Higher Education (NATFHE)	NO YES YES: NATFHE
9. Primary purpose of the Research • Educational qualification	YES

SECTION 2: DETAILS OF THE PROJECT

1. What is/are the principal research question(s) posed by this research?

   The overarching question this study addresses, from a post positivist paradigm, is: What are the gender differences in Behavioural, Control and Normative beliefs in the intent to study ICT Post 16as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?

The four accompanying sub questions are:

- Are there gender differences in ICT students' attainment and what impact does this have on their intent to study ICT post 16 and beyond?
- How do female students' learning styles and associations with ICT impact on 'pipeline shrinkage' (Michaelson, 2005, SIGIS, 2004, Ali, 2001, Camp, 1997, Leverson, 1990).
- How do female students in single and mixed gender schools differ in their Behavioural, Control and Normative beliefs in the intent to study ICT Post 16as measured through The Theory of Planned Behaviour (TpB) model (Ajzen & Fishbein, 1980)?
- What impact does teacher gender have on the beliefs of female students in single and mixed gender schools?

2. Outline of the proposed project *(a brief description **must** be given here in lay terms. It is **not acceptable** to complete questions by referring to the sections in the UREC forms)*

A project that uses The Theory of Planned Behaviour (TpB) to investigate experiences of female students successfully studying ICT at both Key Stage 4 and A' Level and their option choices. Further, the attitudinal factors that influence female students' uptake of ICT at Key Stage 5 and University will be examined.

3. State the personal experience of the applicant and of any assistants involved with participants in the study in the field concerned. *(In the case of student or non-experienced applicants, please state the name and experience of the supervisor, and the degree of supervision).*

Personal experience:

Senior Lecturer and ICT PGCE Coordinator and previously an ICT subject leader at The Leigh Technology Academy (The Leigh TA) in Dartford, Kent, a leading Technology Academy.

4. What do you consider to be the main ethical issues or problems that may arise with the proposed study and what steps will be taken to address these?
   1. Some of the students who are to be asked to participate in completing The Theory of Planned Behaviour questionnaires are under 18 and consequently permission for their participation will be sought both from the Headteachers who act in loco parentis and through positive consent in response to an explanatory letter to parents sent prior to the questionnaires being given.
   2. Permission from the class teachers will be sought prior to the questionnaires being given.
   3. Regardless of parental permission to participate all students will have an option as to whether they chose to participate or not with an opt out clause. Permission from the students is requested with the clarification provided for them that they do not need to be involved if they do not wish to take part in the questionnaire. Their willingness to complete the questionnaire denotes their permission.
   4. Confidentiality with regard to data is ensured in that all data is anonymised (no names). School codes will be used and information kept in secure data bases and locked filing cabinets. SPSS will be only accessed by the researcher and supervisors.

5. State the intended value of the project, giving necessary scientific background. *(If this investigation has been undertaken previously with human participants, please explain why it needs to be repeated).*

There is a gender imbalance of Post 16students studying Computer Science and ICT. Evidence expounds the premise that female students are disinclined to study ICT beyond the compulsory GCSE level and are under represented in industry. Clearly, research that aims to identify ways to increase female student participation beyond GCSE level will benefit any learning community that strives towards equality.

6. Where exactly will the study take place, i.e. where will the interaction with participants take place, e.g. online, laboratory, primary care trust, etc?

In 3 Partnership Secondary schools: The Leigh Technology Academy, The Thomas Aveling School, The Sarah Bonnell School during the period from January 2008 – March 2008. I am a regular visitor to these schools as a PGCE ICT Subject leader and I have been CRB Checked.

No members of the applicant's family attend these institutions as students and no family member is involved in any way in the research to be undertaken.

7. Have collaborating departments or departments whose resources will be needed, been informed and agreed to participate? YES

In relation to the classrooms and space

8. State likely duration of the project, including proposed start and finish dates where available.

September 2003 – July 2005: Complete Literature Review, Theoretical perspective & initial research preparation. January 2008 - March 2008 collect student questionnaires and lesson observations. July 2007 – April 2008 complete chapter construction and data analysis.

To be completed by May 2008

9. What is the expected total duration of participation in the study for each participant, e.g. 20 minutes to complete a questionnaire, an hour for an interview, etc?

20 minutes to complete the questionnaires (See copy attached)

10. What monitoring arrangements will be in place to check if any new ethical issues emerge during the project?

Consultations with teachers who will be present during completion of the questionnaires

11. Specify whether the following procedures are involved:

	NO
Any invasive procedures, e.g. venepuncture.	YES
Any intrusive procedures, e.g. questionnaire(s), interview, diary, focus groups.	NO
Physical contact.	NO
Any procedure that may cause mental distress, in particular if dealing with vulnerable participants, e.g. young, mentally ill, elderly, etc.	NO
Patient records or data with no other direct participant contact.	NO
Prisoners or others in custodial care.	NO
Adults with incapacity (physical and/or mental).	NO
Testing a medicinal product or device.	YES
Children/Young persons.	

Outline the procedures involved in your study. *If samples are to be taken, state* ***type, frequency*** *and* ***amount*** *and whether this is part of their normal treatment. If Radiological Investigations are part of the procedures please indicate the number and frequency of exposures and total calculated dosage – see Annex V.*

Questionnaires to be completed by post Key Stage 3 students

12. What are the potential adverse effects, risks or hazards for research participants from the interventions?

None

13. What is the potential for pain, discomfort, distress, inconvenience or changes in lifestyle for research participants?

None

14. What is the potential benefit for research participants?

Enables them to voice their views/opinions on ICT. Results will be shared with the students and teachers to give voice to further discussions. An examination of implications for pedagogy.

15. What is the potential for adverse effects, risks, hazards, pain, discomfort, distress or inconvenience for the researcher(s) themselves (if any)?

None

16. Does the research involve any of the following: • working in a laboratory and/or medical establishment? NO • working with or abstaining from hazardous substances? NO • working with sources or ionising radiation? NO • working in an environment where either the participant or the researcher could be at an increased risk of harm, either physically or mentally, e.g. working in an isolated environment, where unreasonable peer pressure/intimidation could apply, etc. NO **If YES to any of these items, you must complete a full risk assessment (see Annex VI). In addition, in the case of ionising radiation, including the administration of X-rays, you must also complete Annex V.**

SECTION 3: RECRUITMENT OF PARTICIPANTS/CONSENT

1 In how many and what types of host organisation(s) is it intended that the proposed study will take place? No more than 3 Secondary Schools: Two mixed Secondary Schools, The Leigh Academy and The Thomas Aveling School, one all girls school, The Sarah Bonnell School.
2 How will you approach and recruit participants for the study? If controls are to be included please state how they are to be selected and attach a copy of the advertisement if used. Through the Head teacher
3 Please specify the type and number of participants to be used in this project, the selection criteria and the exclusion criteria (Note: names of student participants receiving educational credits and/or payments in commercial sponsored research must be notified to the appropriate Head of School, University of Greenwich) What are the principal inclusion criteria, e.g. healthy participants, in-patients, clinic attenders, etc? (please justify)

Students who are or who have studied ICT at Key Stage 4 – The Leigh Academy - 25 The Thomas Aveling School – 25 The Sarah Bonnell School – 25 Students who are or who have studied ICT at Post 16– The Leigh Academy - 15 The Thomas Aveling School – 15 The Sarah Bonnell School - 15 What are the principal exclusion criteria? (please justify) Students who have not studied ICT at Key Stage 4 and Key Stage 5		
4	Are participants to be included under the age of 18? ***(if YES, please fill in Annex II: Research Involving Participants under 18 years of age – NOTE: it is the researcher's responsibility to ensure any enhanced check from the Criminal Records Bureau that may be required is obtained before the research commences)***	YES
5	Is any form of human tissue to be used in this study? ***(if YES, please fill in Annex IV: Research Involving Human Tissue – PLEASE ENSURE YOU READ THE GUIDANCE NOTES)***	NO
6	Please attach a copy of the Participant Information Sheet *(see Guidelines for Applicants – **Annex VII** for details)* Information and Instruction sheet provided for teachers Attached	
7	Is written consent to be obtained using the UREC consent form? *(see **Annex I**)* Is a form other than the UREC consent form to be used? *(if YES, please attach a copy)* Letters to Headteachers and Subject teachers attached	NO YES
8	Will payments be made to participants, e.g. reimbursement of expenses, incentives or benefits? *(if YES, please give details)*	NO
9	What arrangements have been made for participants who might not adequately understand verbal explanations or written information, e.g. where English is not a first language or they have low functional literacy? Teachers and researcher will support understanding of the questionnaire	

ANNEX II: RESEARCH INVOLVING PARTICIPANTS UNDER 18 YEARS OF AGE

Title of Research: A Predisposition To Underachieve? Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary schools.	
1. In what way, if any, does the proposed investigation benefit the individual participant? For example, identifies a particular need for support or intervention Teachers identifying the benefit of group learning/ attitudinal factors that may enhance participation in ICT at KS 5 and beyond at GCSE	
2. Is parent's/guardian's consent to be obtained? *(If YES, in what form - verbal, written witnessed etc? Please attach a copy of the relevant forms – If NO explain why not?)* Headteacher and students' consent sought. Whilst Headteacher to act in loco parentis parental consent Is also to be sought (for students under 18) through an explanatory letter to parents/carers sent prior to the questionnaire being delivered (Included in letters of explanation to Headteachers) . .Pupils consent through participation following and explanation of the Instruction Sheet.	YES
3. Will the child's or young person's assent/consent be sought and if so how? *(If YES, in what form - verbal, written witnessed etc? Please attach a copy of the relevant forms – If NO explain why not?)* A verbal, witnessed by the class teacher, explanation of the written Instruction Sheet will be given to the pupils.	YES
4. Are the risks of the investigation judged to be minimal or nil and if so how? *(please attach a risk assessment form if necessary)* *Investigation is to promote positive participation and consequently involves minimal risk*	YES
5. Does the applicant and/or any researcher with direct contact with a child or young person have formal Criminal Records Bureau clearance? *(If YES, please attach a certified copy or a signed undertaking from the researcher that the required clearance has been obtained).* *Yes*	
6. Will another adult be present at all times during periods of interaction between the researcher and child/young person and if YES who? The Subject Teacher	YES

7. Have arrangements been made to provide counselling/support for any child or young person who may become psychologically affected as a result of the research? If YES please give details: N/A Reflection on attitudes to learning is custom and practice at Key Stage 4 and 5	NO
Signature of applicant	**Date**

Appendix 7

Letters to ICT Subject Leaders

the UNIVERSITY of GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Mr M Turner
The Leigh Academy
Green Street Green Road
Dartford
Kent
DA1 1QE

Dear Mr Turner,

Re: Doctorate in Education Research Project Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary Schools and beyond.

As we have discussed many times my doctoral thesis is an investigation into what influences female students in their predisposition to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is pertinent to your department and the high impetus you place on gender parity of achievement.

I have sought both parents' and the Head's permission to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the Academy itself will be referred to by name and there will be no penalty for non-participation.

I would ideally like to undertake this research during January and February, 2008.

I enclose copies of the questionnaires and would welcome any further queries you have regarding the research.

Thank you.

Yours sincerely,

Maurice Nyangon

the
UNIVERSITY
of
GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Mrs M Hellyer
The Thomas Aveling School
Arethusa Road
Rochester
Kent
ME1 2UW

Dear Mrs Hellyer,

Re: Doctorate in Education Research Project Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary Schools and beyond.

As we have previously discussed my doctoral thesis is an investigation into what influences female students in their predisposition to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is pertinent to your department and the high impetus you place on gender parity of achievement.

I have sought both parental and the Head's permission to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the Academy itself will be referred to by name. There is no penalty for non participation.

I would ideally like to undertake this research during January and February.

I enclose copies of the questionnaires and would welcome any further queries you have regarding the research.

Thank you.

Yours sincerely,

Maurice Nyangon

the
UNIVERSITY
of
GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Mr S Eason,
Sarah Bonnell School
Deanery Road
Stratford, London
E15 4LP

Dear Mr Eason,

Re: Doctorate in Education Research Project Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary Schools and beyond.

As we have previously discussed my doctoral thesis is an investigation into what influences female students in their predisposition to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of particular concern to a Head of ICT in a girls' school.

I have requested permission from both parents and Mrs Tooley to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the Academy itself will be referred to by name. There will be no penalty for non-participation.

I would ideally like to undertake this research during January and February 2008.

I enclose copies of the questionnaires and would welcome any further queries you have regarding the research.

Thank you.

Yours sincerely
Maurice Nyangon

Letters to Heads of Schools requesting permission to carry out the survey

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

the UNIVERSITY of GREENWICH

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Mr F Green
The Leigh Academy
Green Street Green Road
Dartford
Kent
DA1 1QE

Dear Mr Green,

Re: A University of Greenwich Doctorate in Education Research Project Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary Schools and beyond. Supervised by Dr N Hall Telephone 02083318058 and F Kinchington Telephone 02083319524

As we have discussed many times my doctoral thesis is an investigation into what influences female students in their predisposition to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of concern to all education leaders and pertinent to The Academy's success.

With your permission, I propose to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the Academy itself will be referred to by name. There will, of course, be no penalty for non participation. Prior to the questionnaire being given to the students who are under 18 parents should be given the opportunity to opt out if they prefer their son or daughter does not participate. In order to do so students should be given a copy of the letter to parents/carers enclosed and positive consent to participation given on the return proforma.

I would ideally like to undertake this research during January and February.

I enclose both copies of the questionnaires and the letter of parental consent. I would welcome any further queries you have regarding the research.

Thank you.

Yours sincerely,

Maurice Nyangon

the
UNIVERSITY
of
GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Mrs C Tooley
Sarah Bonnell School
Deanery Road
Stratford
London
E15 4LP

Dear Mrs Tooley,

Re: A University of Greenwich Doctorate in Education Research Project Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary Schools and beyond. Supervised by Dr N Hall Telephone 02083318058 and F Kinchington Telephone 02083319524

As we have previously discussed my doctoral thesis is an investigation into what influences female students in their predisposition to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of concern to all education leaders and pertinent to the school's success.

With your permission, I propose to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the Academy itself will be referred to by name. There will, of course, be no penalty for non participation. Prior to the questionnaire being given to the students who are under 18 parents should be given the opportunity to opt out if they prefer their son or daughter does not participate. In order to do so students should be given a copy of the letter to parents/carers enclosed and positive consent to participation given on the return proforma.

I would ideally like to undertake this research during January and February.

Thank you.

Yours sincerely,

Maurice Nyangon

the UNIVERSITY of GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Mr R Hart
The Thomas Aveling School
Arethusa Road
Rochester
Kent
ME1 2UW

Dear Mr Hart,

Re: A University of Greenwich Doctorate in Education Research Project Addressing the Attitudes and Beliefs that lead to Gender imbalance in the ICT uptake in Secondary Schools and beyond. Supervised by Dr N Hall Telephone 02083318058 and F Kinchington Telephone 02083319524

As has been discussed my doctoral thesis is an investigation into what influences female students in their predisposition to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of concern to all education leaders and pertinent to school's success.

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I would ideally like to undertake this research during January and February.

I enclose copies of the questionnaires and would welcome any further queries you have regarding the research.

Thank you.

Yours sincerely,

Maurice Nyangon

Appendix 8

Parental consent letters

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

the UNIVERSITY of GREENWICH

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

The Leigh Academy
Green Street Green Road
Dartford
Kent
DA1 1QE

Dear Parents/Carers,

Re: Doctorate in Education Research Project to Address the Attitudes and Beliefs that lead to female students failing to study ICT in Secondary Schools and beyond.

I am a Senior Lecturer at The University of Greenwich and as part of my work I am currently completing a Doctoral Thesis. I am investigating into what influences female students in their tendency to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of particular concern to many Headteachers and, in our growing technological world, many parents.

I have requested permission from the Headteacher, Mr Green, to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the school itself will be referred to by name. There will be no penalty for non-participation.

I would ideally like to undertake this research during January and February 2008 and I am taking this opportunity positively to request your permission for your son or daughter to participate.

If you agree to their filling in a questionnaire and being part of The University of Greenwich study please fill in the attached consent slip and return to the Head of ICT.

Thank you for your support.

Yours sincerely,

Maurice Nyangon

I do/do not (Please delete as appropriate) give permission for my son/daughter to take part in a study being undertaken by The University of Greenwich into why female students do not study ICT at Key Stage 5 or beyond.

Signature:---

Name of Student:---

the UNIVERSITY of GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

The Thomas Aveling School
Arethusa Road
Rochester
Kent
ME1 2UW

Dear Parents/Carers,

Re: Doctorate in Education Research Project to Address the Attitudes and Beliefs that lead to female students failing to study ICT in Secondary Schools and beyond.

I am a Senior Lecturer at The University of Greenwich and as part of my work I am currently completing a Doctoral Thesis. I am investigating into what influences female students in their tendency to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of particular concern to many Headteachers and, in our growing technological world, many parents.

I have requested permission from the Headteacher, Mr Hart, to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the school itself will be referred to by name. There will be no penalty for non-participation.

I would ideally like to undertake this research during January and February 2008 and I am taking this opportunity positively request to your permission for your son or daughter to participate.

If you agree to their filling in a questionnaire and being part of The University of Greenwich study, please fill in the attached consent slip and return to the Head of ICT.

Thank you for your support.

Yours sincerely,

Maurice Nyangon

I do/do not (Please delete as appropriate) give permission for my son/daughter to take part in a study being undertaken by The University of Greenwich into why female students do not study ICT at Key Stage 5 or beyond.

Signature:---

Name of Student:--

the UNIVERSITY of GREENWICH

The University of Greenwich School of Education & Training
Avery Hill Campus Bexley Road Eltham London SE9 2PQ

Tel. Number: 02083319539
Fax Number: 020 8331 9504
E-mail:

Sarah Bonnell School
Deanery Road
Stratford
London
E15 4LP

Dear Parents/Carers,

Re: Doctorate in Education Research Project to Address the Attitudes and Beliefs that lead to female students failing to study ICT in Secondary Schools and beyond.

I am a Senior Lecturer at The University of Greenwich and as part of my work I am currently completing a Doctoral Thesis. I am investigating into what influences female students in their tendency to drop out of studying ICT at Key Stage 5 and beyond despite their achievements at Key Stage 4. I know this is an issue that is of particular concern to many Headteachers and, in our growing technological world, many parents.

I have requested permission from the Headteacher, Mrs C Tooley, to carry out two questionnaires; one to Year 11 students and one to Key Stage 5. The questionnaires address the attitudes and beliefs of students with regard to them continuing to study ICT after completing their current course. The findings will, of course, be made available to staff and students when the doctorate is published.

As is custom and practice the questionnaires are anonymous as will be the analysis. No student, teacher or the school itself will be referred to by name. There will be no penalty for non-participation.

I would ideally like to undertake this research during January and February 2008 and I am taking this opportunity positively to request your permission for your son or daughter to participate.

If you agree to their filling in a questionnaire and being part of The University of Greenwich study, please fill in the attached consent slip and return to the Head of ICT.

Thank you for your support.

Yours sincerely,

Maurice Nyangon

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Signature: ---

Name of Student: --