Secondary school students' perception of and attitude to information technology, with particular reference to their gender

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SECONDARY SCHOOL STUDENTS' PERCEPTION OF AND ATTITUDE TO INFORMATION TECHNOLOGY, WITH PARTICULAR REFERENCE TO THEIR GENDER

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ABSTRACT

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SECONDARY SCHOOL STUDENTS' PERCEPTION OF AND ATTITUDE TO INFORMATION TECHNOLOGY, WITH PARTICULAR REFERENCE TO THEIR GENDER

This research aims to assess secondary school students' attitudes to and anxieties about Information Technology and computers in relation to their gender. A wide variety of literature in the area of IT and gender was studied to provide background information for this research, as well as assisting the design of research instruments. The students and teachers involved in this research were all from middle and upper schools in the Newmarket area. At the time of data collection students were provided with high levels of IT facilities compared to the national average. In Newmarket schools, IT is used in a variety of subjects with the aim of encouraging a more student based learning pedagogy.

The research involved collection of quantitative data. For this purpose, two instruments, *Computer Attitude Test* and *Computer Anxiety Test* were used in middle and upper schools to test the students' general attitudes to and personal anxieties about IT and computers. The majority of the students in the sample indicated that they had access to a home computer and expressed positive attitudes to computers as well as minimal anxiety when using them. However a

majority of the home computer owners were boys who also expressed higher levels of confidence when working with computers compared to the girls. Furthermore, students who had access to a home computer and those in lower year groups also indicated positive attitudes to and minimal anxieties about computers. The study concludes that in secondary schools, male students are more aware of the advantages of computers as well as the potential effect of IT on society and on people's lives.

Dedicated to myself.

I dreamt, suffered and achieved,
and finally when I looked in the mirror,

I smiled.

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CHAPTER 1
Introduction

1.1 How it all began

As a teacher, I am in the privileged position of witnessing the development of many young people. I have realised that many factors affect their attitude to school subjects and the directions which they follow in later life. These factors may include the influence of their families or peers and the economic conditions of the time.

However one factor which, in my specialist area of technology, appears to be a dominant influence, has been the effect of students' gender (Archer, 1989; Archer and McDonald, 1991; Elkjaer, 1992; EOC, 1985). Historically, in schools, technology has attracted more male students than female students (Buckley, 1990; DFE, 1993b), from the original subjects of wood work and metal work to their present mutation, craft, design and technology (CDT). Also historically there have always been more male teachers of technology than female teachers (Spear, 1984). Although recent developments in the National Curriculum have included home economics options in the technology curriculum (SCAA, 1994), bringing in more female teachers into the subject, nevertheless home economics is perceived as a female subject, studied by more girls while CDT appears to still attract more male students (DFE, 1994d).

My own attraction to technology has been mainly due to the overwhelming encouragement that I received from my parents at an early age. I can recall vividly that according to my mother as well as my father, my brothers and I were all going to be technologists and engineers and my sisters were all going to be teachers and nurses. My father himself was a civil engineer and my mother an operating theatre nurse and it is interesting that out of their seven children, only two are following their predicted careers!

In recent years the introduction of computers and Information Technology or IT, in my subject area, has brought in new challenges to technology departments and their students. IT has had a comparatively short existence in schools' curriculum. Consequently, it should have been perceived by students as a neutral subject, encouraging all interested pupils, male and female, to participate. However from my experiences in my school, IT appears to have followed other branches of technology and boys seems to have become the majority participants in IT. The perception of IT as a male orientated subject is also suggested in numerous research studies (Blease, 1990; Culley, 1986; Durndell, 1993; Elkjaer, 1992; EOC, 1985; Harrison, 1991; Janssen Reinen, 1993; NCET, 1994; Virgo, 1993).

One by-product of such a situation may be the generation of an increase in stereotypical attitudes. Stereotypical presumptions and the consequent pressure that it places on female students could discourage them, even further, from learning in areas such as IT. Therefore the concept of stereotyping was the starting point for my research and it posed the question of why IT has been reported as a stereotypically male dominated subject in schools and whether this would be the case in other secondary schools.

My initial informal analysis of the relationship between gender and IT in my school, during my involvement in the development of the IT curriculum,

suggested that there is a gender difference in the way IT is perceived. In general our male students appeared to be keener in their pursuit of IT than their female counterparts. This was evident in their more enthusiastic pursuit of IT in lessons and during Computer Club periods. For example, the signing-on sheets for my Computer Club, indicated that over a period of one term, 74% attending the club were boys while 24% were girls, a ratio of 3 to 1. Furthermore in my IT lessons boys appeared to be the more dominant sex, judging by their enthusiasm to be first on computer stations, while the majority of girls appeared to be hesitant. Girls showed less interest than boys in working with computers and appeared to encounter more IT related problems and needed more assistance than boys. My conclusion at this point was that my female students may have had less hands on experience of computers than their male counterparts. My female students, also, did not appear to be as enthusiastic as boys to work on computers even when I ensured that there were free stations. For me, this clearly suggested the existence of a gap, to the detriment of the female students. In fact there was evidence that, at times, our male students appeared to be somewhat obsessive in their use of computers, preventing some of the female students from having any substantial access to the machines.

It then occurred to me that I might have to re-evaluate the school's and my own procedures for encouraging our female students' participation in IT. The school, for sometime, had been introducing various initiatives to enable more access to technology, in particular IT, for all its students. This was through the purchase of more IT facilities for various departments and the introduction of IT facilities in the school library. The IT department obviously had a great deal to contribute to the argument too and still were aware that boys were the majority gender on the IT courses that they were running at the time. One major initiative which they had taken was to increase the level of capitation and also an initial investment had upgraded the existing computers as well as increasing the

number of machines. At the time of my initial investigations (1993) the ratio of computers to students in my school was 10 pupils per computer compared to the national average of 13 pupils per computer (DFE, 1993a). The IT department felt that such a level would increase the chance of more females having access to computers. This however didn't appear to materialise and my daily contact with students in IT lessons appeared to indicate that although there were more computers available, girls still showed very little interest in using them. Boys were the majority IT users and they were now using more of the new and upgraded machines.

A further analysis of the situation in my school posed a second question, arising from the speed by which IT was introduced in the school's curriculum. Although the Science Department had for sometime been using computers in their laboratory experiments, it was not until 1990 that the school could afford dedicated IT rooms. Initially, many of our students, as well as teachers, showed very little enthusiasm for IT and it was mainly the Technology department who were the principle users of the rooms for activities ranging from basic word-processing to CAD (Computer Aided Design). However two factors changed this situation very quickly. Firstly the increase in the number of computers and the need to justify the costs meant that the school had to make a more determined effort to promote the IT facilities, hence increasing departments' awareness of the availability of the new computers. Secondly, as a result of the National Curriculum requirements (SCAA, 1994), departments showed urgency in including IT in their schemes of work. At the time, staff with IT backgrounds proved themselves to be invaluable to their departments and in the majority of cases these were our male staff. I feel that the speed by which IT was included in the school curriculum caught many of our students, as well as the staff, by surprise. These appeared to be students and teachers with minimal experience in working with computers. This meant that the students who had had experience of working with computers outside the school, and consequently

were more computer cultured, might have adapted to changes with least reluctance. Since boys appeared to be the majority computer users in the school, my conclusion was that boys might have had more experience in using computers outside the school too, that is, they had had more access to home computers. Meanwhile the majority of the school's staff and many students were still getting to grips with the basics of IT!

Therefore my school's initiatives seemed to have made very little impact on the question of participation by girls in IT activities. Our girls appeared, either to be denied access to school computers by the boys' obsessive usage or they were, for some reason, avoiding the machines, as a result of a negative attitude to them.

So my initial question and the subsequent ones were still unanswered. Reasons for the difference in participation were unclear and I realised that in order to throw light on these questions, I needed to understand the way male and female students in secondary schools felt about IT, how they were affected by it and how they saw their roles in an IT environment, now and in the future and to search the literature for relevant research.

1.2 Conclusion

My research is therefore asking the following question:

- How is IT perceived by students?
- What is the attitude of students to IT?
- Does the gender of students affect their perceptions of, and attitudes to, IT?

Therefore the starting point for this study is a review of existing literature on the reasons for the growth of IT in schools, the effect of the National Curriculum on the role of IT in schools and the effect of students' gender on their participation in IT. The results of the literature review are then used to produce research instruments in order to gather appropriate data for further analysis. The analysis of the data aims to clear the issues and go some way towards answering my original questions.

Chapter 2

Literature Review 1

The Growth of Information Technology in the Curriculum

2.1 Introduction

This chapter aims to deal with the growth of IT and computing, particularly in education. It appears that the IT industry is an ever expanding industry which has affected more or less every aspect of our lives, and education is no exception.

The chapter starts by summarising the present situation and continues by concentrating on the effect of IT on the school curriculum, in particular the requirement of the National Curriculum. This is an important issue, since the National Curriculum requirements have increased the pressure on schools to provide IT facilities for all their students, with implications regarding the required funding in order to do so. Prior to the National Curriculum IT was taught as a subject in its own right but now it is used across the curriculum.

2.2 Background

IT is a relatively new subject which is and has been of enormous interest to educationalists and non-educationalists. The rapid development of IT and its

expansion into all walks of life has made the subject an important focus point for researchers. It was not many years ago that mobile telephones were the proud possessions of "Yuppies", but now they are becoming as common as microwaves or video recorders. Games consoles and microcomputers too, are enjoying popularist status, as nearly half a million microcomputers were sold in 1994 (ITN, 1995). These machines are constantly being improved in terms of their processing power and speed which enables them to run more sophisticated software packages. Many new microcomputers used at home by non-specialists can confidently boast the power and speed of the previous generations of mainframe machines which could only be found in industry. New faster, more powerful and smaller processes have reduced the size of desk top machines creating a whole new market for laptops and note books. The American company, INTEL are marketing their new Pentium processor through their vast number of agents and suppliers. Pentium processors are encouraging a new generation of microcomputers which are taking us into the next century with the global recognition that information technology is changing our way of life for good. The sophistication of the new computers has enabled the development of new software that are user friendlier, much more comprehensive, interactive and imaginative and all this at low cost, and enabling the non-specialists to learn to use them without any formal training. The availability of CD-ROM technology and the ever growing INTERNET, as a viable world-wide information highway, are two areas of development which have enabled computer users to access vast amounts of information. It appears that IT has become a dominant industry and the future prosperity of any nation may be linked to the success of their IT industry.

It therefore appears that the younger generation's involvement in the IT is vital and they may have to accept it as part of their everyday life. Such notions, though they may be daunting for many, have highlighted the role of secondary schools, where students prepare themselves for their future careers.

Secondary schools can influence teenagers towards accepting IT and adopting computers as a tool for their development and future careers. This argument is reinforced by many industrialists who have indicated that the job prospects for someone who cannot handle a computer are getting slimmer all the time (Harrison, 1991).

2.3 IT in education

The advent of the National Curriculum has raised many issues with regards to the implementation of IT in schools. IT capability was first set out in the Technology Statutory Orders in 1990 (DES and Welsh Office, 1990). The non-statutory guidance which was published prior to the orders suggested that IT should be a cross-curricular subject (Passey, 1994). However the examination boycotts of SATS by teachers led to a revision of the National Curriculum. As part of this process, IT was established as a subject in its own right (SCAA, 1994), but the cross-curricular nature of IT remains the main feature of the subject. It appears that the new orders see IT as an integral part of every student's education, a fact which is reinforced by the requirements of industry (Harrison, 1991).

The draft proposal explained that;

> *" They (the programmes of study) for Key Stages 1, 2 and 3 have been written to reflect a balance between the specific teaching of IT skills and their use in other subjects at each key stage. "* (SCAA, 1994; p.11)

and;

" For Key Stage 4,....., a programme of study has been produced which allows pupils to develop their IT capability in other areas of the curriculum as an alternative to specialist IT courses. " (SCAA, 1994; p.11)

Furthermore, regarding the secondary schools curriculum, the consultation document proposed that at Key Stage 3, IT is used:

" To communicate and handle information;
To investigate
i. modelling;
ii. measurement and control technology. " (SCAA, 1994; p.11)

The document proposed that at KS3, schools on average should allocate half of the IT time to teach IT skills and knowledge, and the other half for pupils to apply IT within their work across the curriculum. At Key Stage 4, the document produced a program of study which intended to allow pupils to develop their IT capability in other areas of the curriculum as an alternative to specialist IT courses.

It therefore appears that IT is viewed as a tool which can support a range of activities, that is IT must be regarded as a cross-curricular subject. This has meant that the Technology departments are not required to be the sole curriculum planners regarding the implementation of IT and is a reflection of IT's increasing prominence in all areas of the school curriculum.

A point of concern here is teachers' views of IT. There appears to be an official line indicating that IT skills are essential to the future of the students regardless of any educational value which IT may or may not have. Furthermore, it

appears that the concerns of teachers are ignored. Teachers, male and female, are the deliverers of the curriculum and the cross curricular requirements of IT may become an extra burden and a source of anxiety for them.

> *" teachers are concerned about whether they have the competence to assess IT capability. "* (Passey, 1994; p.7)

In secondary schools, teachers as well as students, may have to come to realise that learning and knowing about IT could influence their future prospects even if they are not technically minded.

2.4 Funding

In 1981, Kenneth Baker, the then Minister for Information Technology, launched the 'Micros in Schools' scheme and declared:

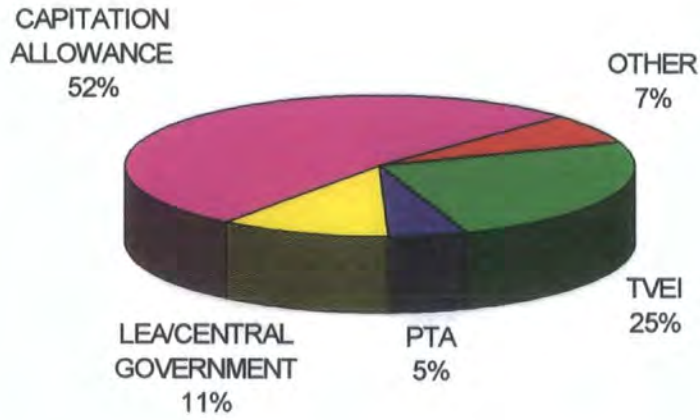
> *" I want to try and ensure that the kids of today are trained with the skills that gave their fathers jobs...And that is the reason why we've pushed ahead with computers in schools. I want youngsters, boys and girls leaving school at sixteen, to actually be able to operate a computer. "* (Scaife, 1993; p. 15)

Such a statement indicates the emphasis placed by the government on the attainment of new skills by the school leavers. There is a parallelism in the statement, which appears to indicate that children require to learn contemporary skills, if they are to be successful in industry, as their fathers had to learn the then contemporary skills appropriate to the economic requirements of their time.

The year 1982 was declared IT year, and initially about £16 million was provided by the Department of Trade and Industry (DTI) and this sum was exceeded by the Department of Education and Science (DES) when the Microelectronics Education Programme (MEP) was launched with a £23 million budget which ran until 1986. As well as the intervention by central government agencies, financial support from the private sector also increased the IT funding further (Alvey Committee, 1983).

The Statistical Bulletin from the Department For Education (DFE, 1993a) indicated an increasing commitment by the government, private sector and schools themselves to provide more and more IT facilities for students. In 1984-85 each school spent around £2250 compared with £15450 spent in 1991-92. In 1991-92 an estimated £59.5 million was spent on IT in secondary schools nationally. Nearly 90% of expenditure on IT equipment (excluding administration) was met from public funds (figure 2.1).

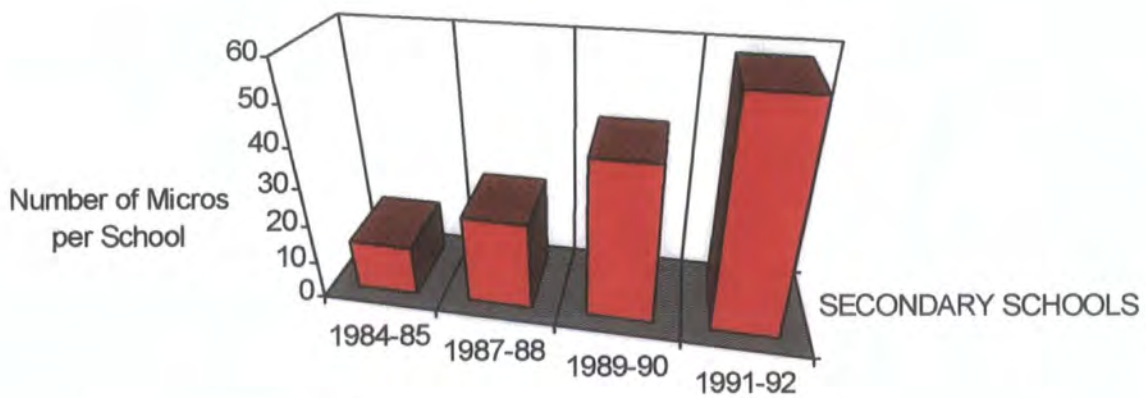
FIGURE 2.1
Source of I.T. Funding in Secondary Schools in 1992



(Source: DFE statistical bulletin, 1993a)

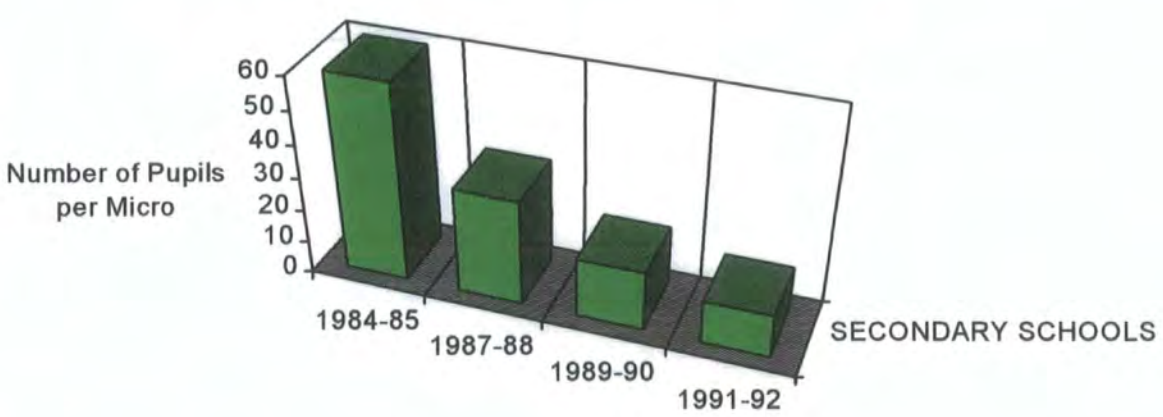
There were on average 58 microcomputers per secondary school in 1991-92, compared with 13 in 1984-85 (figure 2.2) and the average number of pupils per micro in 1991-92 was 13, compared with 60 pupils per micro in 1984-85 (figure 2.3).

FIGURE 2.2
Increase in the Ratio of Micros per Secondary School from 1984 to 1992



(Source: DFE statistical bulletin, 1993a)

FIGURE 2.3
Decrease in the Ratio of Pupils per Micro from 1984 to 1992



(Source: DFE statistical bulletin, 1993a)

The availability of other IT equipment, such as computer peripherals, were also featured in the report. At the time of publication, on average, each secondary school had the following equipment:

Printers	
Laser	0.9
other (colour)	2.4
other (monochrome)	18.1
Modem	1.2
Tape Streamer as backup to hard disk	0.4
Disc Drive (hard free standing)	2.1
CD-ROM drive	0.6
Overlay Keyboard	1.0
Mouse	26.2
Digitiser	0.6
Control Interface	2.6
Keyboard Synthesiser	2.6
Digital Sound Processor	0.4
Sequencer	0.3
Computer Music System, e.g. MIDI	0.8
Switches or other alternative input devices	1.7
Interactive Video Player	0.1
Computer Controlled Machine	0.3
Programmable Robot	1.1
Data Logging Device	1.8
Electronic Kit	4.9
FAX	0.3
Satellite Receiver	0.4

(Source: DFE statistical bulletin, 1993a)

It is clear that the rise of IT and its assimilation into the secondary schools' curriculum has been relatively fast. However not many reasons for this rise are apparent. The main argument appears to centre around the attainment of a new skill, a message which has been conveyed by the government rather than by schools. This new skill appears to have become an important addition to school leavers' portfolio of skills, required by industry (Harrison, 1991). This suggests that the government's reasons for supporting IT in schools may have been instrumental rather than educational.

> *" computers were introduced into education with an efficient economy perspective rather than an educational rationale. "*
> (Beynon, 1989; p. 255)

It therefore appears that IT was introduced in school for economic necessities rather than educational requirements. However for it to be successful, schools' co-operation would have been vital.

The growth of IT indicates that schools have adopted computers without many objections. Heads of departments in nearly one third of secondary schools reported that IT did make a substantial contribution to teaching and learning (DFE, 1993a), a figure double the percentage in 1987-88. On average around 70% of secondary school departments used IT in their teaching and nearly two thirds used central computing facilities (DFE, 1993a). Schools estimated that 86% of students would have had hands-on experience of computers by the end of the academic year 1991-92 (DFE, 1993a). The great majority of secondary schools reported that computers were used by students with special educational needs and over 60% had used computers to improve their access to the curriculum (DFE, 1993a).

Scaife (1993) suggest that this enthusiasm for IT by schools appears to be due to the computer's basic advantages and benefits, which are:

- collecting and storing large amount of data,
- performing complex calculations on stored data rapidly,
- processing large amounts of data and displaying it in a variety of formats.

A result of such perceptions of the advantages of computers, may have been for schools to reorganise their curriculum in order to accommodate more IT and consequently to reduce time consuming routines and allow students more time to learn the important aspects of school subjects. That is:

> " *computers minimise inauthentic learning and increase authentic and purposeful learning.* " (Scaife, 1993; p.23)

Therefore the growth of IT in schools appears to be as a result of an increasing demand by schools themselves rather than any enforcement by outside agencies, and although computers may have been introduced into education for reasons of future economical prosperity (Beynon, 1989), schools themselves did in fact recognise the importance of computers and their role in improving the learning process and the learning environment.

2.5 IT courses in secondary schools

As was indicated earlier, SCAA (1994) has identified IT as a cross curricular subject within the National Curriculum. However prior to the curriculum changes, IT courses in secondary schools were specific and two distinctive types were in operation, *"Hard Computing"* and *"Soft Computing"* (Elkjaer,

1992; Mahony, 1990). Hard computing referred to the more technically demanding areas of IT, usually formal and mathematical or involving specialised computing languages. This type of computing appeared to be far removed from the real world and everyday users. Soft computing, on the other hand, involved areas such as Word-processing, DTP (Desk Top Publishing), Multimedia, Graphics and Arts applications. The soft areas required no technical knowledge and involved contact and concern with users as well as machinery (Martin, 1991). Soft computing was considered as easier to master and at the same time less pure than hard computing, which meant hard computing put the user amongst the elite (Mahony, 1990).

There appear to have been various IT courses taught in schools. The following four categories are suggested to have been the most popular (Bardsley, 1987; Culley, 1986; Janssen Reinen, 1993; Martin, 1991; Scaife, 1993):

1. Computer Studies and Computer Science courses:

   These were Hard computing courses and their growth in schools are attributed to pressures from pupils (particularly boys) who had access to computers at home and wanted the opportunity to extend their knowledge and gain a qualification. Parental pressures, perceiving enhancement in job prospects for their children, also played a role. One notable point about these courses was their possible role in the enhancement of the awareness about a gender gap in computing, as boys appeared to constitute the majority gender on such courses.

2. Computer Awareness and Computer Literacy courses:

   These courses emphasised the soft computing aspects of IT. The courses were introduced in order to give pupils a basic understanding of the concept of the new technology and its social implications while some

hands-on experience with computers was included. Many teachers found such courses useful, enabling all students to take part.

3. Computer Aided Instruction (CAI) and Computer Assisted Learning (CAL) across the curriculum:

Here computers were used across the curriculum to aid the teaching and the learning process. CAI and CAL may have been the first instances of cross-curricular IT. CAI was used to administer drill-and-practice examples or programmed instruction while CAL was a more interactive and sophisticated use of the computer. CAI and CAL were used within many areas of the curriculum, but remedial and special education areas found CAI and CAL especially helpful (Culley, 1986). The most common usage of CAI and CAL was in mathematics and experimental science, where computers could replace teachers as instructors, enabling students to work on mathematical problems and scientific experiments at their own pace.

4. Computer Managed Learning (CML) and School Administration:

While CAI and CAL concentrated on students' learning, CML helped them and their teachers by relieving them of some of the routine and time consuming data management processes, such as test analysis and maintenance of records. Computers also started to be used extensively in school administrative applications such as time tabling.

2.6 Conclusion

The literature in this area indicates that IT has become a major part of schools' curriculum and it is now required to be used as an aid in teaching and learning and should be used in various areas of the curriculum (SCAA, 1994). This

appears to have been enforced on schools (Passey, 1994), though schools now appreciate computers' benefits (DFE, 1993a).

Therefore the introduction of IT in schools appears to have been mainly due to pressures from outside rather than any enthusiasms from teachers. It is suggested that computers were introduced into education with an " *efficient economy perspective, rather than an educational rationale* " (Beynon, 1989). There seems to have been very little debate about the introduction of IT into education and the evidence indicates that consequences for teacher pedagogy and learning processes have not been fully assessed.

Many teachers probably had very few IT skills and their students might in fact have had more knowledge about computers than they did. This could have set the agenda, that is the more IT cultured students, who were suggested to have been mostly boys (Culley, 1986) were the main computer users in schools. This may have disadvantaged and even discouraged other students, particularly in the hard areas such as the Computer Studies and Computer Science courses.

The change in the picture, with the arrival of the National Curriculum, should have enabled teachers and students to be more concerned with cross-curricular computing, for example Information Control. The curriculum requirements indicated that the hard approach, of skill-and-learn and content-laden computing, was no longer required and the soft approach, of content-free and open-ended computing, which gives more freedom to the students, should be encouraged. On the face of it, such a pressure-free approach should have encouraged teachers to use more IT in their lessons, encouraging more students, including girls, to participate. This is the area which is investigated in the next chapter.

Chapter 3

Literature Review 2

The Effect of Students' Gender on Their Participation in Information Technology

3.1 Introduction

Chapter 2 concluded that there is now an increase in IT provision in schools. The main factor for this increase appears to have been governmental requirements rather than educational needs. The requirements of the National Curriculum also increased the importance of IT in schools. One of the consequences of this increase in provision has been to highlight the perceived gender differences in participation in IT. The chapter suggested that boys, due to their wider experience, tend to be the main participants in IT. At this stage it may be suggested that girls, for reasons which may be clear later, are less likely to appreciate the advantages of IT.

This chapter therefore aims to focus on students' understanding and attitude to IT and the differences between male and female students in their perception of IT and computing.

The study draws on the research evidence and other literature in this field to consider the reasons for the perceived gender gap in participation in IT.

3.2 IT and gender

The suggestion from the last chapter is that girls tend not to be enthusiastic participants in IT, a point suggested by the National Council for Educational Technology (1992b). NCET's suggestion is that Information Technology is seen as a gender-specific subject, that is, stereotypical attitudes are creeping into this area of curriculum and factors such teachers' attitudes, parents' influence and access to resources are perpetuating the problem (NCET, 1994). It is not, however, clear how students themselves perceive their roles in an IT environment. If the inevitability of the importance of IT in all areas is to be accepted, then the participation of all students, male and female is important. Human resources cannot be ignored if a successful IT environment is to be achieved. It is therefore vital to gauge gender specific attitudes to IT and realise the differences in boys' and girls' perception of IT.

3.3 Stereotyping

> *" A father and his son were driving to a ball game when their car stalled on the railroad tracks. In the distance a train whistle blew a warning. Frantically, the father tried to start the engine, but in his panic he couldn't turn the key and the car was hit by the onrushing train. An ambulance sped to the scene and picked them up. On the way to the hospital, the father died. The son was still alive but his condition was very serious, and he needed immediate surgery. The moment they arrived at the hospital, he was wheeled into an emergency operating room, and the surgeon came in, expecting a routine case. However, on seeing the boy, the surgeon blanched*

and muttered, ' I can't operate on this boy - he's my son. " (Hoyles, 1988; p.1)

It is pointed out by Hoyles that, to most of us bizarre worlds with such things as reincarnation come more easily to mind than the idea that a surgeon could be a woman !

Dated stereotypical perceptions, such as above, may still be a feature of the traditionally male dominated professions. What is surprising is the existence of such perceptions in a relatively new area such as IT.

Many other studies in the field of IT, have also discovered a reluctance by girls to participate in IT and Computing (Blease, 1990; Culley, 1986; Durndell, 1993; Elkjaer, 1992; EOC, 1985; Harrison, 1991; Janssen Reinen, 1993; Virgo, 1993). The paradox is that computers have never been the exclusive domain of men. Many attribute the invention of computers to a female and therefore research findings of girls' reluctance to participate seem to argue against historical facts (Deakin, 1984; Lockheed, 1985). Many women, far from shying away from computers and computing, were in fact the leading manipulators of concepts in IT and have made valuable contributions to the development and application of computers (Deakin, 1984; Lockheed, 1985). Augusta Ada Lovelace, daughter of Lord Byron became a close friend and confidant of Charles Babbage (inventor of the first analytical computer, 1792-1871). She was said to have grasped the principles of Babbage's 'Analytical Engine', so well that she translated a paper by Menabrea entitled 'A Sketch of the Analytical Engine invented by Charles Babbage'. She is also credited with persuading Babbage to abandon the decimal system in favour of the binary. She was perhaps the world's first programmer (Lockheed, 1985). Adele Goldstine wrote the first programs for the ENIAC, built in the 1940s. Grace

Hopper was the central figure in the development of the language COBOL. She is also credited as the first person to use the term "bug", referring to a computer malfunction in reference to a moth in the machine (Lockheed, 1985). Others such as Somerville, deMorgan, Annabella Milbank and Mary Shelley were also leading scientists and mathematicians of their time, who happened to be females, but nevertheless contributed to the advancement of their fields (Deakin, 1984). In the USA, in 1960 when the computer industry was young, there were only 200 computer operators, and 65% of them were women (Dicesane, 1975). More recently in 1980 it was estimated that 59% of computer operators were women as well as 31% of computer programmers and 22% of systems analysts (Strober, 1984) and in 1991 women constituted 54% of computer operators, 39% of computer programmers and 28% of systems analysts (Classe, 1992).

Therefore females have historically been involved with IT and, computing has not been a male dominated invention. It is as if the female population in schools somehow drifted away and cannot see themselves as participants in this field.

3.4 Gender differences in IT

In her studies, Elkjaer (1992) suggests that gender is a *"relational concept"* as well as a *"relativistic concept"*. That is, a gender concept is formed in relation to other gendered persons as well as in the context in which it exists. To explain this further, Elkjaer (1992) indicates that gender issues within a context, are specific to that context in relation to others who also live and are affected in the same context. This implies that gender differences, in say mathematics, may not hold true for computing, since mathematics and

computing are two different contexts and male/female reactions and attitudes are specific to particular contexts.

This is a valid point. In the context of computing, students interact with machines, whereas in mathematics no such interaction is necessary, unless computers are used in mathematics lessons in which case the lesson becomes IT related. The factor here is that of the presence of machines called computers, which may become the focus of the lessons and consequently gender differences could become specific as a result of their presence. Therefore contexts arising from IT contain a certain specific educational framework that is unlikely to be produced via other subjects.

Elkjaer continues, by suggesting that gender specific experiences in IT can be interpreted in the light of 3 distinct processes: 'structures', 'symbols' and 'identities'. The processes can be defined as follows:

1. STRUCTURE: this is of the educational organisation of teaching and learning in Information Technology. The structure of learning falls into two *'Spheres of Learning'*, which are *'Private Sphere'* and *'Public Sphere'* (Elkjaer, 1992). In the private sphere social relations and teamwork occur. Stereotypically this sphere is more attractive to girls and contains few opportunities for hands-on experience in IT. In the public sphere, on the other hand, discussions about the role of IT occur and those tend to be dominated by boys. Therefore it appears that girls are more prominent off-computers, in the private sphere, while boys control the IT environment or the public sphere.

2. SYMBOLS: These refer to the subject content of IT and computing courses and again they fall into two *'Spheres of Content'*.

Stereotypically, the *'Feminine Sphere'* includes the humanistic and social science application of IT (soft computing), while the *'Masculine Sphere'* includes computer skills (hard computing).

3. IDENTITIES: Elkjaer argues that it is in the clash between structural and symbolic masculinity and femininity that gender identity is formed. Girls encounter masculine subject content in the private sphere and boys face feminine subject content in the public sphere (Elkjaer, 1992). Therefore soft computing in a human-based environment is attributed to girls while boys are recognised as using hard computing in IT-dominated environments.

Here it may be suggested that far from shying away from it, girls may actually be attaining IT skills, though these tend to be soft computing ones. Girls' lack of enthusiasm may be a baseless perception and, it is assumed, due to their preference for working in the private sphere of learning where they enjoy socialisation and team work and use computers as and when necessary. Consequently girls' IT skills are less likely to be recognised since they are reluctant to demonstrate them in public spheres. This suggestion indicates that the structure of an IT learning environment, that is the public sphere of learning, is more likely to be dominated by boys and consequently girls are less likely to fully achieve their potential in IT as they have less access to computers than boys.

Therefore the question which arises here is whether opinions about IT are formed in such circumstances, that is while learning occurs in the public sphere. To be more precise, my question is whether there are preconceptions by students in secondary schools about IT, prior to working in an IT

environment or are opinions, regarding gender differences in IT, formed while working in the public sphere of IT, where computer skills are necessary.

To answer this question I believe that it is important to consider pre-secondary education where gender specific preconceptions could be developed.

3.5 Early years

Studies suggest that gender differences in the use of computers are evident at an early age (Hoyles, 1988; Young, 1990). A report for the Microelectronics Education Programme states;

> *" There are increasing signs that computers are being used more by boys and male teachers than by girls and female teachers. Primary schools may need to take positive steps to ensure that both sexes have equal opportunities. "* (Straker, 1989; p.230)

Before such steps can be taken, a more positive teacher training may be necessary. However it is indicated that although many primary level, female student teachers, believe that the use of computers enhances the learning process, they nevertheless express a negative feeling towards them (Summer, 1990a). Such negative feelings tend to suggest that there could be a shortage of skilled female IT teachers in primary schools, thus reducing the effective use of computers. The introduction of the National Curriculum should have encouraged female teachers in primary schools to learn about IT skills in order to deliver the required tasks. However there are indications that this may not have happened. Practising primary teachers have expressed

concerns and a lack of confidence in IT (Blease, 1990), despite the introduction of Soft Computing which was perceived as female friendly, and computers appear to be mainly confined to areas such as word processing tasks (Rodrigues, 1994).

A further point here is that of the gender of the majority of primary teachers, which traditionally has been female (EOC, 1985). It therefore appears that from an early age students witness their teachers, who are usually female, having little enthusiasm for IT. Matters will not be helped if primary teachers do not make any effort to change the pattern of girls' behaviour. The traditional patterns of play and primary education may have emphasised and, in some instances, created learning and behavioural differences between girls and boys. These patterns also extend to the toys purchased for girls and boys (EOC, 1985) where boy toys tend to be technical (transformers, Lego, remote control car,...) and, girl toys tend to be non-technical ones(dolls, books,...) (Brown, 1990; EOC, 1985; Siann, 1987; Straker, 1989). The suggestion here is that, possible lack of enthusiasm by female primary teachers and their encouragement of gender specific play, may indicate to their female students that a less technical education is for them. Therefore it appears that the reluctance by girls to use IT is an embedded notion of technology as oriented towards boys' interests which is installed in them at a young age. This reluctance to enthuse about technology is carried forward with them to the next stage of their education, at secondary schools.

3.6 Secondary schools

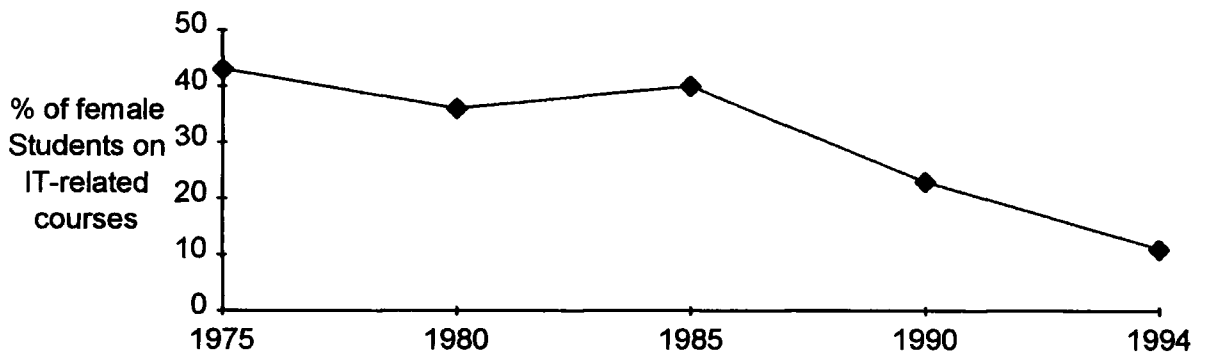
The stereotypical image of boys in technical subjects and girls in non-technical ones is extended into secondary education and research has

indicated a difference in the take up of Information Technology by boys and girls (Culley, 1986; Hoyles, 1988), suggesting that girls may have acquired a reluctance to use IT at an early age;

> *" ... our culture defines computers as pre-eminently male machines."* (Hoyles, 1988; p.1)

A consequence appears to be the reluctance of female students, between 14 and 16 years of age, to take up computer related courses and a significant reduction appears to have occurred in the last 14 years (fig 3.1).

Figure 3.1
Female Students Studying I.T. Related GCE and GCSE Courses Between 1975 and 1994



(Source: Buckley, 1990; Culley, 1988)

Furthermore, girls' reluctance to participate in Information Technology appears to extend into post-secondary education and the job market. This problem has been recognised by many employers who feel that arguments about the gender gap in IT are discouraging female students from considering careers in IT (Bansal, 1990).

" false pre-suppositions about gender can waste much of the nation's computing talent. " (Harrison, 1991)

This could have a major effect on industrial advances and consequently the economy of the nation, if up to a half of the nation's work force avoids one of the major industries. In 1990 it was estimated that the computer industry had a work force of 250000 skilled people and up to 25000 jobs are vacant at any one time (McDonald, 1990). Therefore lack of female enthusiasm may indirectly have a detrimental effect on the industry.

This point takes me back to my question in section 3.4, which was, whether preconceptions about gender roles in IT alienate girls, or do they become reluctant as a result of working with computers. My own experience with my students suggested that girls had a less than positive attitude to computers prior to using them and it seems likely that this may be the general case.

Furthermore, as an example, figures indicate that in 1993, 76% of the clerical and secretaries positions in industry were occupied by women compared to 24% by men (EOC, 1993). The advent of computers, used for word-processing documents and letters, has made typewriters redundant and therefore secretarial work now requires IT skills, though in soft areas. Therefore it appears that women have acquired IT skills through this change in secretarial jobs. Studies (indicated in section 3.3) also suggested that there are many female computer specialists in hard areas too. So why is there a perception of a gender gap in IT?

It seems likely that this perception regarding gender roles in IT is a feature of education rather than industry and despite girls' reluctance to engage in IT in schools, they appear to recover later on.

So what causes the gender gap in schools?

3.7 Reasons for the gender gap

There have been numerous studies carried out in the field of IT and education, suggesting various reasons for the differences in commitment to IT between boys and girls.

> *" While girls and boys might show a similar appreciation of the significance computers might have for their personal futures, boys tend to be more positively disposed than girls towards computers, are more likely than girls to take optional computer courses in school, to report more frequent home use of computers, and tend to dominate the limited computer resources that are available in schools. "* (Hoyles, 1988; p.1)

As was previously suggested, students' perception of IT and computing may form in their primary education. There appears to be a constellation of complex factors which can influence the formation of students' perception and create a gender gap in IT. The following categories were found to be the areas where arguments for and against a gender gap have been developed. They are not in any particular order and they certainly do not form an exhaustive list. On the contrary, since such discoveries appear to have generated very few positive solutions in solving the gender gap problem, then one can have a genuine expectation of the existence of other reasons which may explain the problem more clearly.

The categories are as follows:

PERCEPTION OF COMPUTING AS A 'MALE' SUBJECT

In the early 80's, as schools were required to integrate computer science in their curriculum, computers became linked to mathematics and science (EOC, 1985; Large, 1989). This could have been either an intentional link where computing was perceived as a mathematical and scientific subject through its established relationship in universities or an unintentional one as headteachers placed computing into mathematics and science departments.

Traditionally mathematics and science, particularly physical science, have sometimes been perceived as masculine or hard subjects, more often suitable for male students. Female students may have been either discouraged from participating in them, possibly on the basis of advice from their parents or teachers, or due to their own apparent lack of confidence in their ability in such subjects, female students may have shied away from studying them (Adigwe, 1992; Archer, 1989; Archer and MacRae, 1991; Elkjaer, 1992; EOC, 1983a; Culley, 1986 and 1988; Large, 1989; Scaife, 1993). Studies also show that significantly more teacher-initiated contacts occurred with boys in mathematics and science lessons (Badger, 1981; Mifsud, 1993) as well as pupils giving higher estimates of male student-teacher interactions in mathematics and science lessons than female student-teacher interactions (Billington, 1993). This appears to have marginalised girls in mathematics and science lessons where computing was also delivered. Consequently and perhaps inevitably,

female students tended to avoid computing courses and computers (Culley, 1988; Elkjaer, 1992; Erinosho, 1994; Ramsden, 1990).

However, although the link between female students' participation in hard subjects and their participation in information technology may hold true in some cases, there have been studies which contradict the perception of female students as disliking hard subjects or avoiding them.

Firstly, it appears that it is the nature of the topic in science and mathematics that influences pupils differently, rather than the subjects themselves. For example, in secondary schools male and female students appear to enjoy natural science equally. However boys' favourite topics are in the realm of the dangerous ones such as the study of spiders and in general any spectacular phenomena with an element of danger tends to attract boys, while girls on the other hand appear to enjoy human biology and health (Taber, 1991a; Whyte, 1985). In this case IT cannot fall within any specific realm. Computers use artificial intelligence as means of communication with the user. They do not contribute to the user input and they can only be used within the context chosen by the user, be it in a male friendly subject context or a female friendly one. Therefore it may be that it is the topic, for which computers are used, that effects male and female participation. This point was suggested by studies indicating that girls are more interested in topic based IT (Bell, 1986) and enjoy working with computers rather than learning about them (Janssen Reinen, 1993).

Secondly, a relationship has been found between the socio-economic background of the students and their achievement in hard subjects. It appears that female students with a higher socio-economic background participate more in hard subjects than female students with a lower socio-economic background (Ainley, 1993; Garner, 1994; Young, 1990). This could follow the argument that wealthier parents place more emphasis on their children's education and consequently IT becomes important for them as a means of increasing their children's prospects. Furthermore wealthier families have the financial power to purchase computers, enabling their children, male or female, to have more access to computing and in turn increasing their participation in IT.

Thirdly, cultural factors appear to influence the participation of female students (Adigwe, 1992; Durndell, 1993; Janssen Reinen, 1993; Johnson, 1984; Klainin, 1989). It appears that in some countries, such as Thailand, female students are doing better in hard subjects than male students.

Fourthly, it appears that the type of school can affect the participation of girls in hard subjects. It was found that girls in single-sex schools achieve significantly higher grades in hard subjects than girls in co-educational schools (Garner, 1994; Young, 1990). The non-existence of male students appears to positively affect the female participation in hard subjects and may be affecting their attitudes to IT too.

And finally and perhaps most significantly, the current secondary schools examination results show a higher percentage of female

students than male students achieving high marks in perceived hard subjects such as mathematics (DFE, 1993b; DFE, 1994c).

Therefore the right conditions appear to encourage more girls to participate in hard subjects and affect their attitude to IT. The introduction of computing as a cross-curricular subject in the National Curriculum could have produced the conditions favourable to girls' participation. It is possible that as computers become more common place, and if they become more associated with information technology, rather than mathematics and science, the gender gap in the use of computers will become less pronounced than in other areas of science and technology.

At this point we must also remind ourselves of Elkjaer's (1992) suggestion which stated that IT must be considered as an individual concept and there is no direct connection between IT and other hard subjects. In this case it appears that Elkjaer's perception of IT is correct.

SEX STEREOTYPING

The idea of hard and soft subjects may be the reflection of the stereotypical values which are held in society. These stereotypical values are reflected through images which are encountered everyday by both genders. The first point of encounter, as stated earlier, is in primary schools. It follows students into secondary education, higher education and finally into the workplace. So what generates, influences and perpetuates stereotyping in IT?

To start with I feel that the role of parents is of paramount importance. It is their expectations which may influence girls' uptake and success in IT. Parents tend to buy their sons more technical toys (EOC, 1985), and more computers are purchased for boys than for girls (Cole, 1994). Consequently many girls may have been brought up by parents to believe that their participation in IT is less important than that of boys. Secondly the attitude of society appears to be that girls should not stray into traditionally male areas (Classe, 1992; EOC, 1985). Thirdly the influence of media in enhancing stereotypical images must also not be underestimated. In IT literature men are usually portrayed as managers, experts, repair technicians and computer executives while women are often shown in clerical roles, such as keyboard operators and secretaries (Elkjaer, 1992; EOC, 1985; NCET, 1992a; Underwood and Underwood, 1990; Wave, 1985). The suggestion is that the media enhances the image of men as the decision makers and women as the attention getters. The suggestion of researchers even extends into the importance of the language used in IT literature. Some feel that expressions such as *"abort", "corruption", "violation", "degradation"* and *"penetrance"* may be a threat in female students' subconscious and consequently females avoid them (Elkjaer, 1992; Spavold, 1990).

The consequence of such views is the development of particular perceptions regarding gender, resulting in stereotypically gender-specific roles and gender identities (Martin, 1991). Coleman (1990) states that girls in general wish to be seen as '*socially acceptable prospective mates to the male species*' . It is therefore inevitable that stereotypical roles are also played in the secondary schools. Girls

appear to accept their stereotypical positions in the society outside schools and inevitably they may accept them in the secondary school society too (Adams, 1985; Cole, 1994; EOC, 1985; Mahony, 1985).

> *" Schools are part of society, what goes on in school interacts with outside forces and is itself part of the creation of social relations, attitudes and assumptions. "*
> (Culley, 1988; p.6)

Yet again, the evidence tends to suggest that the reluctance shown by girls to stray into subjects where boys are perceived to be more dominant, is the result of their own, and other's, perception of gender specific roles in those subjects. In the public sphere of learning, where specialisation is important, gender roles become significant and stereotypical images of gender are suggested to be enhanced further by peer pressure (Boyce, 1989; Siann, 1988; Woodrow, 1991). In their peer groups, girls must follow a *'gender specific socialisation'* pattern (Janssen Reinen, 1993), so as not to be *'considered unfeminine'* (Durndell *et al*, 1990). They fear that the unfemininity image would result in abusive comments by males when they appear in traditionally male areas (EOC, 1985).

The consequence of such perceptions about gender identities and gender roles is the categorisation of school subjects, where *'men are viewed as more technically oriented and interested in how things work'*, while *'women are seen as more artistic and less involved in practical matters'* (Jenssen Reinen, 1993). Since computing is perceived as a male activity, then girls may be considered as the gender that can't be good at IT. Some researchers suggest that this

view is embedded so deep that some females even see computers as unfeminine and are fearful of them (Anderson, 1990; Elkjaer, 1992). The fear becomes more profound when girls' perception of computer experts is defined. They appear to have a negative image of computer users and computer specialists, who are seen as people *'cut off from humans'* and people who *'spend most of their time interacting with machines'* (Durndell, 1991).

> *" The image of the 'Computer-Jock' hunched over the keyboard and hacking away at his spaghetti programming, is of a introvert male with difficulties in relating to other people and who has an obsession for unshared knowledge."* (Underwood and Underwood, 1990; p.149)

Reduction of stereotyping in schools is a hard task for teachers. My own everyday contact with my students confirms that there is a basic and strongly embedded perception, at least in my own coeducational school, about what subjects are suitable for boys and what are suitable for girls. It is likely that this perception is less strong in single sex schools, where female students are found to be much more likely to choose and succeed in subjects such as IT (Buckley, 1990; Culley, 1986; Fish, 1986; Underwood and Underwood, 1990).

Therefore, the picture here is that of mixed gender, public spheres of learning, where girls more often than boys avoid IT. It seems likely that girls' reluctance to participate is due to discrimination by others, through stereotyping of female roles in IT, as well as self-discrimination by girls themselves.

GIRLS' OPINION OF THEMSELVES

The persistent stereotypical views of female role in technical subjects may have led to girls having a low opinion of themselves in IT. Studies suggest that the expectations that others have of the way boys should behave has in turn a direct effect on the achievements of the girls who, *"show a general tendency to view failure feedback as reflecting on their intellectual ability"* (Licht, 1983). Consequently girls appear to undervalue themselves (Deakin, 1984). Croydon studies (EOC, 1985) found that on many occasions, the girls' low opinion of themselves had led to difficulties in IT. They feared ridicule and preferred to be silent rather than wrong (EOC, 1985). Female students may therefore have the preconception of being prejudged and being laughed at to the extent of avoiding computers as a face saving exercise. Yet again it is the avoidance of computers by girls in the public sphere of IT which appears to be suggested, rather than girls' lack of ability in IT.

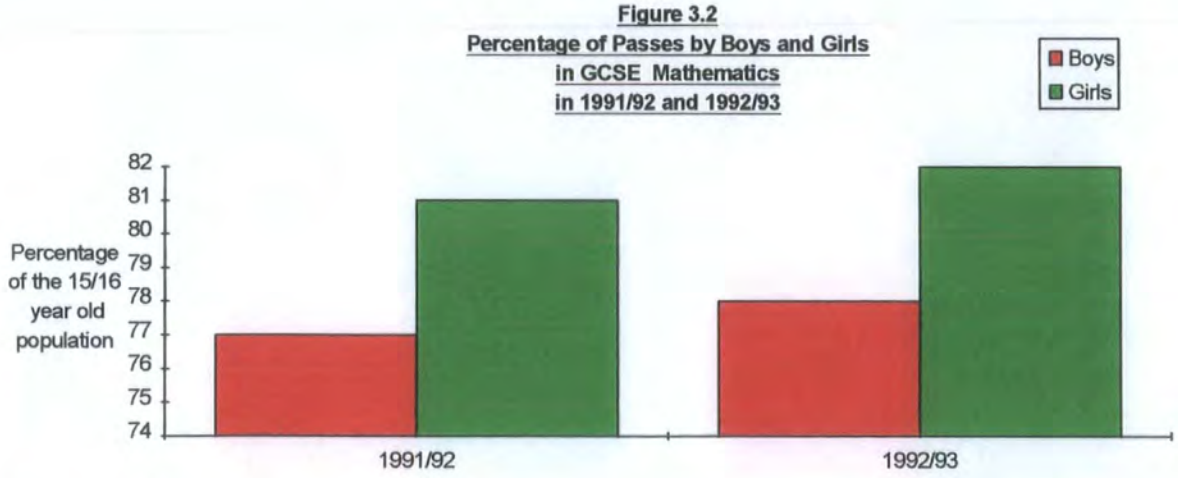
COGNITIVE FUNCTIONING AND SPATIAL ABILITY

A high level of cognitive functioning and the ability to solve visual-spatial problems, such as mathematical problems or dissecting and completing complex visual stimuli, has been suggested as a user quality, required in computer studies (Culley, 1986). Studies suggest that boys, for various biological reasons, appear on average to have higher spatial understanding than girls and consequently are perceived to be better in computing than girls (Bock, 1973; Elkjaer, 1992; EOC, 1985; Serbin, 1983; Siann, 1988; Underwood *et al*, 1990). Studies do

not indicate in which branch of computing this is the case. Soft computing areas such as word processing do not require mathematical mastery and it is likely that the suggestion is confined to the hard computing areas.

In any case this argument appears to have been refuted in various ways. Firstly, it is suggested that visual-spatial skills can be mastered by practice and experience in space-related activities such as computer programming (Cheshire, 1981). It was found that after a period of learning of computer programming, girls' skill level and cognitive functioning became higher (Cheshire, 1981). Therefore it is not certain that there is a causal relationship between spatial ability and computing mastery. Secondly recent GCSE results (figure 3.1) indicate that girls are now outperforming boys in cognitive subjects such as mathematics (DFE, 1993b; DFE, 1994c). Therefore it is unlikely that gender differences in cognitive functioning and spatial ability, if valid, have any significant effect on gender differences in IT.

Figure 3.2
Percentage of Passes by Boys and Girls in GCSE Mathematics in 1991/92 and 1992/93



(Source: DFE statistical bulletin, 1993b & 1994c)

KNOWLEDGE AND SKILLS

It is suggested that female students tend to plan their work before carrying it out on computers while boys more often than not want to use the computers immediately without working out what they want to do or the best way of approaching their work (EOC, 1985). Boys' planless method of exploring computers could, relatively, improve their knowledge of the machines and their general IT skills. Girls, on the other hand through their diligent planning may limit themselves by using computers for a particular purpose or task, and as suggested, girls appear not to want to learn about computers for their own sake (EOC, 1985). In effect it appears that girls are willing and are prepared to use computers, but then they use them as learning tools rather than machines to be mastered.

SELF EFFICACY AND MOTIVATION

The conclusion by Elkjaer (1992) suggested that boys' dominance of IT's public sphere of learning is not the dominance of the content but rather that boys need to show off or pose. IT content poses no problems for girls, who are at least as capable as the boys and have the enthusiasm to participate in IT. Other studies suggest this point, too, and indicate that, as a group, girls see themselves as being as able as males in learning about and using computers. However they seem to be unsure of their own individual abilities to use computers, a phenomenon called the *' We can, I Can't '* Paradox (Collis, 1984; Makrakis, 1993; Temple, 1989).

The suggestion appears to be that girls lack self-esteem and personal confidence in their ability in an IT environment, while at the same time they are keen advocates of the advantages of computers. This lack of self-esteem or lack of confidence may have developed in the public sphere of IT, where the boisterous dominance of boys gives rise to girls' unwillingness to want to participate in IT. Consequently this may have been interpreted as a preconceived fear about computers indicating a lack of confidence.

COMPUTER SOFTWARE

In recent years computers in schools have become of a standard format. The hardware usually consists of a VDU, a container for storage and operation of PCB's, a keyboard and a mouse. It is therefore the software on a computer which to a great extent determines its quality. NCET (1992a) found evidence that software packages affect girls' motivational levels and their attitudes towards computers. Formal packages, such as programming ones, appear to require autonomous learning skills (Fennema, 1983), a skill which emphasises independent mastery. Girls, as social learners, may find this style of working alienating. Informal packages, such as games, may also disadvantage females (Linn, 1985). The most popular computer games appear to reflect a male dominated market. They are largely based on themes concerning war scenarios and physical adventures (Hoyles, 1988). The violent nature of many popular games (such as Doom or Mortal Combat) tends not to appeal to females (Linn, 1985). Girls have been found to respond more to software packages of adventure games and simulation types (Hughes, 1987)

and not many of these appear on the market. Hence, the majority of the available software is marketed towards male customers who are perceived as the main consumers (Fish, 1986; Whyte, 1985), thus perpetuating and even emphasising the perception of a male dominated IT world.

TEACHERS' ROLES

Teachers' skill factors in IT must be considered as an important element in the curriculum. As indicated before, IT skills are becoming more crucial to teachers, as their students' levels of computer literacy are becoming higher (Williams, 1990). In 1983, a report by the Alvey Committee (The London School of Economics and Political Science, 1983), indicated that there is a shortage of IT specialists in schools and its recommendations included the provision of facilities in order to encourage more computer science graduates to join the teaching profession. A HMI report in 1989 reported that this had not materialised:

> *" Patchiness evident in all dimensions of IT provision: namely in the general capability of staff, in staff development opportunities, in the generosity of resources provided, in institutional awareness of the issues and, above all, in the sparse and sporadic distribution of good practice. "*

It appears that there is often a vast discrepancy between pupils' computer experiences in different schools and between classes in the

same school (EOC, 1985; Watson, 1993), and the use made of computers is often found to be dependent upon the interest of an individual teacher and/or department (Watson, 1993). In the majority of cases, this tended to be the male teachers (Culley 1988; Scaife, 1993).

It was mentioned that schools may have had very little to do with the introduction of IT in their curriculum (Beynon, 1989; Large, 1989). This suggests that teachers may still not be clear about the role of IT in their specialised subjects and are concerned that the reasons for IT use in schools have yet to be established. Blease (1990) suggests that a characteristic of teacher behaviour is reluctance to venture into new areas where there might be some risk of things going wrong. Teachers, who are increasingly under pressure to produce results, are reluctant to give up or modify tried and tested methods, which may have been developed over many years. They are not able to establish a link and relevance between IT and their own specialised areas. Beynon (1989) suggests that only the hardened *'technoromantics'*, who in the majority of cases are males, have accepted IT without any questions (Beynon, 1989). Teachers' attitude is that:

> *" their role as the knowledge controllers in the classroom will erode, and as they become more involved with IT then they will not have the skill to do their own curriculum planning and deliberation and become isolated executors of someone else's plans and procedures through a microcomputer "* (Apple, 1986; p. 162)

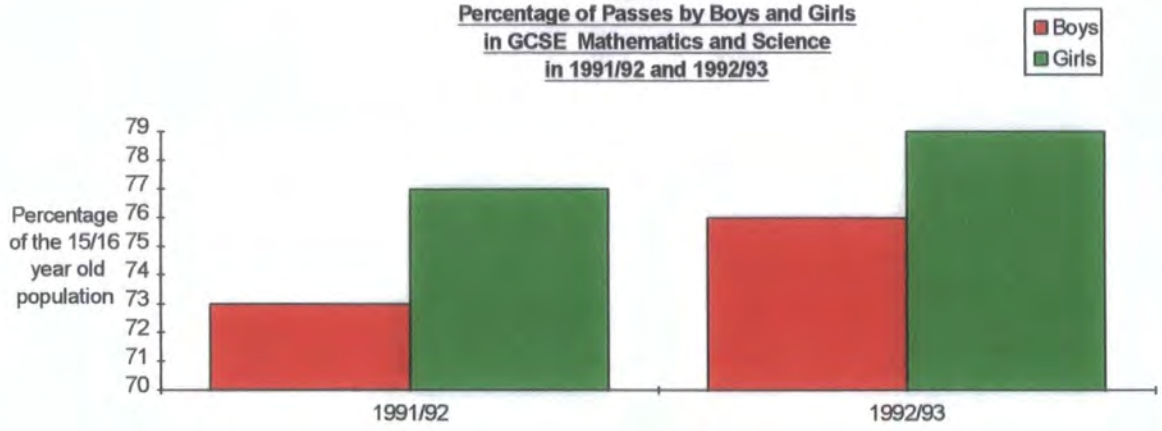
In many cases the lack of confidence in IT has been found to be the main cause for teachers' less than positive attitude to IT (Heywood and

Norman, 1988). In such a scenario the students' expertise becomes an important factor, as they cannot rely on their teachers. Self-help groups, usually dominated by boys, may become established in IT classes, and thus stereotypical perceptions of IT are perpetuated further. Teachers may even rely on such groups, thus further increasing girls' perception of themselves as IT illiterates. So could there be a specific teacher-student relationship in an IT lesson?

Earlier it was suggested that teachers in perceived hard subjects tend to encourage their male students more (Billington, 1993). This may take the form of asking male students more questions, standing nearer to them or giving them more criticism and more praise (Badger, 1981; Dweck, 1977). Teachers' criticism of boys appeared to be often diffused and non-intellectual, while the criticism of girls was more likely to be perceived to relate to their intellectual ability (EOC, 1985). The evidence tends to suggest that boys learn to blame their lack of success on factors other than ability, such as lack of effort, while girls blame their difficulties on their ability in hard subjects (EOC, 1985). So does this situation affect girls' achievements in hard subjects?

The evidence tends to suggest two conclusions. Firstly, it appears that far from being less able than boys, girls in fact do as well as and sometimes even outperform boys in mathematics and science (figure 3.3).

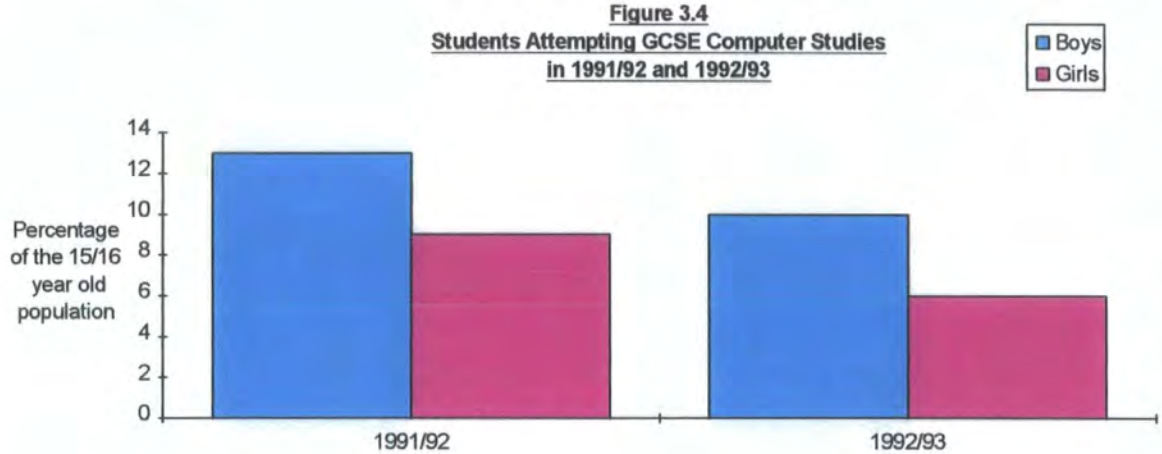
Figure 3.3
Percentage of Passes by Boys and Girls in GCSE Mathematics and Science in 1991/92 and 1992/93



(Source: DFE statistical bulletin, 1993b & 1994c)

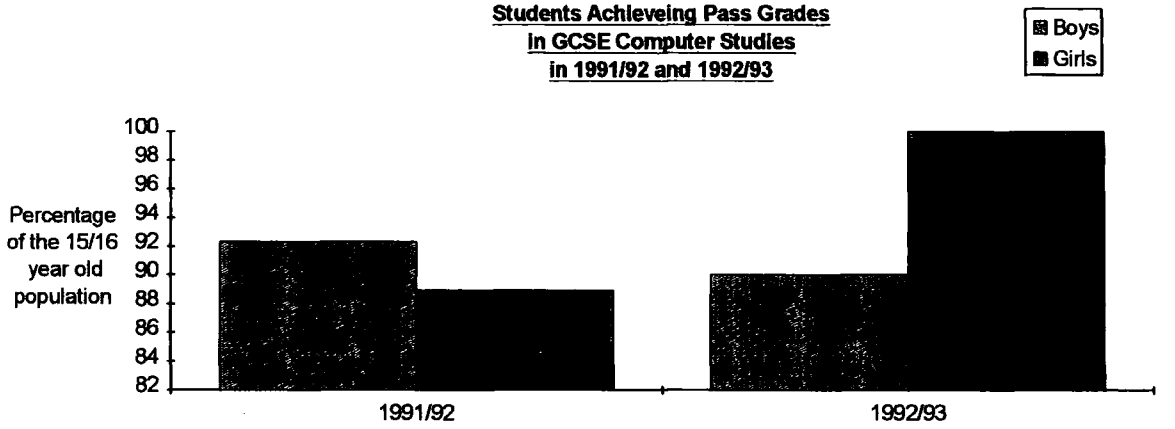
However the evidence also suggest that, where offered, more boys than girls choose Computer studies (figure 3.4), though there has been an increase in the number of girls and a decrease in the number of boys who achieved a GCSE grade in Computer studies (figure 3.5).

Figure 3.4
Students Attempting GCSE Computer Studies in 1991/92 and 1992/93



(Source: DFE statistical bulletin, 1993b & 1994c)

Figure 3.5
Students Achieveing Pass Grades
in GCSE Computer Studies
in 1991/92 and 1992/93



(Source: DFE statistical bulletin, 1993b & 1994c)

A final point which I feel is an important factor is the perception of IT teachers. Although figures indicate that there are more women who qualify as teachers each year (DFE, 1994c; DFE, 1995; EOC, 1993; Orr, 1985), the majority of IT teachers are found to be male (NCET, 1992a; Underwood *et al*, 1990). Adams (1985), Billington (1993), Cole (1994), Janssen Reinen (1993) and NCET (1994) concluded that this shortage in female IT teachers tend to emphasis the gender gap and leave men to be seen as the typical IT experts. Consequently the perception of male teachers as the role-models of competent computer users in secondary schools appears to be due to their sheer numbers rather than any superior IT ability. Thus there is a risk of IT being seen as a male oriented and male dominated subject, giving the impression that IT is taught mainly by men and is learnt mainly by boys.

DIFFERENCES IN ACCESS

There is conclusive evidence that boys are the more extensive users of computers than girls and they have more access to them (Cole,

1994; Coleman, 1990; Culley, 1986; Mohamedali, 1988). Access to computers can be identified in two broad areas;

1. Internal Access or access in school which tends to favour boys. In schools, computers are either used in lessons or in computer clubs, as an extra curricular activity. Studies suggest that in coeducational schools, computer rooms are regarded as male territory, where boys dominate physically and psychologically and girls are less likely to fight for control than boys, thus spending less time on the machines and eventually avoiding them completely, becoming *'non-participating computer-phobics'* (Coleman, 1990; Culley, 1986 and 1988; Elkjaer, 1992; EOC, 1985; Harrison, 1991; Lockheed, 1985; Underwood *et al*, 1990). Girls in coeducational schools "*are more likely to be influenced by gender stereotypes in their attitude to computers*" (Hoyles, 1988). This may encourage boys to become even more convinced of their perceived superiority in IT. Their assertive or even aggressive behaviour may put girls off who might be brave enough to attend computer clubs in their schools but have to put up with the consequences of their attendance, by "*running the gauntlet of mocking boys*" (Coleman, 1990). The question here is, if the absence of boys would make any difference in the attitude of girls to IT. It appears that it does. It was found that in single-sex schools for girls, computer clubs are a flourishing feature and it is suggested that the greater enthusiasm of younger girls (perhaps before stereotypical views have been formed?) for computers is evident, when teachers "*couldn't keep them off the machines*" (Culley, 1986).

2. *External Access* is the notion of Home Computing or Social Computing (Durndell, 1993). It has been found that at home more males have access to computers than females and more boys than girls have computers bought for them (Cole, 1994; Culley, 1986; Harrison, 1991; Kirkup, 1990; Underwood and Underwood, 1990). Although it appears that both mothers and fathers are keen for their children to learn about computers, fathers are more likely to join in computer activities at home and even when the machine was available to both sexes, boys were more likely than girls to be using them (Culley, 1986; Whyte, 1985).

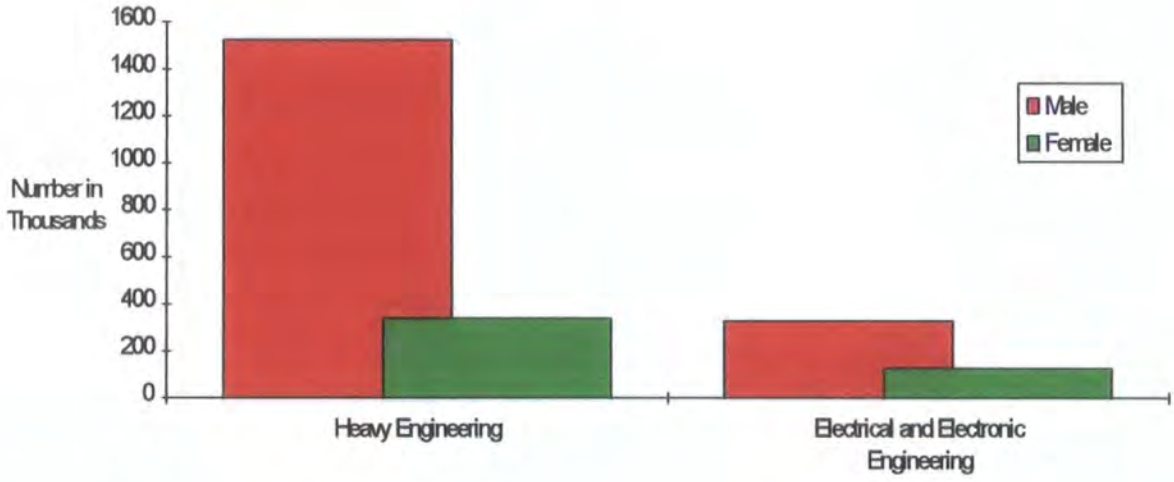
Existing research suggests that, because of their greater accessibility to computers, boys are able to build up a network of friends with whom *"to share ideas and experiences about computer use"* (Hoyles, 1988). Therefore Social Computing can all too easily become a male oriented, male dominated phenomenon where "*no females are allowed*" (Durndell, 1993).

CAREER

Earlier, it was indicated that students plan or should plan their careers towards the end of their secondary school education. Their plans are influenced by many factors, such as their personal interests, parental influence and the job market. However studies suggest that in secondary schools students do make distinctions between men's jobs and women's jobs (Taber, 1992) and the jobs perceived to be most

suitable for men and least suitable for women tend to be the ones that relate strongly to hard subjects (Classe, 1992). This stereotypical presumption of jobs, is further reflected by the representation of different genders in industry. For example in the area of engineering, male employees outnumber women employees (figure 3.6).

Figure 3.6
Full Time Employment in the Engineering Industry in 1992



(Source: EOC, 1993)

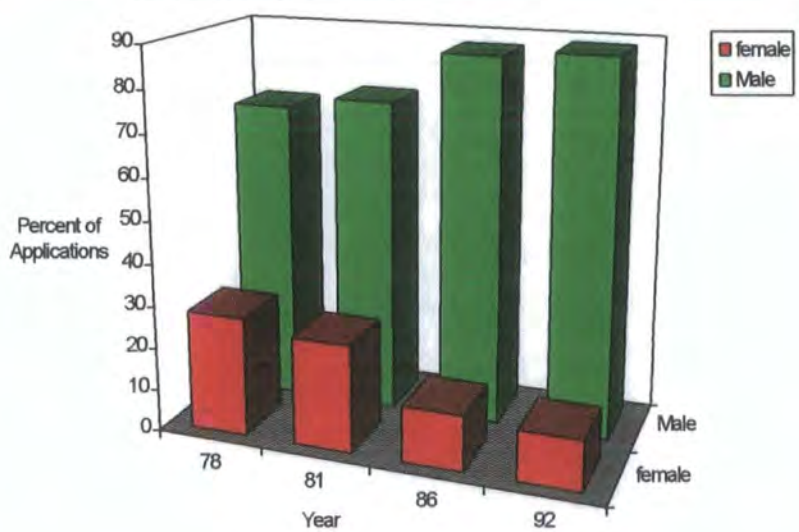
One reason for this situation may be that students' views of the suitability of jobs for men and women is based on their perceptions of the jobs and the representation of the two sexes in those jobs. Taber (1992) found evidence that secondary school students perceive jobs in the IT field, such as computer engineering, to be more suitable for men than women. Culley (1988) suggests that the choice of computing subjects by boys and girls therefore reflects this perceived idea about employment in the IT industry. Matters are not helped if career councillors in schools generally adopt a non-directive philosophy on

gender related employment, and they may propagate a *'boffinesque'* image of IT jobs (Classe, 1992).

> *" schools find it difficult to prepare students for flexibility in aspirations when the world of work is still heavily stereotyped."* (Orr, 1985)

The perception of man's job and woman's job affects choices in further education as the figures indicate that a larger number of boys apply for computer science courses (fig. 3.7) and follow a computer based further education course, than girls (Buckley, 1990; Cole, 1994; Culley, 1986; EOC, 1993; Hoyles, 1988; Scaife, 1993; Siann, 1988; SOED, 1991; Whyte *et al*, 1985). Furthermore it appears that the number of female applicants for computer courses have been decreasing, as figure 3.7 shows.

Figure 3.7
Applicants to British Universities for Computer Science Courses From 1978 to 1992



(Source: EOC, 1993; Hoyles, 1988)

So what about higher education and what happens to girls who choose computer courses?. Among university students, both gender groups reported similar levels of enjoyment of and interest in computers (Abouserie, 1992; Temple, 1989) and female students were perceived more positively as computer technologists by both genders (Siann, 1988). However Temple (1989) suggests that despite a more positive attitude, particularly amongst women, individual female students are *'scared off'* by uncertainty about their own abilities - an uncertainty that is apparently reinforced by, among other things, the attitudes of their male peers. Temple concludes that female students are interested in computers rather than being comfortable and confident in them. It therefore appears that in higher education there may still be a reluctance by females to use computers, which could have been perpetuated by male students' stereotypical attitudes, though perhaps not as extensive as they appear to be in secondary schools.

3.8 Conclusion

The findings in this chapter suggest that at secondary school level, there is a persistent gender gap in the perception of, attitude to and personal feelings about IT (Culley, 1986; EOC, 1985; NCET, 1992a). Girls in general are not as enthusiastic about using computers as boys and when using them they are likely to be involved in soft computing tasks such as word-processing, while boys tend to be more involved in the formal and technical Hard Computing areas, such as programming (Culley, 1986; Hoyles, 1988). The conclusion here is that computers are perceived as male oriented machines and it would be appropriate that perception about IT as a subject should be reconsidered

as perception about computers. Although the present cross curricular nature of IT, following the introduction of the National Curriculum, has left very little room for formal computer courses, the evidence tends to suggest that IT is still perceived as a male subject and is considered as working with computers (Culley, 1986; Hoyles, 1988).

Stereotypical images of computers have dominated the literature in this section. These images are suggested to be evident in the language of computing, IT books, media representation of IT and the working practices adopted by different gender in an IT environment (Elkjaer, 1992; EOC, 1985; NCET, 1992a; Spavold, 1990; Underwood and Underwood, 1990; Wave, 1985). Consequently factors responsible for the perceived gender gap in IT may have stemmed from stereotypes, that is, they are the by-products of stereotypical images and views. These images and views are seen to be more prominent in co-educational schools, and in single sex schools girls have been found to be more enthusiastic and positive about computers (Buckley, 1990; Culley, 1986; Fish, 1986; Underwood and Underwood, 1990). Therefore it can be concluded that girls DO want to be involved in IT and computing, but the presence of boys is often a key deterrent. In single sex schools, stereotypical roles are less likely to be played and therefore negative attitudes to computers may be reduced. Consequently girls' attitudes to computers are strongly influenced by the social configuration in which they learn, that is, the *'Sphere of Learning'* (Elkjaer, 1992) in which learning with computers occurs.

It appears that the patterns of learning, within the spheres of learning, also influence students' perception (EOC, 1985). The literature indicated that girls prefer to learn with computers rather than learn about them (Janssen Reinen, 1993). Girls also appear to enjoy and respond to social learning, that is

learning in a collective environment rather than in autonomous, independent learning situations (Elkjaer, 1992). This is in contrast to learning in a computer environment where autonomous learning is the case (Fennema, 1983). Therefore girls may be reluctant to use computers, since they cannot verbally interact with machines, and they find very little scope for group learning in a computer room. Girls may prefer collective learning, using soft computing, while autonomous and individual learning pattern may be boys' choice. The conclusion is that girls want to be involved with computing, though in different circumstances. They opt to work in their own female peer groups in secondary schools and avoid computers when on their own, preferring social learning rather than autonomous learning.

This raises the issue of the *'we can, I can't'* paradox (Collis, 1984; Makrakis, 1993; Temple, 1989). Girls feel that they are as good as boys in using computers and learning about them, but as individuals they don't want to be the first to try. They appear to express a personal anxiety when considering their own individual self in a computing environment. Therefore the conclusion yet again indicates that girls have a positive perception of computers but they are negative in their personal attitudes to computers.

Some studies have taken the issue of personal anxiety a step further, suggesting that such a condition may have established circumstances where girls display a phobia of computers (Anderson, 1990; Elkjaer, 1992). Girls have the fear of *'getting things wrong on computers'* even though they are *'happy to use computers'* (Anderson, 1990). Their attitude, therefore appears to be negative even though they perceive computers as useful tools. No evidence has been found to indicate that the physical image of computers, such as the colour or the keyboard layout, could influence the attitude of the user. Hardware appears to be blameless. However there was evidence that

software on computers can play a major part in influencing the gender specific participation in IT (Hughes, 1989; NCET, 1992a). Software and the extent of its complexity or user friendliness, may generate negative or positive reactions by the user. The complexity of using a software package can generate and perpetuate situations in which the preconception of making mistakes could deter the user and shape attitudes.

It appears that preconceptions about computers play an important role in the issue of gender gap. As well as the above point, the preconceptions about the image of computer users was also suggested as an influencing factor. Girls' see IT experts as *'Computer Jocks'* (Durndell, 1991; Underwood and Underwood, 1990), who may have no other interests in life. On a personal experience level, it is clear that in my school the majority of boys known for their computing exploits are the ones who are usually rejected by others, because of their extreme personality differences and inferior social standings. Such male groups dominate my school's computer rooms and are well known for their computer skills. This is consistent with a view that computer experts in schools are perceived as boys, who are loners and, who do not fit in schools social groups. Their computer skills and expertise have given them the opportunity to help others and become part of the schools mainstream scene. In effect, the picture here is of male computer users who, prior to moving on into social computing, are involved in individual work with computers and as a result have become experts. They then use their expertise as a means to improve their social standing.

In such a case, I recognise computers as tools for social interaction rather than as an integral and important part of education. This alternative role of computers, raises the question of their effect on society and its structure. This point was indicated in the National Curriculum orders, suggesting that

students should be able to evaluate the uses and limitations of IT in everyday life and begin to question their appropriateness and effectiveness and their social impact (SCAA, 1994). This I view as an important factor in the development of attitudes to computing, that is, the perception of what a computer is and how it effects us, can create and perpetuate positive and negative attitudes.

The result of all the above mentioned points, is that gender differences in computing may not be as a result of differences in ability but rather the result of differences in learning patterns, and the conditions of learning environments. Girls appear to be as capable as boys in using computers, but in mixed-gender learning environments, such as those in co-educational secondary schools, girls may need more encouragement to persist in their use of computers. Therefore girls in general may express positive views about the importance of computers, showing similar appreciation to that of male students, of the significance of computers.

In older girls the enthusiasm about computers appears to be even more prominent (Boyce, 1989; Woodrow, 1991). It appears that as girls grow older their perceptions of and attitude to computers also becomes more positive (Siann, 1988), though some individuals still show anxiety about working with computers (Temple, 1989). This seems to be a reflection of changes in females' stereotypes, whereby stereotypical identities do not appear to affect older female students' attitude to computing (Durndell, 1987).

It may be concluded that in secondary schools, younger girls are more affected by stereotypical issues and pressures than older girls. This may be as a result of girls viewing gender roles in computing more in terms of social conventions at lower years and personal choice at higher levels.

Consequently, students at higher levels may perceive computers as an important and useful part of their education and therefore issues regarding the attitude of students to computing must be a reflection of students' views of computers' general role and benefits.

One final factor which has been agreed by a number of researchers, is the issue of access to computers. Male users are the major purchasers of microcomputers and more computers are bought for boys than girls (Cole, 1994, Culley, 1986; Harrison, 1991; Kirkup, 1990; Underwood *et al*, 1990). Consequently the market may have become geared towards male users. Boys also dominate computer rooms in schools (Coleman, 1990; Culley, 1986; Elkjaer, 1992; EOC, 1985; Harrison, 1991; Lockheed, 1985; Underwood *et al*, 1990) and as a result they have more access to computers in lessons or in computer clubs. This difference in access may reflect stereotypes, in particular, views of parents on what are the appropriate presents for boys and girls. Nevertheless, this difference, although not a factor in creating the gender gap, may contribute to the perpetuation of the gap.

In my research, I therefore will consider the question of the gender gap in terms of two areas. Firstly, secondary level students' perception of computing and the formation of their attitudes and secondly, their anxieties about computing. Perception of computing, refers to students' attitude to computers, in terms of their significance and how they affect the society and people's lives. Anxiety about computers refers to students' personal feelings in a computing environment. It may indicate the level of personal anxiety and phobia and should be considered as a measure of individuals' feelings and concerns. Factors such as the students' age and their access to computers

will also be considered as influencing factors in the perception of and attitude to computers.

CHAPTER 4
Questions Arising From Literature Review

4.1 Introduction

The literature review concluded that male and female students in secondary schools have different perceptions of IT, with boys more positive about computers than girls, at least in the early secondary school years. The studies differed in their interpretation of the reasons for the differences in the boys' and girls' attitudes to IT, though there was strong agreement that attitudes differed to the disadvantage of girls. Girls also expressed a general anxiety about computers, while nevertheless working with computers or in an IT environment.

Therefore the initial aim in this chapter is to define *perception* of, *attitude* to and *anxiety* about computers. The questions arising from the literature are then analysed in order to establish the detailed research proformas for this project. Two factors, age of students and access to computers, are considered followed by other areas which, I argue, also require further investigation. Finally the findings in this chapter will be used to determine the appropriate methodology.

4.2 Perception, attitude and anxiety

Perception is defined as the act or power of perceiving or considering an object and attitude is defined as the condition of things or relation of persons viewed

as expressing some thought or feeling (Hornby, 1977; Kirkpatrick, 1986). More plainly, it is the way a person feels and thinks about something. Therefore students, who perceive the role of computers as positive, express positive attitude to computers, that is, consider them as beneficial and their beliefs are evidence of their positive thoughts on the role and effect of computers.

This state may stem from students' awareness of the influence of computers. It is crucial to note that it does not necessary relate to their personal experiences of using them, a matter which is dealt with later, but rather what they see, read or hear about computers. It is the stand which students take when considering computers in relationship to themselves and others. However, it does not follow that a student with positive attitude towards computers will experience no anxiety when actually using one.

Anxiety is defined as the state of being anxious or apprehensive about something (Hornby, 1977; Kirkpatrick, 1986). In this study anxiety about computers deals with students' feelings towards computers, when using or attempting to use them. Anxiety, defined in this way, is not necessarily consistent with students attitudes to computers, i.e. their intellectualised opinions about them. At a cognitive level, some students may have positive attitudes towards computers - or the reverse. At an objective level, they may feel a great deal of anxiety about using them - or no anxiety at all.

Their degree of success of working with computers could create anxiety-free or anxiety-laden feelings in students. For instance, if a student's work has improved through the use of a computer, then he or she may become more positive about computers. On the other hand a less successful or daunting experience with a computer could generate negative feelings in the student. Consequently experiences of students with computers (or their experiences in an IT environment) may affect their personal opinions **and** their feelings. This

point was argued by Boyce (1989) as being the main factor in determining users' attitudes to IT, rather than their gender. The distinction between general attitude towards computers and a personal experience of anxiety when using them nevertheless remains important as a possible explanation for differences between different groups and pupils.

Therefore this study deals with two areas. Firstly students' general attitude to computers and second their anxiety about computers, which deal with their feelings when using them.

4.3 Age of students

It is apparent that researchers in the field of computer and gender have agreed that even in cases where there are no evident gender gaps between boys and girls in the uptake of computing, the pattern of learning in a computer environment may nevertheless be different between genders. Furthermore, girls show different patterns of learning in various stages of their education, and their attitude to themselves and their environment changes as they grow older. This was a concluding point in the previous chapter, where it was indicated that for female students, increasing age is associated with a change of attitude from negative to less negative or even positive, to computers. This change appears to stem from girls' changing reaction to stereotypical values, as they grow up. Nevertheless such changes may not occur in boys, who appear more consistent in their attitudes to computers. The question of the age of the student also appears to relate closely to their stereotypical perception of what a computer is and does, and how they perceive a computer user. The first question that can be asked is as follows,

1) *Is the age of students related to their attitude to and anxiety about computers?*

4.4 Access to computers

A further point is the effect of everyday access to computer technology on students' attitudes and anxieties. It is important to consider experience of working with computers, in conjunction with the question of access. As was indicated, students' attitude may be dependant on the amount of access that they have to computers. In particular external access, that is home computing (away from the formal discipline of a lesson, when the user does not share the machine with others), may generate a more positive attitude towards IT. So a positive attitude is more likely when external access is possible. Furthermore, it was explained that the introduction of the National Curriculum has given all students in secondary schools the entitlement to access to IT facilities, that is internal access. This means that theoretically, all students should have had hands-on experience with computers through internal access. Consequently it is the extent of external access which may influence attitudes.

2) *Is external access to computers related to secondary school students' attitude to computers and their anxiety about them?*

4.5 A question of complexity

In the concluding part of the last chapter it was indicated that IT in a secondary school context means the use of computers, that is the use of keyboard and mouse in order to manipulate software. Although there are many items of new and user friendly software for secondary school computers, nevertheless there still is the need to understand computer operations in order to manipulate

software. Students inevitably express differing attitudes to computers, mainly, I feel, as a result of their success or failure in manipulating software. It is therefore possible that some students in secondary schools perceive computers as complex machines as a result of their difficulties in using particular software.

Thus the perception of computers, as sophisticated machines which can carry out sophisticated operations, may cause anxiety in some users. On the other hand such perceptions may also be inspirational for some who look forward to the challenge. Furthermore, it was also mentioned that early experiences of using computers might improve understanding of computer operation and could influence attitude of the user. Therefore such early experiences may influence the user to form opinions about the use of computers and about his or her ability to manipulate software.

One can predict that older students in secondary school will have had more experience of using computers, both internal and external, than the younger students, and therefore older students may perceive working with computers as less daunting than younger ones. Therefore the following question can now be proposed,

3) *Do older students perceive computers as less complex than younger ones?*

4.6 Social interaction

A point of concern in the literature was the girls' perception of computers as non-social machines, which discourage social contact, that is girls may feel that working with computers could mean losing contact with other people. They

seem to be keen on using computers when social interaction was involved, that is when they were involved with their friends in group work while using a computer as a focal point. Consequently it may be the case that girls are more likely to see computers as machines which could eventually replace humans, doing their jobs faster and more efficiently. Taking this argument a step further, girls may be more likely to perceive computers as having an adverse effect on employment and the relationships between human users. Eventually computers could remove the need for human socialisation and human contact. Such a scenario may be more likely to discourage a positive attitude to computing in girls than boys and may increase their anxiety in using IT. It is therefore their emotional requirements which appear to influence their perception of IT. The question can now be asked,

4) *Do boys and girls differ in their perception of the social impact of computers?*

4.7 Image of computers and computer users

Although there are examples of female successes in the computing field which could be considered as role models, there was evidence in the literature of a general lack of self-efficacy or self-esteem amongst female students in secondary schools which may be an influencing factor in the perceived gender gap. It was suggested that girls tend to consider computers as boys' toys and see boys as the natural computer users, with many role models for them to follow. Girls are more likely to have a negative image of their gender in this respect. Furthermore, it was suggested that girls appear to avoid computers due to their fears of being labelled Computer Jocks. The image of computer and computer user, therefore, appears to be an important factor. The following question can now be asked,

5) *Do boys and girls differ in their perception of computers and computer users?*

4.8 A question of purpose

The popularity and growth of computers in schools was credited in the literature to their original purpose, that is their data handling abilities. Computers are also used for many other purposes, such as word-processing and graphics applications. Once mastered, users can manipulate software and produce work which previously they may have avoided. This can be seen as a factor affecting attitudes to computers. Therefore,

6) *Do students in secondary schools regard computers as useful learning tools and is there a relationship with gender, external access to computers and/or age of students?*

4.9 Conclusion

The questions posed in this chapter aim to generate answers to my original enquiries, which were;

- How is IT perceived by students?
- What is the attitude of students to IT?
- Does the gender of students affect their perceptions of, and attitudes to, IT?

It was explained that in the context of this study, attitude to computers is the student's general opinion about computers and computing and with regards to anxiety, it is the students' personal feelings when using computers that are of concern.

I aim to establish whether any gender group, amongst secondary school students, have positive attitudes to computers, that is they perceive computers as important and useful, while expressing anxiety about working with them, that is they don't perceive themselves as enthusiastic computer users. In effect it is the *'we can, I can't'* paradox, discussed earlier, which is to be investigated here.

Therefore the third question, above, can now be rephrased as;

- Is the gender of students related to their attitudes to, and/or anxieties about, IT?

The chapter has emphasised that as well as gender, age and experience of working with computers could also be influential in determining attitudes and anxieties in computing environments. These two factors will be taken into consideration when analysing the results of any surveys in this study.

The argument can then be taken further by choosing methods to investigate attitudes and anxieties.

CHAPTER 5
Methodology and Procedure

5.1 Introduction

During the review of the existing literature, as well as gaining background information, I was also introduced to a number of procedures which could be adopted in the measurement of students' attitude to and anxieties about IT.

Therefore, this chapter begins by defining the objectives of the study. It then follows by stating the required data which is to be collected to achieve the objectives and the methodology for doing so. Finally the design of my questionnaires and procedures for the selection of samples and collection of data are described.

Throughout this chapter the factor of resources including staff, time and finance is considered, as they had a significant influence on this study.

5.2 My perception

From the literature, I have recognised the following, suggested as the most consistent reasons for the existing gender gap in IT in secondary schools:

1. There is a tendency to perceive IT on stereotypical gender linked lines, both by male and by female students. This perception is encouraged further by teachers and the media.

2. Girls' general attitude to and their personal anxieties about IT have been instilled in them at an early age, through adults' perceptions of IT and computers, including their parents' and teachers' views. However as they grow older, their perception and attitudes tend to become more positive.

3. There is a small number of female IT specialists in secondary schools, resulting in very few role models for female students, and this may have attributed to female students' negative views of computer experts.

4. Lack of access, both internal and external, to computers by female students is a further problem.

5.3 Attitude to and anxiety about computers

From the definitions given in the last chapter, attitude to computers and computing refers to the students' general belief about computers. This area may deal with students' opinion on matters such as:

- the advantages and disadvantages of computers,
- computers' effect on their own and other's lives at present and in the future,
- computers' effect on society as a whole,
- computers' effect on their educational work.

Anxiety about computers is defined as students' personal feelings and their anxieties when working or attempting to work with computers. This area can deal with matters such as:

- personal appreciation of computers,
- personal fears of computers,
- personal feeling about one's confidence when using computers,
- personal feeling about soft and hard computing.

The result of the literature review indicated that general attitudes to computers may be similar when expressed by various students, male and female, but anxiety about using computers could be different for boys and girls.

5.4 Access, age and gender factors

In section 5.2, I indicated that girls become more positive towards computers as they grow older. The existing literature suggested that this is a reflection of their changed attitudes to stereotypical issues, that is, older girls in secondary schools are expected to have a more positive view of computers.

Section 5.2 also indicated that internal, or curricular, and external, or extra-curricular, access to computers can influence attitudes to and anxieties about computers. Curricular access is a legal requirement of all secondary schools' curriculum. Therefore all secondary schools students, in theory, should have access to their school's computing facilities. What is not clear is the level of students' access to home computing, that is extra-curricular access. In the existing literature home computing has been suggested as an influencing factor on students' attitudes and anxieties.

Finally, the factor of gender is obviously the main feature of this study and must be considered in the survey.

The three factors described are, therefore, to be used when comparing respondents in the survey. This should confirm findings in the literature which indicated that such factors are influential in forming attitudes and anxieties.

5.5 Objectives of the instruments

Section 5.3 gave an indication of the areas which the survey can address. Therefore the instruments should seek information about students' positive and negative attitudes and their personal anxieties. Thus the instruments could reflect students' experiences of working with computers, their views on the role, purpose and image of computers and their perception of computer users. Furthermore, the three factors of Age, Access and Gender, which were identified as influencing the gender gap, must also be considered. Therefore I decided to consider the design of the following two instruments:

1. An instrument to evaluate students' attitude to computers, which would aim to seek students' general opinion and views on the role and influence of computers in society, in education and in other areas.

2. An instrument to evaluate personal anxiety of students when working in an IT environment. In this case the instrument would require responses to questions about individuals' own personal feelings about computers and using computers.

5.6 Areas of investigation

Initially it was necessary to obtain information on pupils' gender, age, year group that they belonged to and if they had access to computers outside school, that is home computers. These provided the variables which were to be used in comparing respondents.

Following my review of the information which I gained from literature review and the areas indicated in section 5.3, I planned to consider the following for further development:

- Advantages and disadvantages of computers in and outside the secondary school curriculum
- Benefits of computers in and outside secondary schools
- Scope for using computers in the secondary school curriculum
- Effect and influence of computers on individuals and on society
- Learning with and about computers in secondary schools
- Image of computers
- Image of computer users
- Image of computer expert

5.7 Factors affecting choice of methodology

Before any further development of the methodology, I faced some distinctive problems which stemmed from the following factors:

1. Lack of research time, due to my commitments as a full-time teacher, meant that very little time could have been dedicated to organisational procedures, such as interview schedules or pilot

surveys. This was due to the fact that the work had to be carried out during term time when access to students was possible. This was also the period during which I was most busy.

2. The schools which I intended to use in my study were middle size establishments, catering for approximately 1100 students in total. The use of qualitative methods would have taken longer than appropriate and could have disrupted many classes.

3. One of the schools, chosen for the study, was, at the time, preparing for an OFSTED Inspection. This clearly limited the time which their staff and students could have allocated to other work, such as my survey.

Clearly, a very structured survey was the desirable path for me to take. Therefore an appropriate methodology had to be selected.

5.8 Choice of methodology

The aim here was to choose a methodology for collecting the appropriate data, which would be as problem-free as possible and least time consuming, bearing in mind the restrictions described in 5.7. During my literature review I became aware of various research methods and instruments and the following methodologies were used by other researchers in assessing the attitude and perception of males and females to IT and computing:

- Surveys and Questionnaires, used by Bostock (1987); Culley (1986); Durndell *et al* (1990); Durndell (1993); Equal Opportunities Commission (1985); Heinssen (1987); Makrakis (1993); Martin

(1991); Nickell (1986); Passey (1994); Siann (1988); Spear (1985); Summer (1990a); Temple (1989). The questionnaires used by these researchers fell into two categories. They were either structured and closed questionnaires used with large samples, or less structured and open-ended ones used with smaller number of respondents.

- Interviews, used by Elkjaer (1992) and Straker (1989) appeared to be the more open-ended version of questionnaires where the researchers were able to seek out expanded answers. Interviews appeared to be heavy on time, requiring protracted data analysis.

- Observation, used by Straker (1989) and Underwood *et al* (1990). This method appeared to be the most time consuming of all as it required researchers to gather live data from live situations, and consequently meant that, I would have to be in other schools during lessons. This would have proved difficult, since observing the subjects would also have required me being away from my teaching duties and permission for this would not have been granted.

As mentioned earlier the main problem with my study revolved round the time restriction and although I aimed for large amounts of data, I nevertheless was aware of the problems in carrying out a large scale survey during term time. At this time schools are at their busiest and I felt staff could ill-afford losing any teaching time.

Furthermore the majority of the literature I reviewed, which aimed to assess attitudes to computers, tended to favour a structured, closed and numerical method using a large sample.

" Though the lists of data collection instruments are lengthy, there is a useful rule of thumb: the larger the scale of the evaluation or the sample, the more structured, closed and numerical the methods may have to be; the smaller the scale, the less structured, open and word-based the data may have to be. " (Morrison, 1993; p.63)

Therefore structured instruments appeared to be the most appropriate for my data collection. Consequently I decided to follow this path and examine such surveys and questionnaires, which I had reviewed, in more detail and consider their use as a possible basis for my own research instruments.

5.9 Existing surveys

From my literature review the following studies appeared to offer structured instruments:

Computer Attitude Scale (CAS) developed by Nickell and Pinto (1986):

This instrument consisted of 20 five-point Likert items (Appendix 1), 8 expressing positive attitudes towards computers (e.g. *' Life will be easier and faster with computers '*) and 12 items expressing negative attitudes (e.g. *' People are becoming slaves to computers '*). Possible scores on the CAS ranged from a minimum score of 20 (indicating an extremely negative attitude towards computers) to a maximum score of 100 (indicating an extremely positive attitude towards computers). In their studies, Nickell and Pinto used CAS with five different samples. The samples had the following properties:

Sample	No.	Sample Characteristics
1	206	83 males and 123 females, university students
2	152	college students, 82 of whom were just starting an introductory computer class
3	47	computer operators
4	49	university students
5	47	university students

The main features of this study were that it took place in USA and the samples consisted of post secondary education students. The literature review indicated that cultural difference may play a part in students' attitude to computers and therefore the reaction of my samples (in Britain) to CAS statements could be different to that of Nickell and Pinto's (in USA). Furthermore, in the US study, CAS statements were aimed at older students. Therefore for my study, which is aimed at younger students, the statements would need to be reviewed and may be modified. Finally, although Nickell and Pinto concluded that CAS appears to be a reliable and valid research instrument, following their analysis of their results, they nevertheless noted that their findings were based on a limited subject pool. Therefore CAS suggested possibilities in assisting the design of my own instruments, but changes might be necessary and any modified statements would need to be tested for their reliability and validity.

CARS (Computer Anxiety Rating Scale) developed by Heinssen, Glass and Knight (1987):

This instrument is very similar to CAS. It is a 19-item inventory (Appendix 2), designed to assess an individual's level of computer anxiety. It comprises of 10 items reflecting anxiety-laden statements (e.g. *' I feel apprehensive about working at a computer terminal '*) and 9 items reflecting non-anxiety statements (e.g. *' I am confident that I can learn computer skills '*). The responses to items are based on a 5-point scale (1= strongly disagree; 5= strongly agree), and

responses to non-anxious items were later reversed before obtaining a total score. This arrangement therefore meant that, unlike CAS, scores were now ranging from 19 (a low level of computer anxiety) to 95 (a high degree of computer anxiety). CARS was used with the following sample:

Sample	No.	Sample Characteristics
1	270	university students consisting of 103 men and 169 women, aged between 17 to 45

Following preliminary analyses, Heinssen *et al* suggested that CARS was a highly consistent instrument and found it to be reliable and stable over a test-retest interval of four weeks. Similar to CAS, CARS was also used in USA with a sample consisting of post-secondary students. As a basis for my instrument, statements in CARS could offer very good possibilities but again changes to the statements might be necessary. Furthermore a test-retest procedure should be used to ensure the reliability and stability of my instruments if any of CARS' items are included.

As well as CARS and CAS the following literature also presented possibilities:

- Temple and Lips (1989) on attitudes towards computers amongst university students: The research aimed to evaluate gender differences in attitudes towards and involvement with computers, among university students in Canada. A questionnaire was used in the study which comprised of 51 items (Appendix 3), ranging from short statements dealing with attitudes to computers such as *' Computers are exciting '*, to the longer and more descriptive statements relating to anxiety in a technology environment such as *' If others are waiting in line for me to finish using a photocopier computer terminal, I will always hurry to finish, or return later to complete the project '*. Yet again this study occurred

outside Britain, involving post-secondary students. Furthermore, many of the items do not relate to my studies. Nevertheless I decided to consider and refine any which I judge to be appropriate.

- Equal Opportunities Commission in the London Borough of Croydon (1985): This large scale project aimed to evaluate IT curriculum in the borough's schools. As part of the study, a 53 item questionnaire titled *'Image of Computer Technology'* (Appendix 4) was produced. The responses to the questionnaire were based on a 3-point scale, evaluating students' attitudes to gender issues, engineering and computers. There are similarities between the items in this questionnaire and those in Nickell and Pinto's (1986) CAS, such as *' Computers are taking over the world '* in this study and *' Soon our world will be completely run by computers '* in CAS. The sample comprised of 'O'level candidates, that is secondary level students, and since the study was carried out in Britain it therefore offers very good possibilities.

- IT at KS3 by Passey (1994): This instrument comprised of 28 statements (Appendix 5), and was administered to 32 IT co-ordinators in a local education authority. The statements formed optional answers to the question; *' Why do your subject colleagues deliver IT across the curriculum, and assess IT across the curriculum? '.* The instrument was not intended to assess the respondents' attitude to and anxiety about computers, rather it was intended to seek co-ordinators' opinions regarding a National Curriculum issue. However in doing so, the items represented attitude and anxiety statements which I encountered in other studies. The main factor here was to choose statements which would be suitable for secondary school students and develop them further.

5.10 Details about my research instruments

The final instruments had to distinguish between the two areas of investigation, that is general belief and personal anxiety. As mentioned before I felt that the most appropriate way of dealing with this was to use two instruments, which could be based on existing questionnaires of known reliability, as well as being structured and closed. The instruments were to address the two areas through questioning students' views on computers, and were as follows:

1. Instrument 1: Computer Attitude Tests

Computer Attitude Test (C.Att.T.) was designed to investigate the general belief of individual students to computers. It aimed to seek students' responses to the following statements which were initially set out in section 5.6 (Areas of Investigation):

- *Advantages and disadvantages of computers in and outside the secondary school curriculum,*
- *Benefits of computers in and outside secondary schools,*
- *Effect and influence of computers on individuals and on society,*
- *Scope for using computers in the secondary school curriculum,*
- *Learning with and about computers in secondary schools.*

The statements used in this instrument, were largely based on the Computer Attitude Scale (CAS) developed by Nickell and Pinto (1986), work carried out by Temple and Lips (1989) on attitudes towards computers amongst university students and the studies conducted by the Equal Opportunities Commission in the London Borough of Croydon (1985). The instrument was to be based on a 5-point Likert Scale (Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree),

scores ranging from 5 for Strongly Agree, to 1 for Strongly Disagree. 34 items, which I felt fulfilled my objectives, were chosen from the aforementioned studies and are in Appendix 6.

2. Second Instrument: Computer Anxiety Test

Computer Anxiety Test (C.Anx.T.) was designed to investigate students' personal feelings about IT and their confidence in the learning process in IT and it is similar to C.Att.T. in its format and scoring. However this instrument aimed to investigate the following areas, as was set out in section 5.6:

- *Image of computers,*
- *Image of computer user,*
- *Image of computer experts.*

The C.Anx.T. was largely based on the Equal Opportunities Commission work in Croydon (1985), Computer Anxiety Rating Scale (CARS) developed by Heinssen, Glass and Knight (1987) and studies on IT at KS3 by Passey (1994), from which 28 items were chosen and are in Appendix 7.

5.11 Initial refinements of the instruments

As was indicated earlier, pressures of time on participating schools was the biggest obstacle in this study. As a consequence I decided to use professional judgement and experience to refine the two instruments before piloting them. My main task was to reduce the number of items in each instrument to 20.

Furthermore, in consultation with my supervisor, the decision was made to change the 5-point to 4, removing Undecided, with new scores as follows:

- Strongly Agree 4 points
- Agree 3 points
- Disagree 2 points
- Strongly Disagree 1 point

This new arrangement, as well as being more convenient and less time consuming to administer, had two other important advantages. Firstly the reduction to a 4 point scale allowed dichotomous scoring, that is all respondents could be rated either positive or negative by combining the relevant data. Secondly the new 20 item instruments, would have given the convenient range of, a minimum score of 20, for an extremely negative attitude and perception, to a maximum score of 100, indicating an extremely positive attitude towards and perception of computers. Nevertheless the process of eliminating the items was a rather difficult task, as I felt that all the initial items were valid and appropriate. The refinements were as follows:

1. **Initial refinements of C.Att.T.** (Appendix 8)

The items that were eliminated or changed were as follows:

Items	Reasons for elimination
1, 2, 7, 8, 11, 21, 30	These items were positive and negative statements regarding the effect of computers on humans and society. Item 17 suggested the effect of computers in the future and I felt that it would be appropriate to include the following item to suggest the effect of computer at present: *Computers control our world today.* and to suggest the computer's effect on human welfare the following item was also added: *Computers take away the human qualities from society.*
12, 15	These were similar as they both indicate the effect of computers on the working population. Therefore they were replaced by the following item: *Computers are putting people out of work.*
20, 25, 33	These items were eliminated since they referred to home computing. These items did not fulfil my initial aim, which was to measure students' general attitudes to computing and then use the factor of home computer for comparative analysis.

22, 23, 26, 32

These items were identical but opposite, as item 32 was the negative version of item 22. They could have generated equal but opposite responses from students, that is a student finding computers interesting was expected to find computers NOT boring. Furthermore items 23 and 26 assessed interest in computers. As a result the four items were reduced to the positive item below:

Computers are interesting machines.

24

This item was rather interesting and to the point. Nevertheless it represented a negative attitude and at this stage I felt that there were rather too many negative statements. As well as removing the word *'world'* I felt the suggestion of advantages of computers was appropriate. The statement was modified to the following:

Our lives have improved and are easier because of computers.

This new item was similar to 18 and therefore item 24 was eliminated completely.

27, 28, 31	These items dealt with ability to work with computers. Furthermore, item 31 appeared to suggest personal attitude to using computers, and this area would be covered in C.Anx.T. In effect the three items suggested statements concerning computer users and consequently were replaced by the following statement: *Computers are difficult to work with.* However this new statement already existed, in a more detailed fashion, in the form of item 19 and therefore it too was eliminated.
29	This was eliminated, as it also was a comparative statement about gender.
34	This item was rather a general statement and did not address the issue of why computers are valuable and necessary.

At this stage C.Att.T. consisted of 16 statements, four short of the original target. As a result I decided to add the following items to the instrument, which I felt would represent statements about general attitudes to learning with computers and, respondents' perception of the importance of computers in post secondary education:

- *Computers are useful in whatever you do when you leave school.*
- *Knowing about computing will help me earn a living.*
- *Computers can make learning more fun.*
- *I enjoy spending my spare time working with computers.*

The final list was therefore a 20-item instrument which included 12 items reflecting positive attitude towards computers and 8 items reflecting negative attitude (see Appendix 8).

2. Initial refinements to C.Anx.T. (Appendix 9)

The initial refinements to this instrument were similar to that of C.Att.T., that is, my aim was to reduce the 29 items to 20, using a 4-point Likert Scale. A further point here was to ensure that items represented in C.Att.T. should not be represented again in C.Anx.T. The items that were eliminated or changed were as follows:

Items	Reasons for elimination
1	This item relates to careers, i.e. post secondary and this study is concentrating on secondary students. Furthermore post secondary was represented as attitude statements in C.Att.T. Therefore this item was changed to the following: *I look forward to using a computer to do my homework or coursework.*
2, 28	The two items are the same and were both replaced by the following statement: *I think I would be unable to learn a computer programming language.*

18	This item considers non-users and since IT is part of the secondary schools' curriculum, therefore this study considers all the students to have had some experience of using computers.
19, 24, 25	These items deal with the image of computer users and literature review indicated that it may be the image of computer experts rather than computer users which could influence gender differences. Furthermore, as a result of the curriculum requirements, students in secondary schools should have had access to computers, that is they should have been users and thus the three items were changed to point to experts rather than users. The new item is: *Computer experts are a bit peculiar.* As a further development, and to emphasis the theme of anxiety, the statement was related back to the respondent and was changed as follows: *I might be considered peculiar if I become a computer expert.*

20, 21, 22 These items were similar in content, that is, they stated computer use as fun and interesting. This area was also covered in C.Att.T. as items 16 and 19 (Appendix 8). However, it appeared appropriate to me to include an item in C.Anx.T. which would state users personal feelings about the use of computers, mainly because I myself, as a regular computer user, perceived computers as machines which everyone would enjoy using! Therefore the following statement was included:

Computers are fun to use.

23 This item referred to home computing which is one of the factors used in comparative analysis of the data and therefore was eliminated.

27 This item was similar to item 5 and was eliminated.

The final instrument consists of 20 items, 11 of which reflect anxiety-laden statements about computers and 9 reflect non-anxiety statements. The items are shown in Appendix 9.

5.12 Piloting and revision of the instruments

The piloting of C.Att.T. and C.Anx.T. served to ensure the minimisation of errors, particularly highlighting any item difficulties. The pilots took place in my own school where I had been working as a full-time teacher. The two instruments were administered to a sample of year 10 students, who were members of my tutor group. The main reason for choosing this sample was that

they were easily accessible to me, during tutorial periods which occurred every morning.

The pilot was carried out in July 1994 and two sessions were designated for the purpose. In the first session students completed the instruments, followed by a discussion session in order to clear out any problems in the instruments.

The evaluation of the pilot revealed that a number of items were unclear and ambiguous to the students. The items and the changes made to them, following the pilot, are listed as follows:

In C.Att.T.

Item 4 *There are unlimited possibilities in computer applications that haven't even been thought of yet.*

The combination of the words in this item appeared to be unclear for a minority of the students, who were recognised as the least able in my tutor group. Therefore in order to ensure that low ability students in other year groups, particularly in the lower years, would understand the statement, it was changed to:

> *There are so many other things that can be done with computers which no one has thought of yet.*

Item 6 *The use of computers is enhancing our standard of living.*

A number of students did not know the meaning of the word 'enhancing'. It was changed to its related word 'improving', which appeared to be understood by students.

Item 7 *Computers are a fast and efficient means of gaining information.*

The word 'gaining' was not understood by a number of students. From a relevant choice of 'increasing', 'accumulating' and 'collecting', the latter appeared to be understood by the majority. Therefore 'gaining' was changed to 'collecting'.

Item 13 *Computers control our world today.*

It was pointed out by one of the students that this item could be interpreted as computers are in charge of the world. It was the majority's opinion that computer are used in a number of areas, but not all. Consequently this item was changed to:

Computers control too much of our world today.

This item in fact complements item 2 (*Soon our world will be completely run by computers*), which states that computers may progress from *'controlling too much'* to *'controlling all'* very soon!

Item 16 *Computers are interesting machines.*

A number of students appeared to be unhappy with this item. They indicated that it is what a computer does that is interesting, rather than what a computer looks like. The item was changed to:

Computers are interesting to use.

Item 17 *Computers are useful in whatever you do when you leave school.*

Similar to item 16, students indicated that knowing about what computers can do would be useful. The item was changed to:

> *Computer technology is useful in whatever you do when you leave school.*

In C.Anx.T.

Item 7 *I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.*

After discussions with a number of students the item was changed to:

> *I am afraid that if I begin to use computers I will become dependent on them.*

It was apparent that students related the word 'skills', in the context of this statement, to what could be achieved and be improved through the use of computers, that is, the use of computers may replace some of the existing skills. They pointed out that for example, school work could be word-processed to improve bad hand writing or spell-checks on computers meant that students could be less concerned about spelling mistakes. Therefore the use of computers may indicate that basic skills, such as writing and spelling, could become redundant and students could become dependant on computers for these skills.

Item 10 *I feel apprehensive about using computers.*

Some students misunderstood the word 'apprehensive'. From two related words, 'anxious' and 'panicky', the latter was chosen to replace 'apprehensive', as it appeared that students continued to interpret the statement as an anxiety-laden item. The item was changed to:

I feel panicky about using computers.

Item 18 *Computers make me uncomfortable because I don't understand them.*

The discussion regarding this item was in two parts. Firstly, some students indicated that if the word 'uncomfortable' was used, then the user could interpret it as 'dislike', as for example in item 9 *(I dislike working with machines that are smarter than I am).* Secondly, some indicated that the problem of understanding computers, stemmed from their inability to use them properly and effectively. Students who scored low for this item, that is expressed high anxiety, indicated that when on their own, computers don't appear to work for them and they require constant assistance from the more expert students or their teachers and consequently they avoided using them. The statement was re-written as:

I dislike computers because they don't work for me.

It was modified further to its final version, as follows:

I don't like computers because they never work properly for me.

The final versions of the items for C.Att.T. and C.Anx.T. are shown in appendices 10 and 11 respectively.

5.13 Sample

The use of C.Att.T. and C.Anx.T., as structured and closed questionnaires, meant that a relatively large sample could be selected. I decided to choose the respondents from local schools, primarily because they were easily accessible. The schools were selected from the Newmarket Pyramid. In this pyramid schools cater for three age groups. Primary schools for 5 to 8, Middle schools for 9 to 12, and Upper schools for 13 to 18. The three schools chosen were as follows:

School A:

This was a middle school catering for approximately 270 students, in four year groups of 5, 6 (last two years of Key Stage 2) and 7, 8 (first two years of KS3). Each year contained between 65 to 70 students with different levels of ability. The school was situated in a middle class area of Newmarket and as well as local children, the school also catered for children from the surrounding villages. A large number of students came from families, where parents were professionals or worked in the horse racing industry.

School B:

This was also a middle school catering for around 250 students in years 5, 6 (last two years of key stage 2) and 7, 8 (first two years of key stage 3). Each year contained around 60 to 65 students. The school was surrounded by two very large housing states, from which it drew almost all of its intake, and a number of medium sized and small factories.

During my research this school was preparing for an OFSTED inspection.

School C:

This was an Upper school catering for approximately 600 students, in years 9 (last year of key stage 3), 10, 11 (Key Stage 4) and 6th form. Years 9, 10 and 11 contained 160 to 165 students and the 6th form 100 to 120. The school was expanding its 6th form and as a consequence the school's IT facilities were being improved and increased. The school drew its intake from schools A and B.

The pyramid arrangement, of independent middle and upper schools, meant that they had developed their own distinctive cultures and specific approaches to IT, as well as ensuring continuity within the pyramid.

Initially in each school, a meeting between a senior teacher and myself was organised. The purpose of these meetings was to firstly outline my work, aims and objectives to the teachers and secondly to arrange a second meeting with a member of staff in each school who would be asked to be my *'liaison teacher'* during the period of the survey. In the second meeting the procedures for sample selection and data collection were discussed and arranged.

5.14 Procedures for sample selection

Prior to the selection of students, the liaison teachers emphasised the problem of time constraints. They advised me to be conservative on the total number of students to be selected in order to ensure adequate time for the administration of the survey. Therefore the sample selection was carried out in consultation with the liaison teachers.

Firstly, in each school, four lists were drawn up, one for each year, containing students of all abilities. Each list was then divided into groups of males and females and a random sampling procedure was employed to choose a final sample from each list. The random sampling technique was to select the 4th students on each list, that is students number 1, 5, 9, 13, and so on. The final samples are shown in table 5.1.

Table 5.1

Sample Size and Characteristics

	School A				School B				School C				
Year												6th	TOTAL
Group	5	6	7	8	5	6	7	8	9	10	11	Form	
Male	8	8	9	8	8	8	8	8	20	20	16	15	136
Female	8	9	8	8	8	9	9	8	19	21	17	15	139
Total	16	17	17	16	16	17	17	16	39	41	33	30	**275**

The size of this random sample was 275. Consulting the sample size table in Morrison (1993), for a population size of 1100 (the total number of students in all three schools) the sample should be 285. Therefore my sample size was very close to the ideal figure.

5.15 Procedures for data collection

After consultations with the liaison teachers, it was decided to carry out the surveys during the summer term and in June 1995. It was suggested that at this time schools may not be as busy as previous terms. The procedures were similar in all three schools and were as follows:

In schools A and B:

In each school the survey was carried out during a dinner break, in a period of 20 minutes. Prior to students' arrival, a room was prepared to ensure adequate amount of furniture and stationery. Immediately after their arrival a short announcement regarding the administration procedures was made. All years completed the questionnaires at the same time, firstly C.Att.T. followed by C.Anx.T.

In school C:

The same procedures as those in schools A and B applied here. However year 11 students and some of the 6th former students were, respectively, preparing for their GCSE and 'A'level examinations. Consequently it was suggested by the liaison teacher to administer the surveys during tutorial periods when the students in the sample are most likely to be available. The two instruments were distributed amongst tutors, for the purpose.

5.16 Conclusion

This chapter has focused on the design of the instruments and the methodology which was used for the collection of data. The objectives of this study and the time and resource constraints under which this research study had to operate, led me to revise and evaluate existing instruments in this field and use them as basis for my own instruments.

Initially the instruments were refined by myself, and a final revision and refinement occurred after piloting them with a sample of year 10 students. The results from the pilots meant more changes to the C.Att.T. than C.Anx.T. One

reason for this difference may have been that students tend to be clearer about their personal feelings towards computers and more ambiguous about their general attitudes to computers. It appeared that a more thorough pilot, using all the initial statements and a larger sample which included students from other year groups, could have resulted in the selection of less ambiguous statements for the two instruments.

A sample of 275 students in years 5 to 6th form completed the final versions of the two instruments. The instruments were Computer Attitude Test (C.Att.T.) and Computer Anxiety Test (C.Anx.T.), and both were based on a 4-point Likert Scale (Strongly Agree, Agree, Disagree, Strongly Disagree), with scores ranging from 4 for Strongly Agree, to 1 for Strongly Disagree. Each instrument consisted of 20 statements, depicting positive and negative attitudes to and anxiety about computers. The instruments also required the respondents to include their school name, age, year group, gender and if they had access to home computers.

Overall the sessions during which the students in the sample completed the instruments were successful, though a small number of low ability year 5 students required some help. The final instruments were to investigate the areas as stated in the following table:

Area Investigated	**C.Att.T.**	**C.Anx.T.**
Students' Attitude	X	
Students' Anxiety		X
Effect of Age	X	X
Effect of Access	X	X
Effect of Gender	X	X

Therefore the instruments were to evaluate secondary school students' general attitude to computers and their personal anxiety when dealing with computers rather than question their perception of gender differences in computer use. The factors of age, access and gender were then to be used to compare respondents.

The next task now was to enter the data for computer assisted analysis.

CHAPTER 6

Reliability of C.Att.T. and C.Anx.T.

6.1 Introduction

> *" A reliable instrument for an evaluation will yield similar data from similar respondents overtime. "* (Morrison, 1993; p.162)

This chapter deals with the reliability of Computer Attitude Test and Computer Anxiety Test.

As indicated earlier, as a result of using existing instruments, I felt that it was necessary to test the reliability of the two instruments over time. That is to demonstrate that the sample would be consistent in its scoring, on both instruments, over a period of time.

6.2 Method of analysis

For this purpose, I compared scores on the two instruments by a sample using a test-retest method. The sample chosen was my tutor group again, who were now in year 11. For the test and the retest procedure, the sample consisted of 15 students, 9 boys and 6 girls. As was the case in the piloting stage, the basis for the selection of this sample was that the students were accessible to me, on a daily basis, through registration periods and tutorials. Furthermore, no

change of status in terms of home computing occurred in this sample over the test-retest interval.

The first test was carried out as part of the overall data collection exercise when the two instruments were distributed for completion by the 275 students in the sample. The second test was conducted, approximately 35 weeks later, prior to the 15-case sample leaving school to prepare for their GCSE examinations.

The statistical package, Microsoft Excel was used for data analysis and the data was entered into a Spreadsheet file (Appendix 13).

6.3 Results

The results of the two tests are shown in tables a.2 and a.3 (Appendix 14), the summary of which is as follows:

Table 6.1
Table of Summary
Test-retest Reliability of C.Att.T. and C.Anx.T.

	Mean Rating - *1st test*	**Mean Rating - *2nd test***	***r***
	(sd)	***(sd)***	***(p)***
C.Att.T.	58.13	55.80	.94
	(6.21)	(6.58)	(<.001)
C.Anx.T	60.13	61.60	.86
	(6.27)	(6.18)	(<.001)

6.4 Comment

The test-retest data collected for the sample yielded a statistically significant, positive correlation for both instruments, C.Att.T. (r =.94, p<.001) and C.Anx.T, (r=.86, p<.001), demonstrating high reliability.

6.5 Conclusion

Although the results of the tests indicated that the two instruments are reliable, a larger sample for the reliability tests, from other years, would have been more desirable. This would have increased the amount of data, providing better evidence of the instruments' test-retest reliability. However at the time of the second test in June 1995, selection of a larger sample would have meant some tutorial reorganisation by other teachers. This, I felt, would have imposed an extra burden on my colleagues and consequently I decided against it.

Furthermore, schools in the pyramid follow a very similar IT curriculum. The content of the curriculum has been decided and agreed upon by various subject areas in the pyramid. As a general guide, core subjects, such as Mathematics and English, are taught throughout the year and peripheral subjects, such as Technology and Art, are taught on a carousel basis. The important factor in this case is that IT has become a cross curricular subject throughout the pyramid. This has been as a result of, not only the requirements of the National Curriculum, but also the pyramid curriculum. Therefore it can be assumed that all students follow a similar pattern of education during their period of stay in the pyramid and should have had used IT during that time.

This suggests that students spend some of their curriculum time using computers and therefore should gain similar experiences in IT to those of the

15-case sample. It could then be suggested that the 15-case sample is typical of the pyramid students' population and therefore the reliability tests should hold true for the rest of the population too.

CHAPTER 7
The Sample

7.1 Introduction

This chapter deals with the descriptive statistics of the sample and the inter-relationship between the three factors of access, age and gender. Furthermore, the sample is considered within the National Curriculum key stages, that is, key stages 2, 3 and 4.

Initially, I used *Microsoft Works* to carry out some basic statistical calculations. *Excel* incorporated a more powerful package presenting me with more detailed results. Finally I moved on to the *Statistical Package for Social Scientists* or *SPSS* which provided me with a very powerful analysis tool. Consequently all three packages were used to arrive at the results in this chapter.

7.2 Method of analysis

The data were coded for data entry, to simplify production of descriptive statistics and subsequent inferential analysis (Appendix 15).

The collected data was entered into a spreadsheet file. This facilitated any file conversions which were needed, that is, the spreadsheet could have been

converted and copied into Excel or SPSS directories which would have facilitated further analysis.

In order to examine the significance of the results, null hypotheses are formulated where appropriate.

7.3 Final details of the sample

Due to various reasons, not all the instruments were completed. This was mostly evident in years 6, 11 and 6th form. The final response rate to the instruments are shown in table 7.1 and figure 7.1.

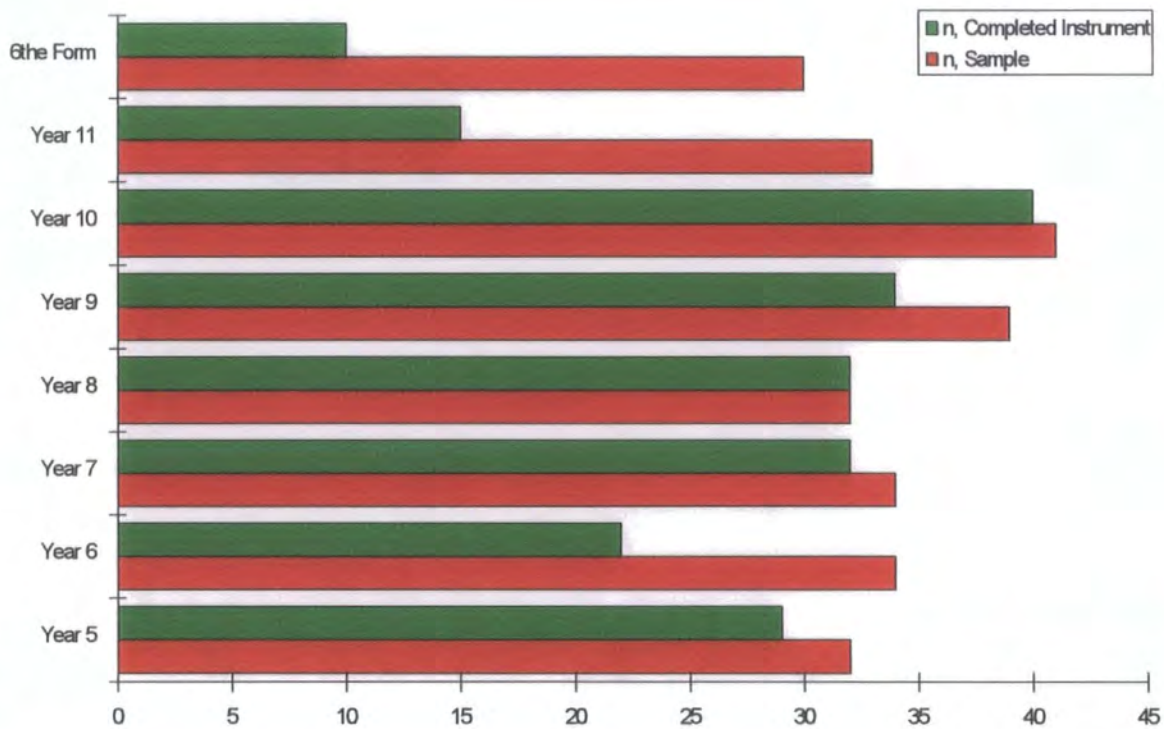
Table 7.1

Sample Participation by Year and Gender

	School A			School B			School C		
	n, Completed Instruments			n, Completed Instruments			n, Completed Instruments		
Year Group	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls
5	15	6	9	14	7	7			
6	14	6	7	8	2	7			
7	17	9	8	15	8	7			
8	16	8	8	16	8	8			
9							34	17	17
10							40	27	13
11							15	9	6
6th Form							10	6	4

Figure 7.1

Comparison of the Number in the Sample and Number Who Completed the Instruments



The lower numbers for the year 11 and the 6th form were mainly due to the pressures of their coursework and examination preparation. The final response rate was 77.82%.

7.4 Relationship between the factors

In this section the inter-relationship between the three factors of access (which indicates external access to home computers), age of students and gender of students is investigated. The results concentrates on the following inter-relationships:

- access/age
- access/gender
- access/age/gender

Clearly any relationship between age of students and their gender is irrelevant to this study and therefore omitted.

Furthermore, age of students increases as they move up in year groups and as table 7.2 shows, initial analysis of the data found that students with an age difference of one year are likely to be in the same year groups and students of the same age are in consecutive year groups. Consequently the variable of age was replaced by the variable of year group to ensure accurate comparisons.

Table 7.2

Age Groups in Each Year Group

***n* = 214**

	Age								
Year	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
5	7	22							
6		6	17						
7			5	26					
8				4	28				
9					13	21			
10						13	27		
11							8	7	
6th Form								4	6

7.5 National Curriculum factor

It was indicated earlier that the impact of National Curriculum and the IT requirements within each key stage would be an important factor in this study. Students in the sample were in the following key stages;

Table 7.3

National Curriculum Key Stages for the Sample

***n* = 214**

Key Stage	Year Groups	*n*
2	5, 6	51
3	7, 8, 9	98
4	10, 11	55
	Total	204

Therefore, as well as year groups, key stage is also considered in the analysis of the data.

7.6 Access to home computer

Initially the following null hypothesis was formulated

> ***' In secondary schools, there will not be a statistically significant difference between the number of students who have access to a home computer and the number of students who have not got access to a home computer. '***

For the full sample the results are shown in table 7.4.

Table 7.4

Result of the replies to the question

" Do you have your own computer at home ? "

***n* = 214**

	Yes	No	x^2	*p*
Sample	135 (63%)	79 (37%)	14.65	< .01

Just under two thirds of pupils had access to a home computer. The next question, therefore was to check whether they were evenly distributed by year groups, key stage and gender.

7.7 Access / Year group

The relationship between access and age considers the following null hypothesis:

> ***' In secondary schools, there will not be a statistically significant relationship between the students' age (year group) and their access to home computer. '***

Initial analysis (table a.5, Appendix 16) indicates that result is not significant. A further analysis, within each year group yields the following results;

Table 7.5

Access to Home Computer within Each Year Group

Year Group	Access to Home Computer	No Access to Home Computer	x^2	*p*
5	16 (55.2%)	13 (44.8%)	.31	NS
6	9 (41.0%)	13 (59.0%)	.73	NS
7	18 (56.2%)	14 (43.8%)	.50	NS
8	19 (59.4%)	13 (40.6%)	1.12	NS
9	26 (76.5%)	8 (23.5%)	9.53	<.01
10	30 (75.0%)	10 (25.0%)	10.00	<.01
11	10 (66.7%)	5 (33.3%)	.83	NS
6th Form	7 (70.0%)	3 (30.0%)	1.60	NS

Almost three quarter of students in years 9 and 10 have access to home computer. Since the results for other year groups are not significant, I decided to check the distribution within key stages.

7.8 Access / Key stage

With regards to the key stages, the following hypothesis was formulated:

> ***' In each key stage, there will not be a statistically significant difference between the number of students with access to home computer and the number of students with no access to home computer. '***

The first analysis considers the whole of population in the three key stages, yielding the following result;

Table 7.6

Relationship between Access and Key Stages

n = 204

	Key Stage							
	2		3		4			
	Yes	No	Yes	No	Yes	No	x^2	*p*
Do you have your own computer at home ?	25	26	63	35	40	15	6.55	<.05

The result indicates that there is a significant difference between numbers of students with access and no access. Checking the hypothesis within each key stage, yields the following result:

Table 7.7

Access to Home Computer within Each Key Stage

Key Stage	Access to Home Computer	No Access to Home Computer	x^2	*p*
2	25 (49.0%)	26 (51.0%)	.02	NS
3	63 (64.3 %)	35 (35.7%)	8.00	<.01
4	40 (72.7%)	15 (27.3%)	11.36	<.001

Almost two third of the students in key stage 3 (years 7, 8 and 9) and three quarter of students in key stage 4 (years 10 and 11) have access to home computer. The next step is to check the distribution by gender.

7.9 Access / Gender

The literature suggested that boys are more likely to have access to home computers than girls. To examine this suggestion, the following hypotheses were therefore formulated, indicating that variables of gender and access to home computers may be independent:

Hypothesis 1:

> ***' In secondary schools, there will not be a statistically significant difference between the number of male students with access to a home computer and the number of female students with access to a home computer. '***

Hypothesis 2:

> ***' In secondary schools, there will not be a statistically significant difference between the numbers of male students with access to a home computers and the number of male students with NO access to a home computers. '***

Hypothesis 3:

> ***' In secondary schools, there will not be a statistically significant difference between the numbers of female students with access to a home computers and the number of female students with NO access to a home computers. '***

The results are as follows:

Table 7.8

Relationship between Access and Gender

***n* = 214**

	Boys		Girls			
	Yes	No	Yes	No	x^2	*p*
Do you have your own computer at home ?	85 (75%)	28 (25%)	50 (49%)	51 (51%)	15.14	< .001

Three quarter of the boys in the sample have access to computers compared to only half the girls in the sample. The result are clearer to see in figures 7.2 and 7.3.

Figure 7.2

Access in sample and in each Gender Group

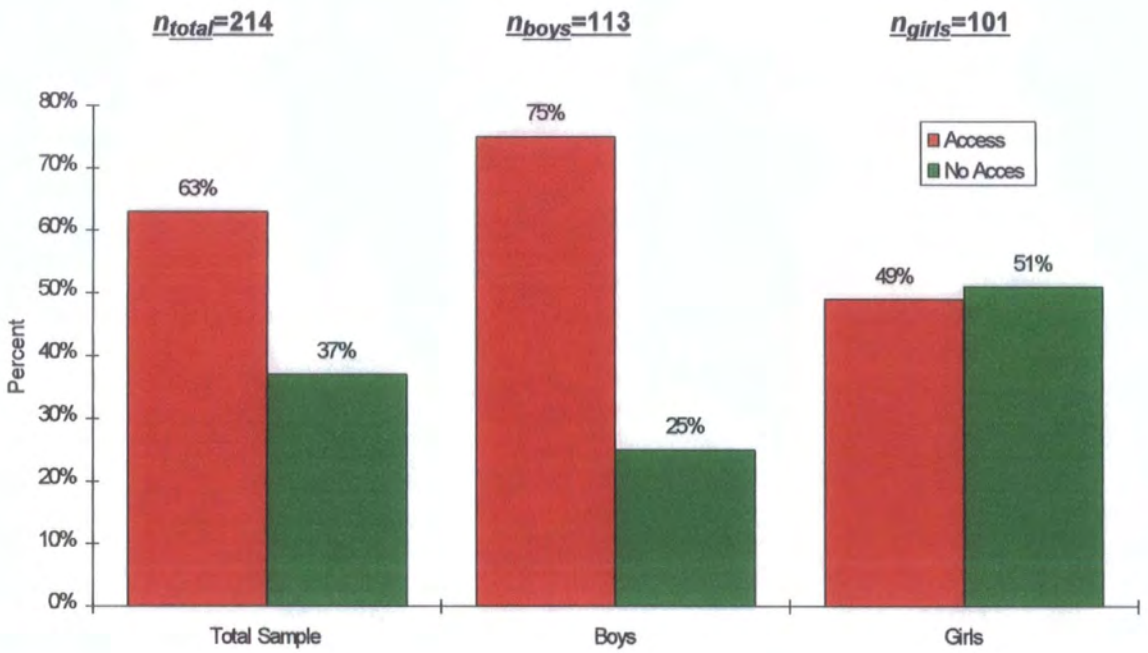
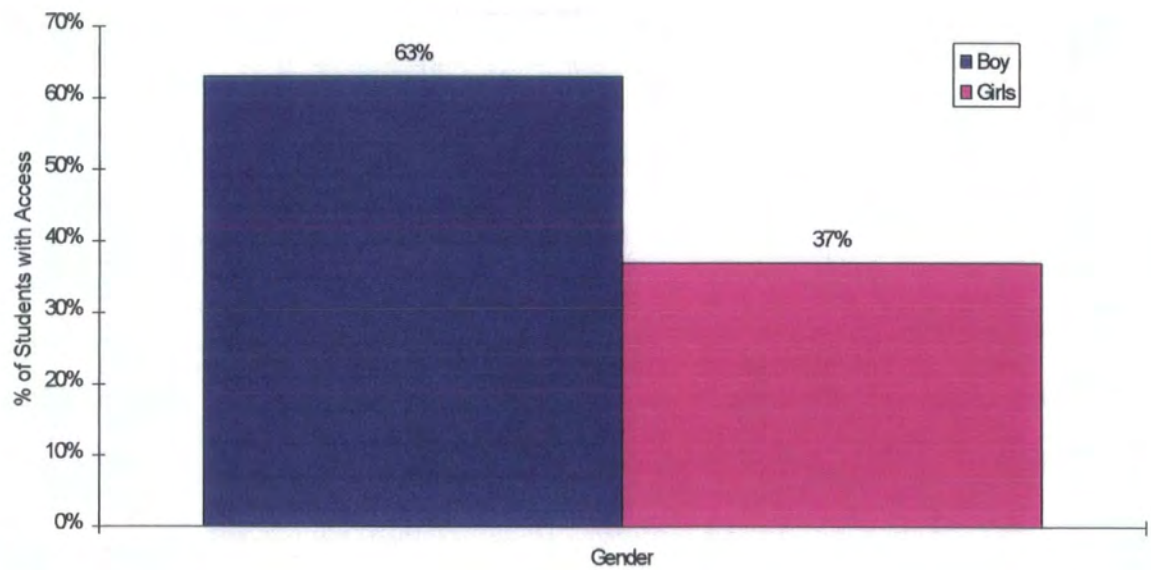


Figure 7.3

Access by Gender

n=214



Overall almost two third of the students who have access to home computer are boys. The next stage is to check the result when the variables year group, key stage and gender are all used.

7.10 Access / Year group (Key stage) / Gender

The analysis here considers the access / gender relationship within each year group and each key stage. The tables of results are as follows;

Table 7.9

Relationship between Access and Gender in Each Year Group

" Do you have your own computer at home ? "

	Boys		Girls			
Year Group	Yes	No	Yes	No	x^2	*p*
5	9	4	7	9		NS
6	4	4	5	9		NS
7	10	7	8	7		NS
8	12	4	7	9		NS
9	15	2	11	6		NS
10	22	5	8	5		NS
11	8	1	2	4	5.00	<.05
6th Form	5	1	2	2		NS

The only significant result is in year 11, where four fifth of the students with access are boys. the distribution by key stages are as follows:

Table 7.10

Relationship Between Access and Gender in Each Key Stage

" Do you have your own computer at home ? "

	Boys		Girls			
Key stage	Yes	No	Yes	No	x^2	*p*
2	13	8	12	18	2.37	NS
3	37	13	26	22	4.19	<.05
4	30	6	10	9	5.91	<.05

In key stages 3 and 4, boys are in the majority amongst students who have access to a home computer.

7.11 Comment

The analysis of the replies to the question, *" Do you have your own computer at home ? "* shows that significantly more pupils have access to home computer than those who do not (table 7.4). Almost two thirds of students in the schools in the sample have their own personal computer or have access to one at home (x^2=14.65, p<.01).

The results in table 7.5 indicate that in each of the eight year groups there is no significant difference between the number of pupils with a home computer and the number without. However in years 9 and 10, there are significantly more students who have access to computers (x^2=9.53, p<.01 and x^2=10.00, p<.01 respectively). In both year groups almost 75% of the students have access to home computers.

When considering the National Curriculum key stages, students' in key stages 3 and 4 tended to have home computers (table 7.7). In key stage 3 almost 65% and in key stage 4 almost 73% have access to computers (x^2=8.00, p<.01 and x^2=11.36, p<.01 respectively).

Within the population of students with access, 63% are male and 37% are female. Furthermore amongst the male students 75% have their own computers whilst among the females only 49% have computer at home (x^2=15.14, p<.001).

When considering the three factors together, the results indicate that in year 11, amongst students with access to home computer, only one fifth are female (x^2=5.00, p<.05). Results in key stages 3 and 4 are significant (table 7.10). Amongst the students with access, in key stage 3, 59% are male and 41% female and in key stage 4, 75% are male and 25% are female (x^2=4.19, p<.05 and x^2=5.91, p<.05).

7.12 Conclusion

It appears that a significant number of secondary school students are now able to use computers outside their schools and students in years 9 (last year of KS3) and 10, 11 (KS4) are the majority home computer users. It is possible that computers are used with a view of preparing for GCSE work in key stage 4.

Although a fairly large number of female students have access to home computers, nevertheless in all year groups boys are in the majority, in line with other studies (Cole, 1994; Culley, 1986; Underwood *et al*, 1990).

In the next two chapters, the focus is on the two instruments and the influence of the three factors of access, age and gender on secondary students attitude and anxiety.

CHAPTER 8

RESULTS 1

Computer Attitude Test

8.1 Introduction

The Computer Attitude Test (C.Att.T.) was designed to examine secondary students' perception of computers as described in chapter 4.

In this chapter the results from C.Att.T., are analysed using comparative variables of access, year group, key stage and gender. SPSS was almost exclusively used for this purpose.

8.2 Method of analysis

All variables were treated as numerical and as in previous chapter, data were coded for entry in SPSS data file, to simplify production of descriptive statistics and subsequent inferential analysis. Missing data were excluded in the analyses.

The result for each item was entered with the scores for negative statements reversed. Therefore the method of entering the ratings and the interpretation of the scores is as follows:

Considering the result for the positive statement *'computers make learning fun'*, with the factor of access to home computer, the result is:

Item	Access				No Access			
	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
Computers make learning fun.	3	8	81	43	1	9	49	20

The table above indicates that amongst the 135 students with access to home computer, 3 strongly disagreed with the statement giving a total score of 3 (3x1), 8 disagreed giving a total score of 16 (8x2), 81 agreed giving a total score of 243 (81x3) and 43 students strongly agreed scoring a total of 172 (43x4). Therefore the final total score for students with access is 434 (3+16+243+172), giving a mean score of 3.21 (434/135).

The same procedure is followed for the results of the scores by the 79 students with no access, producing the following;

Item	Mean rating Access	Mean Rating No Access	*t*	*p*
Computers make learning fun.	3.21	3.11	1.10	NS

The above result shows a tendency for students with access to **agree** with the positive statement but the difference between the two groups does not reach statistical significance.

Now, considering the result for the following negative statement, we have;

Item	Access				No Access			
	Strongly Disagree (4)	Disagree (3)	Agree (2)	Strongly Agree (1)	Strongly Disagree (4)	Disagree (3)	Agree (2)	Strongly Agree (1)
* Computers intimidate me because they are complex.	39	71	20	5	12	46	20	1

In this case since the item is a negative statement then the ratings are reversed. Thus rating for strongly disagree scores 4, disagree 3, agree 2 and strongly agree scores 1. This gives a final total of 414 (39x4+71x3+20x2+5x1) and a mean score of 3.07 (414/135). The same procedure is carried out for scores by students with no access giving the final results as follows;

Item	Mean rating Access	Mean Rating No Access	*t*	*p*
* Computers intimidate me because they are complex.	3.07	2.87	1.87	NS

The result shows a tendency for the students with access to a home computer to deny feeling intimidated by computers than students with no access to home computer, that is students with access are more positive

and **disagree** with the statement. yet here, too, the difference between the two groups does not reach statistical significance.

Initially descriptive statistics are obtained for an overall view of the scoring on the C.Att.T. These include the frequency of replies for the four points, that is strongly disagree, disagree, agree and strongly disagree, as well as the mean and standard deviation for each item.

The factors of access, year group and key stage and gender are then included in the analysis of the 20 items. For each item, comparison between groups (that is access/no access groups, year groups, key stage groups, male/female groups) are carried out in two ways. Firstly, using the frequencies of replies and the chi-square analysis, with tables of results presented in the appendices section, and secondly using the t-test and one-way analysis of variance to compare the means with the results presented in tables in this chapter.

This arrangement aims to avoid the danger of a data saturation in the text and the results from the more powerful t-test are more easily understood as they compare means, while the first set of tables are available to the reader for reference.

Finally, subscales of the 20 items are developed using principle components analysis, in order to investigate the factorial structure underlying responses to the items in the questionnaire.

8.3 Descriptive statistics

For each item, the scores, the mean and the standard deviation are reported in table 8.1:

Table 8.1

Mean and Standard Deviation, C.Att.T.

N = 214

Item	Strongly Disagree	Disagree	Agree	Strongly Agree	*m*	*sd*
1. Computer technology is useful in whatever you do when you leave school.	3	36	124	51	3.04	.68
2. Computers are responsible for many of the good things we enjoy.	9	59	114	32	2.79	.74
3. * Soon our lives will be controlled by computers.	36	95	68	15	2.71	.83
4. * I feel intimidated by computers.	61	128	22	3	3.15	.65
5. There are so many other things that can be done with computers which no one has thought of yet.	4	18	149	43	3.08	.59
6. * Computers take away the human qualities from society.	26	101	70	17	2.64	.79
7. Computers can eliminate a lot of tedious work for people.	2	20	135	57	3.15	.61
8. The use of computers is improving our standard of living.	6	37	136	35	2.94	.67
9. Computers are a fast and efficient means of collecting information.	2	0	103	109	3.49	.55

10. * Computers intimidate me because they seem so complex.	51	117	40	6	3.00	.74
11. * Computers are putting people out of work.	21	73	90	30	2.40	.85
12. Computers are bringing us into a bright new era.	3	27	142	42	3.04	.62
13. Knowing about computers will help me earn a living.	8	31	125	50	3.01	.73
14. * Soon our world will be completely run by computers.	41	125	30	18	2.89	.81
15. Life will be easier and faster with computers.	6	37	129	42	2.97	.69
16. * Computers are difficult to understand and frustrating to work with.	45	109	53	7	2.90	.76
17. Computers are interesting to use.	1	8	130	75	3.30	.56
18. * Computers control too much of our world today.	22	121	62	9	2.73	.70
19. Computers can make learning more fun.	4	17	130	63	3.18	.65
20. I enjoy spending my spare time working with computers.	11	67	90	46	2.80	.83

* indicates that the item represents negative statement,

m = Mean, *sd* = Standard Deviation

8.4 Attitude to computers by access

Table 8.2 compares the two populations of students, that is access and no access populations, using their means and t-test;

Table 8.2

Attitude to Computers by Access, mean rating

***n* = 214**

Item	Mean rating Access	Mean Rating No Access	*t*	*p*
1. Computers will be useful after leaving school.	3.07	3.00	.69	NS
2. Computers are responsible for good things.	2.78	2.81	.31	NS
3. * Our lives will be controlled by computers.	2.67	2.77	.84	NS
4. * I feel intimidated by computers.	3.15	3.16	.18	NS
5. Other things can be done with computers.	3.16	2.95	2.47	<.01
6. * Computers take away the human qualities.	2.73	2.48	2.19	<.05
7. Computers eliminate tedious work.	3.16	3.14	.27	NS
8. Computers improving standard of living.	2.96	2.89	.81	NS
9. Computers are efficient in collecting information.	3.50	3.47	.45	NS

10. * Computers intimidate me because they are complex.	3.07	2.87	1.87	NS
11. * Computers putting people out of work.	2.43	2.34	.73	NS
12. Computers bringing us into a new era.	3.10	2.95	1.69	NS
13. Computers will help me earn a living.	3.03	2.99	.41	NS
14. * Our world will be run by computers.	2.89	2.87	.13	NS
15. Life will be easier with computers.	3.03	2.86	1.72	NS
16. * Computers are difficult and frustrating.	2.99	2.75	2.23	<.05
17. Computers are interesting to use.	3.29	3.33	.50	NS
18. * Computers control too much of our world today.	2.77	2.66	1.13	NS
19. Computers make learning fun.	3.21	3.11	1.10	NS
20. Enjoy spending spare time working with computers.	2.84	2.72	1.04	NS

* indicates that the item represents negative statement.

Item 11 (*Computers are putting people out of work*) scored the lowest with both groups suggesting that students in the sample are generally concerned about the effect of computers on people's jobs. Item 9 *(Computers are efficient in collecting information)* scored the highest with both groups suggesting a general appreciation of computers speed and convenience in dealing with large amounts of data.

In general students with access are more likely to indicate that the use of computers can be expanded into other things and students with no access are more likely to find computers frustrating and fear that computers will replace human qualities.

8.5 Attitude to computers by year group and key stage

Tables 8.3 and 8.4 show the results of the one-way analysis of variance (ANOVA) used to test for differences between the mean rating of year groups and key stages. When a significant difference between means is obtained, Tukey's test is used to show where the differences lie;

Table 8.3

Attitude to Computers by Year Group, ANOVA

***n* = 214**

Item	*m* yr. 5	*m* yr. 6	*m* yr. 7	*m* yr. 8	*m* yr. 9	*m* yr. 10	*m* yr. 11	*m* 6th form	*F* Ratio	*F* Prob.	*Tukey's*
1. Computers will be useful after leaving school.	3.17	2.95	3.34	3.12	2.76	3.00	2.87	3.00	2.23	<.05	7>9
2. Computers are responsible for good things.									2.42	NS	NS
3. * Our lives will be controlled by computers.	3.31	2.86	2.81	2.75	2.47	2.42	2.67	2.20	4.45	<.001	5>9, 10, 12

4. * I feel intimidated by computers.									1.75	NS	NS
5. Other things can be done with computers.									1.24	NS	NS
6. * Computers take away the human qualities.	2.72	2.55	3.12	2.75	2.38	2.52	2.40	2.30	3.15	<.01	7>9, 10
7. Computers eliminate tedious work.	2.83	3.00	3.44	3.06	3.00	3.50	2.93	3.30	5.71	<.001	10>5, 6, 8, 9, 11; 7>5, 9
8. Computers improving standard of living.									.889	NS	NS
9. Computers are efficient in collecting information.	3.62	3.55	3.72	3.28	3.32	3.55	3.33	3.50	2.48	<.05	7>8
10. * Computers intimidate me because they are complex.	3.03	2.73	3.47	3.00	2.71	2.95	2.93	3.20	3.49	<.01	7>6, 8, 9
11. * Computers putting people out of work.	3.21	3.32	2.53	2.62	2.12	2.05	2.13	1.80	8.22	<.001	5>6, 7, 9, 10, 11, 12; 8>10
12. Computers bringing us into a new era.									2.38	NS	NS

13. Computers will help me earn a living.	3.34	3.18	3.16	2.78	2.79	2.92	3.07	3.00	2.30	<.05	5>8
14. * Our world will be run by computers.	3.17	3.09	3.09	3.09	2.59	2.57	2.80	2.60	3.24	<.01	5>10
15. Life will be easier with computers.									2.27	NS	NS
16. * Computers are difficult and frustrating.									1.54	NS	NS
17. Computers are interesting to use.	3.55	3.32	3.44	3.37	3.21	3.20	3.20	2.80	2.87	<.01	5>12; 7>12
18. * Computers control too much of our world today.	2.97	2.50	2.97	2.72	2.38	2.90	2.67	2.40	3.48	<.01	5, 7, 10>9
19. Computers make learning fun.									1.23	NS	NS
20. Enjoy spending spare time working with computers.	3.34	2.55	2.97	2.94	2.62	2.70	2.67	2.00	4.52	<.001	5>6, 9, 10, 12; 7>12; 8>12

m = Mean

Table 8.4

Attitude to Computers by Key Stage, ANOVA

n = 204

Item	Mean Rating KS2	Mean Rating KS3	Mean Rating KS4	*F* Ratio	*F* Prob.	Tukey's
1. Computers will be useful after leaving school.				.51	NS	NS
2. Computers are responsible for good things.	2.80	2.64	3.05	5.70	<.01	KS4>KS3
3. * Our lives will be controlled by computers.	3.12	2.67	2.49	8.55	<.001	KS2>KS3, KS4
4. * I feel intimidated by computers.				1.99	NS	NS
5. Other things can be done with computers.				2.57	NS	NS
6. * Computers take away the human qualities.				1.81	NS	NS
7. Computers eliminate tedious work.	2.90	3.16	3.35	7.73	<.001	KS3, KS4>KS2
8. Computers improving standard of living.				2.64	NS	NS
9. Computers are efficient in collecting information.				1.21	NS	NS
10. * Computers intimidate me because they are complex.				.79	NS	NS
11. * Computers putting people out of work.	2.82	2.42	2.07	11.46	<.001	KS2>KS3, KS4; KS3>KS4

12. Computers bringing us into a new era.	2.82	3.04	3.22	5.56	<.01	KS4>KS2
13. Computers will help me earn a living.	3.27	2.91	2.96	4.71	<.01	KS2>KS3
14. * Our world will be run by computers.	3.14	2.92	2.64	5.27	<.01	KS2>KS4
15. Life will be easier with computers.				.11	NS	NS
16. * Computers are difficult and frustrating.				.80	NS	NS
17. Computers are interesting to use.				2.85	NS	NS
18. * Computers control too much of our world today.				.87	NS	NS
19. Computers make learning fun.				.44	NS	NS
20. Enjoy spending spare time working with computers.				1.88	NS	NS

Item 11 (*Computers are putting people out of work*) scored the lowest within gender groups. However within year groups it scored the lowest only in years 7, 8, 9, 10, 11 and 6th form, but not in years 5 and 6, indicating that year 5 and 6 (KS2) students are not as pessimistic as other years (KS3 and KS4) with regards to the effect of computers on people's jobs.

Therefore, amongst the year groups, years 5 and 7 have the most positive attitude to computers, perceiving them as efficient and interesting. Students in year 9 indicated the least positive attitude to computers.

Students in KS3 and KS4 are more likely to believe that computers eliminate tedious work and at the same time they are also more negative than students in KS2 about the effect of computers on jobs and lives.

8.6 Attitude to computers by gender

Table 8.5 compares the mean for each gender using the t-test. Furthermore the scores for male students are ranked in descending order;

Table 8.5

Mean Score of Items in Rank Order, by Gender

***n* = 214**

Item	Mean rating male	Mean rating female	*t*	*p*
9. Computers are efficient in collecting information.	3.53	3.45	1.13	NS
17. Computers are interesting to use.	3.36	3.24	1.63	NS
7. Computers eliminate tedious work.	3.27	3.03	2.86	<.01
19. Computers make learning fun.	3.27	3.08	2.12	<.05
4. * I feel intimidated by computers.	3.22	3.08	1.60	NS
12. Computers bringing us into a new era.	3.21	2.85	4.47	<.001
5. Other things can be done with computers.	3.15	3.00	1.85	NS
1. Computers will be useful after leaving school.	3.13	2.94	2.08	<.05
10. * Computers intimidate me because they are complex.	3.09	2.89	1.98	<.05
13. Computers will help me earn a living.	3.07	2.95	1.21	NS
15. Life will be easier with computers.	3.04	2.89	1.52	NS
8. Computers improving standard of living.	3.01	2.85	1.73	NS
20. Enjoy spending my spare time working with computers.	2.97	2.60	3.31	<.001

16. * Computers are difficult and frustrating.	2.94	2.85	.83	NS
2. Computers are responsible for good things.	2.89	2.67	2.19	<.05
18. * Computers control too much of our world today.	2.80	2.65	1.50	NS
14. * Our world will be run by computers.	2.75	3.03	2.53	<.05
3. * Our lives will be controlled by computers.	2.65	2.77	1.04	NS
6. * Computers take away the human qualities.	2.63	2.64	.14	NS
11. * Computers putting people out of work.	2.27	2.54	2.43	<.05

Overall boys are more positive than girls with the most significant results being boys higher scores for item 12 (*Computers bringing us into a new era*) and item 20 (*Enjoy spending my spare time working with computers*).

Nevertheless girls' mean scores are high and in fact the lowest mean score is by boys (2.27) for negative item 11 (*Computers putting people out of work*) where girls' lowest mean score (2.54) also appears. Girls score higher than boys for negative item 14 (*Our world will be run by computers*) too, indicating that boys are less positive about the effect of computers on the world and on the people's jobs.

8.7 Principle component analysis

Using the Scree Plot, 6 factors were extracted with eigenvalues greater than 1.0. Item inter-correlations were analysed using principle components analysis followed by a varimax rotation (Appendix 18, table a.10). Several solutions were tried . All six factors were rotated, then five-, four- and three-factor solutions were tried. The rotated five-factor solution proved the most interpretable and the five factors were labelled *'benefits of computers', 'interaction with computers', 'dehumanisation by computers', 'uses of computers', 'effects of computers'* (table 8.6).

Table 8.6

Factors Derived from *C.Att.T.*

Item	***C.Att.T.* - Factor 1: Benefits of Computers**	Loading	Communality
Q2	Computers are responsible for many of the good things we enjoy.	.670	.508
Q8	The use of computers is improving our standard of living.	.633	.497
Q13	Knowing about computers will help me earn a living.	.626	.533
Q1	Computers are useful in whatever you do when you leave school.	.584	.416
Q19	Computers can make learning more fun.	.552	.533
Q17	Computers are interesting to use.	.518	.485

Item	***C.Att.T.* - Factor 2: Interaction with Computers**	Loading	Communality
Q10	Computers intimidate me because they seem so complex.	.773	.640
Q4	I feel intimidated by computers.	.658	.659
Q16	Computers are difficult to understand and frustrating to work with.	.652	.540
Q6	Computers take away human qualities from society.	.581	.580
Q20	I enjoy spending my spare time working with computers.	.523	.570
Q15	Life will be easier and faster with computers.	.398	.364

Item	***C.Att.T.* - Factor 3: Dehumanisation by Computers**	Loading	Communality
Q14	Soon world will be run by computers.	.803	.650
Q3	Soon our lives will be controlled by computers.	.791	.641

Item	*C.Att.T.* - **Factor 4: Uses of Computers**	Loading	Communality
Q7	Computers can eliminate a lot of tedious work for people.	.705	.521
Q12	Computers are bringing us into a bright new era.	.610	.625
Q9	Computers are a fast and efficient means of collecting information.	.515	.588

Item	*C.Att.T.* - **Factor 5: Effects of Computers**	Loading	Communality
Q5	There are so many other things that can be done with computers which no one has thought of yet.	.643	.494
Q18	Computers control too much of our world today.	.503	.518
Q11	Computers are putting people out of work.	.494	.634

Independent sample t-test procedures were used to test for differences on each factor between the mean rating of students with and without access and between boys and girls. A one-way analysis of variance was then employed to test for differences between the mean ratings of students in year groups and within key stages. When a significant difference between factors was obtained, Tukey's test was used to show where the differences lay.

The results are shown in Appendix 18 (tables a.11, a.12, a.13 and a.14), the summary of which is as follows;

Table 8.7

Differences Between Students per Subscale by Access, Year Group, Key Stage and Gender

Variable	*Access to Home Computer*	*Year Group*	*KS*	*Gender*
Factor	a = access n = no access	5 = year 5 6 = year 6 7 = year 7 8 = year 8 9 = year 9 10 = year 10 11 = year 11 12 = 6th form	2 = KS2 3 = KS3 4 = KS4	m = male f = female
1. Benefits of computers	NS	NS	NS	<.01; m>f
2. Interaction with computers	<.05; a>n	<.001; 7>6, 9, 10, 12	NS	<.05; m>f
3. Dehumanisation by Computers	NS	<.001; 5>9, 10, 12	<.001; 2>3, 4	<.05; f>m
4. Uses of Computers	NS	<.001; 7>5, 8; 10>5, 8, 9	<.01; 4>2	<.001; m>f
5. Effects of Computers	NS	<.001; 5>6, 9, 12; 7>9	NS	NS

Male students in year 7 perceive interaction with computers more positively and along with boys in year 10 they have a more positive perception of computer use.

However boys in year 5 of key stage 2 are more likely to perceive computers as dehumanising machines.

8.8 Comment

For convenience and ease of interpretation the results are summarised in table 8.8, showing that overall students express very positive attitudes to computers, with the positive statement 9 (*Computers are a fast and efficient means of collecting information*) scoring the maximum (m=3.49, sd=.55), and negative statement 11 (*Computers are putting people out of work*) scoring the minimum (m=2.40, sd=.85).

Female students in year 5 of key stage 2 scored higher than boys for items 11 (*Computers putting people out of work*) and 14 (*Our world will be run by computers*). Therefore girls in year 5 are less likely to perceive computers putting people out of work and are not as concerned as boys that the world is run by computers.

Table 8.8

Differences Between Students per Item

by Access, Year Group, Key Stage and Gender

Variable	*Access*	*Year Group*	*KS*	*Gender*
Item	a = access	5 = year 5	2 = KS2	m = male
	n = no access	6 = year 6	3 = KS3	f = female
		7 = year 7	4 = KS4	
		8 = year 8		
		9 = year 9		
		10 = year 10		
		11 = year 11		
		12 = 6th form		
1. Computers will be useful after leaving school.	NS	<.05; 7>9	NS	<.05; m>f
2. Computers are responsible for good things.	NS	NS	<.01; 4>3	<.05; m>f
3. * Our lives will be controlled by computers.	NS	<.001; 5>9, 10, 12	<.001; 2>3, 4	NS
4. * I feel intimidated by computers.	NS	NS	NS	NS
5. Other things can be done with computers.	<.01; a>n	NS	NS	NS

6. * Computers take away the human qualities.	<.05; a>n	<.01; 7>9, 10	NS	NS
7. Computers eliminate tedious work.	NS	<.001; 10>5, 6, 8, 9, 11; 7>5, 9	<.001; 3, 4>2	<.01; m>f
8. Computers improving standard of living.	NS	NS	NS	NS
9. Computers are efficient in collecting information.	NS	<.05; 7>8	NS	NS
10. * Computers intimidate me because they are complex.	NS	<.01; 7>6, 8, 9	NS	<.05; m>f
11. * Computers putting people out of work.	NS	<.001; 5>6, 7, 9, 10, 11, 12; 8>10	<.001; 2>3, 4; 3>4	<.05; f>m
12. Computers bringing us into a new era.	NS	NS	<.01; 4>2	<.001; m>f
13. Computers will help me earn a living.	NS	<.05; 5>8	<.01; 2>3	NS
14. * Our world will be run by computers.	NS	<.01; 5>10	<.01; 2>4	<.05; f>m
15. Life will be easier with computers.	NS	NS	NS	NS

16. * Computers are difficult and frustrating.	<.05; a>n	NS	NS	NS
17. Computers are interesting to use.	NS	<.01; 5, 7>12	NS	NS
18. * Computers control too much of our world today.	NS	<.01; 5, 7, 10>9	NS	NS
19. Computers make learning fun.	NS	NS	NS	<.05; m>f
20. Enjoy spending spare time working with computers.	NS	<.001; 5>6, 9, 10, 12; 7, 8>12	NS	<.001; m>f

Factor of access

The result indicates that students with access to computers have a more positive interaction with computers (t=2.32, p<.05) and within the *interaction with computers* subscale, students with no access to home computer are more likely to feel that computers take away the human qualities from society (t=2.19, p<.05) and that computers are difficult to understand and frustrating to work with (t=2.23, p<.05). Furthermore, students with access are more positive that there are so many other things that can be done with computers (t=2.47, p<.01).

Factor of year group and key stage

Students in key stages 3 and 4 indicate that computers will be more dominant in the future than students in key stage 2. This result can be recognised within year groups too, as students in year 5 (KS2) score higher than students in

years 9 (KS3) and 10 (KS4) in the dehumanisation by computers subscale. Students in key stage 4 are more positive about the uses of computers than students in key stage 2.

Factor of gender

The result of the analysis of subscales (table 8.8) indicates that boys are more positive about the benefits (t=2.82, p<.01) and uses (t=3.96, p<.001) of computers, and have a more positive interaction with computers (t=2.33, p<.05). On the other hand, boys are more likely to perceive computers as dehumanising and more dominant in the future (t=2.04, p<.05), putting people out of work (t=2.43, p<.05).

8.9 Conclusion

As indicated earlier, in general students have a positive attitude towards computers. Item 9 (*Computers are a fast and efficient means of collecting information*) scored the highest and from the result tables it is apparent that all the groups and sub-groups perceive computers as efficient machines.

Access to home computer appears to increase secondary students' positive attitude to computers. Their out-of-school experience of working with computers means that they have used them for applications other than school work and consequently have become more proficient. Therefore as a consequence they do not find working with computers difficult or frustrating and don't think that computers affect human qualities. It is interesting to note that even students with no access score high on all items and on all cases the scores were above average, with the lowest score of 2.48 for the negative item number 6 (*computers take away the human qualities from society*), which is 12% above average.

The older students in KS3 and KS4 appear to be pessimistic about the future role of computers perceiving them as taking over from humans but they also express the reasons to be that computers may only take over from humans in carrying out tedious works, such as data collection.

Boys also express pessimism about the computers' apparent dominance in the future. However this may not mean that secondary male students are expressing a negative attitude. Although boys may feel that their lives and others will soon be controlled by computers, putting people out of work, nevertheless they also express that computers will be useful after school and computers are bringing us into a bright new era. It may that boys are not in fact expressing a negative opinion rather they are making a prediction and more than girls, they see their future as being influenced by IT.

CHAPTER 9
RESULTS 2
Computer Anxiety Test

9.1 Introduction

The second instrument, Computer Anxiety Test (C.Anx.T.), was designed to test secondary students' personal feelings and their anxieties about computers.

The results from C.Anx.T. are analysed in this chapter and SPSS is again employed for analysis of the collected data. As in previous chapter the variables of access, year group, key stage and gender are the comparative factors.

9.2 Method of analysis

A separate data file was used to enter the scores for C.Anx.T. and the procedures for the data entry, data analysis and results interpretation is identical to that of C.Att.T.

9.3 Descriptive statistics

For each item, the scores, the mean and the standard deviation are reported in table 9.1:

Table 9.1

Mean and Standard Deviation, C.Anx.T.

N = 214

Item	Strongly Disagree	Disagree	Agree	Strongly Agree	*m*	*sd*
1. * I feel panicky about using computers.	37	125	46	6	2.90	.70
2. * I think I would be unable to learn a computer programming language.	30	118	57	9	2.79	.73
3. The challenge of learning about computers is exciting.	6	32	138	38	2.97	.66
4. I am confident that I can learn computer skills.	1	13	152	48	3.15	.53
5. Anyone can learn to use a computer if they are patient and motivated.	4	6	135	69	3.26	.60
6. Learning to operate computers is like learning any new skill-the more you practice, the better you become.	2	8	124	80	3.32	.59
7. * I am afraid that if I begin to use computers I will become dependent on them.	44	135	29	6	3.01	.67
8. I feel that I will be able to keep up with the advances happening in the computer field.	10	63	123	18	2.70	.69
9. * I dislike working with machines that are smarter than I am.	66	118	19	11	3.12	.77

10. I look forward to using a computer to do my homework or coursework.	7	30	124	53	3.04	.72
11. * I have difficulty in understanding the technical aspects of computers.	23	104	69	18	2.62	.79
12. * It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.	25	74	84	31	2.43	.88
13. * I hesitate to use a computer for fear of making mistakes that I cannot correct.	39	123	41	11	2.89	.75
14. * You have to be a genius to understand all the special keys contained on most computer terminals.	59	113	35	7	3.05	.75
15. If given the opportunity, I would like to learn about and use computers.	3	21	130	60	3.15	.64
16. * I have avoided computers because they are unfamiliar and somewhat intimidating to me.	59	131	18	6	3.14	.67
17. I feel computers are necessary tools in both educational and work settings.	5	38	117	54	3.03	.72
18. Computers are fun to use.	5	11	107	91	3.33	.68
19. * I don't like computers because they never work properly for me.	74	109	25	6	3.17	.74
20. * I might be considered peculiar if I become a computer expert.	46	120	36	12	2.93	.78

* indicates that the item represents negative statement,

m = Mean; *sd* = Standard Deviation

9.4 Anxiety about computers by access

Table 9.2 compares the means of the two groups of student using their means and *t*-test;

Table 9.2

Anxiety about Computers by Access, Mean Rating

***n* = 214**

Item	Mean rating Access	Mean Rating No Access	*t*	*p*
1. * I feel panicky about using computers.	2.96	2.81	1.47	NS
2. * Unable to learn programming.	2.81	2.75	.66	NS
3. Learning about computers is exciting.	3.00	2.92	.81	NS
4. I can learn computer skills.	3.23	3.02	2.76	<.01
5. Anyone can learn to use a computer.	3.27	3.24	.31	NS
6. More you practice, the better you become.	3.31	3.33	.21	NS
7. * I might become dependent on computers.	3.05	2.95	1.07	NS
8. Keeping up with advances in computing.	2.71	2.67	.41	NS
9. * I dislike working with smart machines.	3.23	2.92	2.85	<.01
10. I look forward to using a computer.	3.05	3.03	.26	NS
11. * Difficulty in technical aspects.	2.70	2.48	1.94	NS
12. * Destroy information by hitting the wrong key.	2.55	2.24	2.50	<.05
13. * Fear of making mistakes.	2.97	2.75	2.11	<.05
14. * Have to be a genius to understand keys.	3.08	2.99	.88	NS
15. I like to learn about and use computers.	3.16	3.14	.26	NS
16. * Computers are unfamiliar and intimidating.	3.16	3.09	.78	NS
17. Computers are necessary tools.	3.07	2.95	1.22	NS
18. Computers are fun to use.	3.33	3.33	.03	NS
19. * Computers never work properly for me.	3.23	3.08	1.47	NS

20.* Computer experts are peculiar.	2.93	2.95	.21	NS

* indicates that the item represents negative statement.

Students with access to home computer are more positive about learning computer skills and working with computers and are less likely to have anxiety about making mistakes when using computers.

9.5 Anxiety about computers by year group and key stage

Table 9.3 and 9.4 compares the mean ratings of year groups and key stages and as before Tukey's test is used to show where significant differences lie;

Table 9.3

Anxiety about Computers by Year Group, ANOVA

***n* = 214**

Item	*m* yr 5	*m* yr 6	*m* yr 7	*m* yr 8	*m* yr 9	*m* yr 10	*m* yr 11	*m* 6th form	*F* Ratio	*F* Prob	*Tukey's*
1. * I feel panicky about using computers.									.59	NS	NS
2. * Unable to learn programming.									.51	NS	NS
3. Learning about computers is exciting.									2.22	NS	NS
4. I can learn computer skills.									2.04	NS	NS
5. Anyone can learn to use a computer.									1.15	NS	NS

6. More you practice, the better you become.									.79	NS	NS
7. * I might become dependent on computers.									1.53	NS	NS
8. Keeping up with advances in computing.									1.06	NS	NS
9. * I dislike working with smart machines.									.96	NS	NS
10. I look forward to using a computer.									2.16	NS	NS
11. * Difficulty in technical aspects.									.28	NS	NS
12. * Destroy information by hitting the wrong key.									1.07	NS	NS
13. * Fear of making mistakes.									1.15	NS	NS
14. * Have to be a genius to understand keys.	3.00	3.23	3.41	3.03	2.76	2.87	3.13	3.20	2.40	<.05	7>9
15. I like to learn about and use computers.									1.10	NS	NS
16. * Computers are unfamiliar and intimidating.	3.24	2.95	3.44	3.19	2.76	3.20	3.13	3.10	2.97	<.01	7>9
17. Computers are necessary tools.									2.14	NS	NS
18. Computers are fun to use.	3.62	3.14	3.59	3.50	3.18	3.17	3.20	2.80	3.77	<.001	5, 7>12

19. * Computers never work properly for me.	3.45	3.05	3.37	3.25	2.85	3.10	3.20	3.10	2.11	<.05	5>9
20. * Computer experts are peculiar.									1.65	NS	NS

m= mean rating

Table 9.4

Anxiety about Computers by Key Stage, ANOVA

n = 204

Item	Mean Rating KS2	Mean Rating KS3	Mean Rating KS4	*F* Ratio	*F* Prob.	Tukey's
1. * I feel panicky about using computers.				.58	NS	NS
2. * Unable to learn programming.				.87	NS	NS
3. Learning about computers is exciting.				1.97	NS	NS
4. I can learn computer skills.				.31	NS	NS
5. Anyone can learn to use a computer.				.70	NS	NS
6. More you practice, the better you become.				.27	NS	NS
7. * I might become dependent on computers.				.05	NS	NS

8. Keeping up with advances in computing.	.96	NS	NS
9. * I dislike working with smart machines.	.26	NS	NS
10. I look forward to using a computer.	.66	NS	NS
11. * Difficulty in technical aspects.	.06	NS	NS
12. * Destroy information by hitting the wrong key.	.01	NS	NS
13. * Fear of making mistakes.	1.60	NS	NS
14. * Have to be a genius to understand keys.	.61	NS	NS
15. I like to learn about and use computers.	1.38	NS	NS
16. * Computers are unfamiliar and intimidating.	.16	NS	NS
17. Computers are necessary tools.	2.07	NS	NS
18. Computers are fun to use.	2.45	NS	NS
19. * Computers never work properly for me.	.60	NS	NS
20. * Computer experts are peculiar.	1.11	NS	NS

Students in years 5 and 7 show less anxiety than students in years 9 and 12, when learning about and using computers.

Table 9.4 indicates that the difference between key stage groups does not reach statistical significance.

9.6 Anxiety about computers by gender

The following table compares means and as in table 8.5, the scores for male students are ranked in descending order;

Table 9.5

Mean Score of Items in Rank Order, by Gender

***n* = 214**

Item	Mean rating male	Mean rating female	*t*	*p*
18. Computers are fun to use.	3.35	3.30	.61	NS
6. More you practice, the better you become.	3.33	3.31	.25	NS
5. Anyone can learn to use a computer.	3.31	3.20	1.36	NS
19. * Computers never work properly for me.	3.28	3.05	2.33	<.05
4. I can learn computer skills.	3.27	3.03	3.32	<.001
15. I like to learn and use computers.	3.27	3.03	2.72	<.01
9. * I dislike working with smart machines.	3.24	2.98	2.49	<.05
16. * Computers are unfamiliar and intimidating.	3.19	3.07	1.36	NS
3. Learning about computers is exciting.	3.14	2.78	4.10	<.001
17. Computers are necessary tools.	3.12	2.92	2.06	<.05
7. * I might become dependent on computers.	3.11	2.91	2.13	<.05

10. I look forward to using a computer.	3.10	2.98	1.19	NS
13. * Fear of making mistakes.	3.04	2.71	3.28	<.001
14. Have to be a genius to understand keys.	3.04	3.06	.23	NS
1. * I feel panicky about using computers.	3.01	2.78	2.38	<.05
20. * Computer experts are peculiar.	2.94	2.93	.07	NS
8. Keeping up with advances in computing.	2.81	2.57	2.48	<.05
2. * Unable to learn programming.	2.79	2.79	.04	NS
11. * Difficulty in technical aspects.	2.73	2.49	2.15	<.05
12. * Destroy information by hitting the wrong key.	2.60	2.25	3.00	<.01

Overall boys show less anxiety than girls when learning about and using computers, with the most significant results being boys higher scores for items 3 (*Learning about computers is exciting*), 4 (*I can learn computer skills*) and 13 (*I hesitate using computers for fear of making mistakes that I can not correct*).

9.7 Principle component analysis

The procedure was the same as that used for C.Att.T., that is using the scree plot and trying several solutions (Appendix 20, table a.18). The rotated five-factor solution again proved the most interpretable and the factors were labelled, *'Enthusiasm for computers'*, *'Apprehension about computers'*, *'Complexity of computers'*, *'Dislike of computers'* and *'Computer user characteristics'* (table 9.6).

Table 9.6

Factors Derived from C.Anx.T.

Item	C.Anx.T. - Factor 1: Enthusiasm For Computers	Loading	Communality
Q17	Computers are necessary in educational and work settings.	.670	.515
Q3	Learning about computers is exciting.	.653	.550
Q15	I would like to learn about and use computers.	.649	.493
Q6	The more you practice in computers the better you become.	.601	.498
Q4	I can learn computer skills.	.564	.578
Q8	I will be able to keep up with advances in computer field.	.478	.389
Q10	I look forward to using computers to do my work.	.465	.411

Item	C.Anx.T. - Factor 2: Anxiety About Computers	Loading	Communality
Q16	I avoid computers because they are unfamiliar and intimidating to me.	.767	.680
Q19	Computers never work properly for me.	.552	.592
Q18	Computers are fun to use.	.5517	.604
Q1	I feel apprehensive about using computers.	.5515	.376
Q13	I hesitate using a computer for fear of making mistakes that I can not correct.	.482	.553

Item	C.Anx.T. - Factor 3: Complexity of Computers	Loading	Communality
Q2	I am unable to learn a computer programming language.	.711	.582
Q12	It scares me to think that I could destroy a large amount of information by hitting the wrong key.	.690	.623
Q11	I have difficulty understanding technical aspects of computers.	.640	.472

Item	C.Anx.T. - Factor 4: Dislike of Computers	Loading	Communality
Q7	If I begin to use computers I will become dependant on them.	.731	.598
Q9	I dislike working with machines that are smarter than I am.	.698	.634

Item	C.Anx.T. - Factor 5: Computer User Characteristics	Loading	Communality
Q20	I might be considered peculiar if I become a computer expert.	.695	.589
Q14	You have to be genius to understand all the keys on a computer.	.635	.578
Q5	Anyone can learn to use computers if patient and motivated.	.608	.590

As before, independent sample t-test procedures were used to test for differences on each factor between the mean rating of students with and without access and between boys and girls and a one-way analysis of variance was used to test for differences between the mean ratings of students in year groups and within key stages and where significant, Tukey's test was used to show where the differences lay. The results are shown in appendix 20 (tables a.19, a.20, a.21 and a.22) and their summary is as follows;

Table 9.7

Differences between Students per Subscale by Access, Year Group, Key Stage and Gender

Variable	*Access to Home Computer*	*Year Group*	*KS*	*Gender*
Factor	a = access n = no access	5 = year 5 6 = year 6 7 = year 7 8 = year 8 9 = year 9 10 = year 10 11 = year 11 12 = 6th form	2 = KS2 3 = KS3 4 = KS4	m = male f = female
1. Enthusiasm for computers	NS	<.01; 5>9	NS	<.001; m>f
2. Apprehension about computers	NS	<.05; 7>9	NS	<.01; m>f
3. Complexity of computers	<.05; a>n	NS	NS	<.05; m>f
4. Dislike of computers	<.05; a>n	NS	NS	<.01; m>f
5. Computer user characteristics	NS	NS	NS	NS

Male students are more enthusiastic about computers and show less apprehension about the complexity of computers.

Students with access to home computer show less anxiety about the complexity of computers.

9.8 Comments

For convenience and ease of interpretation the results are summarised in table 9.8.

Overall, the students show little anxiety about computers. The positive statement 18 (*Computers are fun to use*) scores the maximum (*m*=3.33, *sd*=.68) and the negative statement 12 (*It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key*) score the minimum (*m*=2.43, *sd*=.88).

Table 9.8

Differences Between Students per Item

by Access, Year Group, Key Stage and Gender

Variable	*Access*	*Year Group*	*KS*	*Gender*
Item	a = access	5 = year 5	2 = KS2	m = male
	n = no access	6 = year 6	3 = KS3	f = female
		7 = year 7	4 = KS4	
		8 = year 8		
		9 = year 9		
		10 = year 10		
		11 = year 11		
		12 = 6th form		
1. * I feel panicky about using computers.	NS	NS	NS	<.05; m>f
2. * Unable to learn programming.	NS	NS	NS	NS
3. Learning about computers is exciting.	NS	NS	NS	<.001; m>f
4. I can learn computer skills.	<.01; a>n	NS	NS	<.001; m>f
5. Anyone can learn to use a computer.	NS	NS	NS	NS

6. More you practice, the better you become.	NS	NS	NS	NS
7. * I might become dependent on computers.	NS	NS	NS	<.05; m>f
8. Keeping up with advances in computing.	NS	NS	NS	<.05; m>f
9. * I dislike working with smart machines.	<.01; a>n	NS	NS	<.05; m>f
10. I look forward to using a computer.	NS	NS	NS	NS
11. * Difficulty in technical aspects.	NS	NS	NS	<.05; m>f
12. * Destroy information by hitting the wrong key.	<.05; a>n	NS	NS	<.01; m>f
13. * Fear of making mistakes.	<.05; a>n	NS	NS	<.001; m>f
14. * Have to be a genius to understand keys.	NS	<.05; 7>9	NS	NS
15. I like to learn about and use computers.	NS	NS	NS	<.01; m>f

16. * Computers are unfamiliar and intimidating.	NS	<.01; 7>9	NS	NS
17. Computers are necessary tools.	NS	NS	NS	<.05; m>f
18. Computers are fun to use.	NS	<.001; 5,7>12	NS	NS
19. * Computers never work properly for me.	NS	<.05; 5>9	NS	<.05; m>f
20. * Computer experts are peculiar.	NS	NS	NS	NS

Factor of access

The results indicate that students with access have less fear of the complexity of computers (t=2.44, p<.05) and express less dislike of computers (t=2.36, p<.05).

Furthermore, students with access are also more confident in learning computer skills (t=2.76, p<.01), while students without access are more hesitant in using computers in case of making mistakes (t=2.11, p<.05).

Factor of year group and key stage

No significant results are found within key stages. However students in year 9 express less enthusiasm about computers than students in year 5 (F=2.69, p<.01), and more apprehension about computers than students in year 7 (F=2.55, p<.05). Results also indicate that students in year 7 have a more positive view of computer users than students in year 9 (F=2.40, p<.05).

Factor of gender

Male students are more enthusiastic about computers (t=3.56, p<.001), are less apprehensive about computers (t=2.91, p<.01), have less fear of the complexity of computers (t=2.48, p<.05) and express less dislike of computers (t=2.73, p<.01).

9.9 Conclusion

The most significant results are when the factors of access and gender are considered. Experience of working with a computer at home seems to give the student more confidence. This confidence and self assurance is also found to be more visible in male students in secondary schools.

No significant results is found to interpret students' views and opinions about the characteristics of computer users, except year 7 students, but only compared to year 9 students and overall, year 9 students show the most anxiety about computers.

CHAPTER 10
Discussion

10.1 Introduction

This research study aimed to investigate secondary school students' attitudes to and anxiety about information technology or computing, in particular gender differences in these areas.

Following the review of relevant literature, the following questions were formulated:

1) Is the age of students related to their attitude to and anxiety about computers?
2) Is external access to computers related to secondary school students' attitude to computers and their anxiety about them?
3) Do older students perceive computers as less complex than younger ones?
4) Do boys and girls differ in their perception of the social impact of computers?
5) Do boys and girls differ in their perception of computers and computer users?
6) Do students in secondary schools regard computers as useful learning tools and is there a relationship with gender, external access to computers and/or age of students?

Two instruments, C.Att.T. (Computer Attitude Test) and C.Anx.T. (Computer Anxiety Test) were designed to find answers to the above questions. Both instruments were shown to be reasonably reliable measures of secondary school students' attitude to (C.Att.T. : r=.94, p<.001), and anxiety of (C.Anx.T. : r=.86, p<.001), computers.

The data collection was carried out with the three factors of access, age and gender in mind. The results and my interpretation of them are indicated in the following sections.

10.2 Sample response

The response rate was uneven. Students in years 5 to 10 showed a great deal of enthusiasm to participate in the study and were more than happy to give some of their time to complete the two instruments. However the major disappointment was the low response rate of students in years 11 (response rate=45.5%) and 6th form (response rate=33.3%). As was indicated before, the most convenient time for data collection was during the allocated periods by the participating schools which were during periods of light timetable. This meant that at this time many of the GCSE and A'level students were on study leave, preparing for their examinations.

Unfortunately I could do very little to change the situation and although the results from year 11 and 6th form are included in the analysis, nevertheless higher significance levels are needed in order to increase the reliability of the data.

Another problem was a larger than desired difference between numbers of male and female participants, particularly in years 6 and 10. At the time of data collection absenteeism of a number of students from the participating schools caused this difference. However, overall, the numbers in the total sample are close with 113 male students (83% of the initial number) and 101 female students (73% of the initial number) who replied.

10.3 Access to computer

Earlier it was indicated that through the introduction of the National Curriculum, all secondary school students should have been exposed to and have had access to computers. This internal experience of working with computers, should have improved the students' attitude to computers and decreased their anxiety about computers.

The results from the two instruments, show that all the items (in both instruments) have scores higher than 2.40, indicating that secondary school students, in general, are more likely to agree with positive statements and disagree with negative statements, consequently expressing a positive attitude to computers and minimal anxiety about them.

The rapid growth of IT in schools and the IT requirements within the National Curriculum has enabled secondary students to gain experience of working with computers. Internal use of computers in schools is now mainly based on the newer and user friendlier software packages which was described as *'soft computing'*. Therefore the positive attitudes and decrease in anxieties may be the result of an increase in exposure to computers in schools.

Furthermore external access also could have influenced students' positive attitudes and their anxieties about computers. It is found that the majority of secondary school students have access to home computers. The results are significant in lower years , particularly in years 9 and 10, where 75% of the students in each year group have access to home computers. This result was also shown to be significant within key stage groups with 64% in key stage 3 and 73% in key stage 4 who have access to home computers. It can be concluded that year 9 students who are in the last year of key stage 3, and year 10 students who are in the first year of key stage 4, that is most of the students of ages 13 to 15, have access to home computer. Further analysis of the results reveals that, boys constitute the majority amongst the students with access, significantly in key stages 3 and 4.

It can be deducted that in secondary schools, boys aged 13 to 15 are the most likely students to have computers bought for them or have access to home computers.

The large number of students with access to home computers is likely to reflect two factors. Firstly, the ever increasing promotion of personal computers are taking effect and PC's are becoming more common in homes. Secondly it may reflect parents' perception of the importance of computers in their children's educational success. This is most significant in the 13 to 15 age group, when parents may be more conscious of their children's increasing work load as they approach GCSE examinations.

The larger number of boys with external access is in line with other studies (Cole, 1994, Culley, 1986; Harrison, 1991; Kirkup *et al*, 1990; Underwood *et al*, 1990) and may indicate that boys are more demanding for a PC or parents could see PC as more suitable for their boys. Unfortunately the research did not make enquiries about the make up of the respondents' families, such as if the

respondent is the only child, or if the respondent has other brothers or sisters. The question which prompted an answer itself may have been ambiguous. It states, *'do you have your own computer at home?'*. Students may have answered yes to this question, meaning that they use a computer at home, which is not necessarily theirs. In any case family configurations and circumstances may not be as important, since boys appear to seek more access to home computing.

Even though students in secondary school have experienced computing through internal access, nevertheless, external access may improve attitudes and decrease anxieties further. Therefore in answering the second question (Is external access to computers related to secondary school students' attitude to computers and their anxiety about them?) results indicated that students with external access are more positive in interacting with computers, less anxious about the complex nature of computers and, are less likely to express dislike of computers.

It may be the informality of using computers at home, when more exploration is possible, that enables user to become more confident.

10.4 Age of students

The question of age was investigated through considering the year groups and key stages which meant a more precise grouping of the students was possible. This enabled a more general approach to the analysis and further enabled analysis of differences between different National Curriculum key stages.

Students in key stages 3 and 4 express more concern about the dehumanising aspect of computers. Older students indicate that computers will be more

dominant in the future, affecting them in many ways such as assisting in data collection eliminating the tedious and time consuming work involved. Increased use of, and experience with, computers at school, possibly as a result of the National Curriculum requirements could be the reason for the attitude expressed by older students. This is also apparent in their replies to items in C.Att.T. Students in higher year groups showed that they agree with the positive statements as well as agreeing with negative statements too!

Therefore in answering questions 1 (Is the age of students related to their attitude to and anxiety about computers?), it appears that older students, although more aware of computers' positive aspects, are also wary of how computers may effect them and others. Consequently increase in the age of students appears to change their attitude, though not necessarily in a positive direction.

This is a peculiar situation. The factor of age appears to affect students both ways, that is although they have positive attitude to and less anxiety about computers, at the same time they indicate a negative attitude in the sense that they see computers as a dominant force in the future.

This appears to be even more evident in post compulsory education. It is surprising to see that sixth form students are not as positive about computers as other year groups. This may reflect a change in priorities of students in post-compulsory education. Many sixth form students in the sample are employed, part-time, and in many cases these are low paid, manual jobs which rarely require operation of computers. Exposure to such environments, where sixth form students can earn money without knowing about computers, may change their attitude to and anxiety about computers.

One final point to consider in this section is that many students may have a narrow view of computers, that is they perceive IT as solely the use of computers. In fact some of the sixth form students work in local supermarkets and through the use of newly installed electronic tills or electronic stock recorders they are indeed exposed to IT. Therefore it appears that they may not be able to make the connection between IT and machines, other than a PC, which use microprocessors and are a form of computers.

10.5 Gender differences

The literature was consistent in its conclusion that in secondary schools boys are more positive and enthusiastic about computers than girls (Culley, 1986; EOC, 1985; NCET, 1992a). The results of this study are consistent with the existing literature, that in secondary schools, the attitude of boys is more positive and boys also express less anxiety of computers than girls. However girls do not indicate a phobia of computers, in fact they score positively in all items on both instruments ($m_{minimum}$=2.25).

Apart from factor of *dehumanisation by computers*, boys scored consistently higher than girls in all other factors. *Dehumanisation by computers* subscale consisted of two C.Att.T. items, which stated computers' effect on the future and girls scored higher than boys for this factor. This is the most surprising result of this study and is discussed later.

Results also indicate that boys are more enthusiastic to learn about and use computers and they find learning about computers exciting. This is in line with existing literature (Elkjaer, 1992; EOC, 1985; Fennema, 1985; Janssen-Reinen, 1993), where girls appeared to be more interested to use computers as learning tools rather than to learn about them. This attitude of girls was found in

a collective environment where social learning occurs rather than in autonomous learning situations such as learning about computing. Furthermore, boys' higher scores, could be a reflection of their cavalier approach to using computers in the public sphere (Elkjaer, 1992; EOC, 1985). Boys are more interested to use computers without planning, and they may be more prepared to learn by their mistakes and in the process, they may learn more about computers, as was suggested in previous studies (EOC, 1985). Meanwhile girls' more diligent approach may mean that they lag behind and consequently they have less experience, the consequence of which is a more anxiety laden approach to computers.

Returning to the factor of *dehumanisation by computers*, which consisted of two negative statements, students' responses indicated that boys are more concerned about the role of computers in the future and their effect on the human worker. Boys also indicated that computers are taking over jobs from human workers. The results are somewhat peculiar. Girls' higher scores indicate that they in fact disagree with the statements. That is, secondary female students are less likely to perceive computers as running the world or putting people out of work. In particular replies to item 14 show that boys are more likely to agree that the world will be run by computers. There the answer to question 4 is that boys and girls indeed differ in their perception of the social impact of computers, but not in the way that I expected.

So why is this?

The literature indicated that girls could perceive computers as affecting society drastically. Furthermore, boys' higher access means that they have more experience which is extended through the purchase of relative IT items such as computer magazines and literature. Consequently boys could agree with the ever increasing influence of computers, indicated through such items, and

therefore rather than being pessimistic they in fact express an optimism that life will be easier because computers are taking us into a new era in which inevitably computers will rule!

This however does not mean that female students are negative about the role of computers. Girls' mean scores for each item on C.Anx.T. were between 2 and 4, that is in the positive half of scoring, indicating that they do not in general express anxiety about working with computers (which by the way appear not to support the concept of *we can, I can't*). One conclusion is that girls in fact do not see any role for themselves in an IT future. They are positive about computers and perceive them as important, however they do not perceive them as important as boys do.

Working in a mixed school appears not to affect girls adversely. Their scores are lower than boys' but the scores are still encouragingly positive. The stereotyping barrier appears to be eroding away. In particular in hard computing areas such as programming, the scores of female students did not differ significantly from male students'. Boys and girls score the same on their attitude to learning programming though the result did not reach statistical significance.

10.6 Conclusion

A positive attitude and perception is more likely to be expressed by students who have access to home computers, by male students and by students in lower year groups.

Furthermore, students in higher year groups and male students appear to be more aware of the advantages of computers and at the same time both groups

are also more concerned about the potential effect of computers on people's lives and on the society.

The next chapter, as the conclusion to the study, aims to discuss whether the findings of this study confirm the findings of the existing literature.

CHAPTER 11
Conclusions

11.1 Introduction

My aim in this final chapter is to reflect on my findings and express my personal views on the issues raised.

The study concentrated on the reasons for the development of gender specific perceptions and attitudes to computers. Originally I drew on my own experiences which were in line with the existing literature, indicating that there is a gender difference amongst secondary school students' perception of and attitude to IT. Furthermore, the literature elevated the influence of two other factors, that of access to home computer and the age of students.

Following a period of data collection and analysis, I concluded that there indeed is a difference between secondary schools' male and female students in their perception and attitude to IT. Boys show more enthusiasm about computers and at the same time they are more inclined to raise concerns about the effect of computers. However I feel that they are not actually concerned, rather they are expressing an opinion about the role of computers in the future. Furthermore, the results showed that the two factors of access and age do affect perceptions and attitudes, where students with access to a home computer and younger students are more positive.

There was a strong relationship between the two instruments, *Computer Attitude Test* and *Computer Anxiety Test*. In particular students in years 5 and 7 were the most positive and indicated the least anxiety about computers.

The following sections aim to highlight anomalies resulted from the study and possible relationships between various factors.

11.2 A personal view

The starting point for me, like any other research study, was to question myself about my intentions and why I felt that the issue of gender differences in IT was important.

My intentions stemmed from personal experiences, gained following my arrival in Britain and since the start of my teaching career. Settlement in Britain clearly has had a profound effect on my perceptions and attitudes to myself and to others, and non more so than my deeper understanding of discriminatory attitudes, and as a consequence I have become more sympathetic to issues raised as the result of such attitudes.

My attitude to discrimination is clear, that is, I do not think that discrimination against gender, race, religion or any other category is ever appropriate. Although I do not perceive everyone in the same light, nevertheless I feel that we all should be able to have access to opportunities and information in order to follow our chosen paths. As a teacher, I feel that this becomes vitally important amongst secondary school children who are on the final stages of their compulsory education and should be in the process of planning their post compulsory education and their future lives.

In my experience, students appear to find making choices a difficult task. Young people seem to be floating in a grey area of uncertainty and it is important that they receive as much assistance from their teachers as possible. In particular girls, who may have to cope with discrimination too, should be more aware of their options. In order for this to occur I feel that we the responsible adults must be aware of issues that concern students too.

As a technology and IT teacher I need to be extra vigilant to be aware of discrimination. Knowing about attitudes and anxieties in my subject areas would therefore be important.

11.3 The case for IT

The effect of the introduction of IT into the National Curriculum has clearly resulted in a more widespread internal access to computers. Students are becoming more aware of the advantages of IT and are gaining more computing skills through their use in lessons. As a result they are prepared to branch out of soft computing and attempt hard computing areas such as programming. External access has also been an influencing factor in affecting opinions and attitudes about the image of computers, to a more positive one. In short, students' perceptions and attitudes are influenced by their internal and external computing experiences.

However, one point of concern for me is that although students have found IT a useful tool, the growth of IT culture may have divided secondary students into two groups; those who have become interested in computers and would be prepared to go further and learn about hard computing topics such as programming, and those who only use computers in soft areas such as word-

processing. Although in both cases students have an appreciation of the computers' advantages, nevertheless attitudes and anxieties differ as a result of students approach to IT.

This point takes me back to the conclusions from other studies which indicated that amongst secondary students, although girls enjoy working with computers and are not reluctant to participate in IT activities, they nevertheless belong to the second group who prefer to use computers than learn about them. This hypothesis did not hold true in my own results, and girls indicated positive attitude to learning programming. Furthermore, the paradox of *we can, I can't* does not appear to have occurred. The results confirmed that although girls may not be as positive about computers as boys, they certainly are not the reluctant gender and do not display anxiety when dealing with a computer environment. Girls do not avoid computers and are keen to use computers in various contexts as enthusiastic participants in the public as well the private sphere of IT.

Although women's dominance in soft computing fields such as word-processing is well documented, it appears that there could be an increase in the number of females in hard computing jobs too, such as computer engineers and computer scientists. Girls appear to be prepared to compete with boys in the IT industry and girls and boys seem to have a similar attitude to their roles in an IT world. So are there many differences between boys and girls in their perceptions of and attitudes to IT?

The results did reveal differences, but not the ones I expected.

11.4 Gender differences

Clearly the most significant result of my study is the differences of opinion between boys and girls on the effect of computers on the society.

Through their increased experience, students perceive computers' role in their lives as important and it is at this point that gender differences are apparent. Boys indicated that computers will affect their lives in the future to the extent that IT could rule the world, while girls do not perceive this effect. But do boys who have so far indicated a positive attitude to computers see computers as threats?

This I do not believe is the case. It is not that boys are indicating any negative views about the role of computers, rather the case is that boys are perceiving their own roles within an IT environment.

So what do I mean?

To start with I believe that the causes for any negativity to IT does not rest entirely on the students' perception of her or himself. Other agents such as parents and teachers also play important parts in influencing students' role in society. Perceptions about the role of gender inevitably lead us back to the argument of stereotyping. But who perpetuates such stereotypical attitudes and who has the responsibility of changing them, schools, parents or society as a whole.

Schools inevitably are the first targets, but I strongly believe that schools are also the last chance of changing ideals and attitudes. The National Curriculum has encouraged a more widespread uptake of IT and caused an increase in positive attitudes of students to IT and computing. For various reasons, it is

also apparent that parents are now keen to invest in the purchase of personal computers and although boys are in the majority of home computer owners, nevertheless girls do have the opportunity to use them, as half the female students in my research sample indicated.

It is therefore likely that girls, who indicated that computers do not and will not have a controlling influence on our lives and jobs, in fact perceive computers less important than boys do. This is further evident as boys were more positive that computers are taking us into a new era. It is girls' attitude to computers' role in the society, and more importantly their attitude to computers' influence which is the deciding factor in the formation of their attitude to IT. But how did girls form their attitude?

I believe that stereotypes outside the school environment, which girls encounter everyday, have encouraged the formation of such attitudes. Society as a whole is responsible for formulating what is appropriate for boys and what is appropriate for girls. This is discrimination and any counter measures by parents and schools falls well short of pressures that many youngsters face to conform to their stereotypical roles.

The society is discriminating against girls. That is why boys feel computers will rule the world and girls don't. Boys have not been negative, they are in fact playing their stereotypical roles as encouraged by the society. Girls expect to play a very small part in the future of IT and therefore they do not perceive IT as ruling the world and taking over jobs and if it does, then they have very little to do with it.

This means that girls, who are willing to be seen as a computer expert, may never expect their wish to materialise.

11.5 And finally

It is suggested that the general belief is that people tend to explain their own preferences in terms of choice and those of others in terms of stereotypic notions (Archer and McDonald, 1991; Billig, 1988). Students in secondary schools may choose, or not choose, to work with computers as personal statements of their attitudes to and anxieties about IT, but they apply stereotypes to others when considering them in the same context.

The results of my study appear to follow this pattern. Girls perceive a positive role for themselves in an IT environment, however they may not consider themselves as future IT participants though it would be in the hard computing areas. In a way it appears to confirm a notion of *I can, we can't.*

Stereotypes, though still in existence, have changed. Girls are not put off by stereotypes and, stereotypical perceptions do not deter individuals from participating in computing. However personal preferences and general opinions are different.

Boys believe that computers have changed our lives, but are not too concerned that the technology will control their lives. Boys in a sense appear to be willing participants in becoming shackled by computers' influence.

Emancipation of women from their shackles - sexual, social, economic and intellectual - may not be an achievable goal for many years and now it appears that boys are willing to join them!

Appendix 1

Statements that comprised Nickell and Pinto's (1986) Computer Attitude Scale (CAS):

- Computers will never replace human life.
- * Computers make me uncomfortable because I don't understand them.
- * People are becoming slaves to computers.
- Computers are responsible for many of the good things we enjoy.
- * Soon our lives will be controlled by computers.
- * I feel intimidated by computers.
- There are unlimited possibilities of computer applications that haven't even been thought of yet.
- * The overuse of computers may be harmful and damaging to humans
- * Computers are dehumanising to society.
- Computers can eliminate a lot of tedious work for people.
- The use of computers is enhancing our standard of living.
- * Computers turn people into just another number.
- * Computers are lessening the importance of too many jobs now done by humans.
- Computers are a fast and efficient means of gaining information.
- * Computers intimidate me because they seem so complex.
- * Computers will replace the need for working human beings.
- Computers are bringing us into a bright new era.

- * Soon our world will be completely run by computers.
- Life will be easier and faster with computers.
- * Computers are difficult to understand and frustrating to work with.

(* Statements expressing negative attitude.)

Appendix 2

Statements that comprised the Computer Anxiety Rating Scale (CARS) developed by Heinssen, Glass and Knight (1987):

- * I feel insecure about my ability to interpret a computer printout.
- I look forward to using a computer on my job.
- * I do not think I would be able to learn a computer programming language.
- The challenge of learning about computers is exciting.
- I am confident that I can learn computer skills.
- Anyone can learn to use a computer if they are patient and motivated.
- Learning to operate computers is like learning any new skill-the more you practice, the better you become.
- * I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.
- I am sure that with time and practice I will be as comfortable working with computers as I am in working with a typewriter.
- I feel that I will be able to keep up with the advances happening in the computer field.
- * I dislike working with machines that are smarter than I am.
- * I feel apprehensive about using computers.
- * I have difficulty in understanding the technical aspects of computers.

- * It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.
- * I hesitate to use a computer for fear of making mistakes that I cannot correct.
- * You have to be a genius to understand all the special keys contained on most computer terminals.
- If given the opportunity, I would like to learn about and use computers.
- * I have avoided computers because they are unfamiliar and somewhat intimidating to me.
- I feel computers are necessary tools in both educational and work settings.

(* Anxiety-laden statements.)

Appendix 3

Items of the Attitude Towards Computers Survey Statements that were used in the work carried out by Temple and Lips (1989) on attitudes towards computers amongst university students:

- I think that a home computer can be very interesting.
- People managed before without computers, so computers are not really necessary now.
- Mathematics is one of my best subjects.
- I would like to learn how to use a computer.
- When I hand in an essay, I feel I'm going to do poorly.
- People who like computers are often not very sociable.
- Computers are exciting.
- I want to learn all I can about science.
- I would expect a good athlete to like computers.
- Computers will never interest me.
- I look forward to writing down my ideas.
- I would be embarrassed to tell my friends that I would like to join a computer club.
- If I don't see how to do a mathematics problem right away, I never get it.
- If you like science you will like computers.
- The world would be better off if computers were never invented.
- I hope I never have a job where I have to use science.

- Working with computers is not my idea of fun.
- Typing would be the biggest problem I would have in learning to use a home computer.
- No matter how hard I try, I cannot understand mathematics.
- Computers do not interest me.
- You have to be smart to like computers.
- I feel confident in my ability to clearly express my ideas in writing.
- Computers are fun.
- Computers are easy to use.
- I am proud of the work I can do in mathematics.
- If my family had a home computer, I would probably use it more than anyone else.
- Females have as much ability as males when learning to use a computer.
- I sometimes write stories at home even if they are not assigned for school.
- Learning science is just as important for girls as for boys.
- I am concerned that people might make computers too powerful in the future.
- I would rather spend an evening doing something new with a computer than go out with my friends.
- I never find myself thinking about science.
- I enjoy working with computers.
- Using a computer in math class would make math more fun.
- It would be hard for me to learn how to program a computer.
- Computers are boring.
- Girls are just as good as boys in science.
- I do not enjoy writing stories or essays.
- If I had the money, I'd buy a home computer.
- Given a little time and training anyone could learn to use computers.

- Computers are valuable and necessary.
- Computers don't scare me at all.
- Computers make me feel uncomfortable, restless, irritable and impatient.
- People who enjoy working with computers are a bit peculiar.
- I have a lot of self-confidence when it comes to working with computers.
- I think I could handle more difficult mathematics.
- I will admit confusion about a point under discussion in class and ask for clarification.
- I would not hesitate to ask the demonstrator in a computer lab for help.
- If I have a problem in school I usually try to work it out alone or ask a friend before I ask the instructor.
- If another student is doing something that bothers me, I ask them to stop.
- If others are waiting in line for me to finish using a photocopier computer terminal, I will always hurry to finish, or return later to complete the project.

Appendix 4

Statements, entitled 'Image of Computer Technology', that comprised Equal Opportunities Commission work in Croydon (1985):

- I like fiddling with machinery.
- Computers make things better.
- Girls are very good at using tools.
- Computer experts do not care about people.
- Computer technology is useful whatever you do when you leave school.
- Computers are fascinating.
- Computer experts are a bit weird.
- Computers are taking over the world.
- I want to learn all I can about computers.
- A woman could never be a computer expert.
- Computers cause trouble.
- Computer studies is a very difficult subject.
- Computers do more harm than good.
- It's useful to know about computers when you are bringing up children.
- Engineering is a dirty job.
- I'd like to be given a computer as present.
- Girls don't need to know about computers.
- Money spent on computers could be put to better use.

- knowing about computers will help me earn a living.
- Girls who want to be computer experts are a bit peculiar.
- Computers are very exciting.
- Computer experts are ugly.
- Lots of information we get from computers now will be changed in the future.
- I'd like a job making things.
- Only people who want to become computer experts should have to study about computers.
- Computers are very dangerous for everyone.
- When I start thinking about computers I find it hard to stop.
- Learning about computers is more important for boys than girls.
- Computer experts never talk about anything except computers.
- Computers are destroying the way we live.
- I like finding out how things work.
- Computers are to blame for unemployment.
- My father thinks I'll be good with computers.
- The results of computer technology are making life too much of a rush.
- Computers are only for brainy people.
- Boys don't need to learn about cooking and babies.
- People have managed without computers for a long time and we should be able to manage without computers too.
- There are to many facts to learn about computers.
- Girls don't need to know how things work.
- I've always been interested in computers.
- You have to be very strong to be an engineer.
- You can't use your imagination with computers.
- Computers don't affect my life.
- Computers are making most people's jobs more boring.

- I don't expect I'll be any good with computers.
- I'd like to have a job using computers.
- Everyone needs to learn about computers to understand the modern world.
- Computer experts don't seem to be very happy.
- Girls are just as good as boys at working with computers.
- Computers are reducing our freedom.
- There are too many facts to learn about computers.
- Computer experts are boring people.
- There is a computer at home.

Appendix 5

Statements that comprised the study on IT at KS3 by Passey (1994), questioning Secondary IT co-ordinators in one LEA to give reasons why their subject colleagues deliver IT across the curriculum, and assess IT across the curriculum:

- IT is a motivator for pupils.
- IT provides excellent presentational quality.
- IT use supports subject learning.
- Using IT is fun.
- IT enables some things to be done which cannot be done otherwise.
- IT allows ready modification.
- IT takes the tedium out of unnecessarily repetitive tasks.
- IT enables some children to work at other tasks.
- IT is a requirement of the National Curriculum.
- IT controls pupils.
- IT empowers the learner.
- IT is a motivator of teaching.
- IT allows children to work in groups.
- IT is a need in the 20th century.
- IT generates a creative attitude/environment.
- IT use generates IT teacher support in lessons.
- IT saves time on some tasks.
- IT is an appraisal target.

- Work produced using IT is easier to access.
- IT provides an extra range of transferable skills.
- IT provides a set of skills to structure information gathering.
- IT helps pupils to become independent learners.
- IT promotes personal research skills.
- IT can be used for administrative and resource preparation purposes.
- IT allows pupils with special needs to be supported closely.
- IT enables teachers to work with pupils individually.
- IT rewards pupils.
- IT use supports Technology needs.

APPENDIX 6

The original statements which I chose for the Computer Attitude Test (C.Att.T.):

1. Computers will never replace human life.
2. * People are becoming slaves to computers.
3. Computers are responsible for many of the good things we enjoy.
4. * Soon our lives will be controlled by computers.
5. * I feel intimidated by computers.
6. There are unlimited possibilities of computer applications that haven't even been thought of yet.
7. * The overuse of computers may be harmful and damaging to humans.
8. * Computers are dehumanising to society.
9. Computers can eliminate a lot of tedious work for people.
10. The use of computers is enhancing our standard of living.
11. * Computers turn people into just another number.
12. * Computers are lessening the importance of too many jobs now done by humans.
13. Computers are a fast and efficient means of gaining information.
14. * Computers intimidate me because they seem so complex.
15. * Computers will replace the need for working human beings.
16. Computers are bringing us into a bright new era.
17. * Soon our world will be completely run by computers.
18. Life will be easier and faster with computers.

19. * Computers are difficult to understand and frustrating to work with.
20. I think that a home computer can be very interesting.
21. * People managed before without computers, so computers are not really necessary.
22. Computers are exiting.
23. * Computers will never interest me.
24. * The world would be better off if computers were never invented.
25. * Typing would be the biggest problem I would have in learning to use a home computer.
26. * Computers do not interest me.
27. * You have to be smart to like computers.
28. Microcomputers are easy to use.
29. Females have as much ability as males when learning to use a computer.
30. * I am concerned that people might make computers too powerful in the future.
31. * It would be hard for me to learn how to program a computer.
32. * Computers are boring.
33. If I had the money, I'd buy a home computer.
34. Computers are valuable and necessary.

(Statements starting with * represent negative attitude.)

Appendix 7

The initial items which I chose for Computer Anxiety Test (C.Anx.T.):

1. I look forward to using a computer on my job.
2. * I do not think I would be able to learn a computer programming language.
3. The challenge of learning about computers is exciting.
4. I am confident that I can learn computer skills.
5. Anyone can learn to use a computer if they are patient and motivated.
6. Learning to operate computers is like learning any new skill-the more you practice, the better you become.
7. * I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.
8. I feel that I will be able to keep up with the advances happening in the computer field.
9. * I dislike working with machines that are smarter than I am.
10. * I feel apprehensive about using computers.
11. * I have difficulty in understanding the technical aspects of computers.
12. * It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.
13. * I hesitate to use a computer for fear of making mistakes that I cannot correct.
14. * You have to be a genius to understand all the special keys contained on most computer terminals.
15. If given the opportunity, I would like to learn about and use computers.

16. * I have avoided computers because they are unfamiliar and somewhat intimidating to me.
17. I feel computers are necessary tools in both educational and work settings.
18. I would like to learn how to use a computer.
19. * People who like computers are often not very sociable.
20. Computers are fun.
21. * Working with computers is not my idea of fun.
22. I enjoy working with computers.
23. If my family had a home computer, I would probably use it more than anyone else.
24. * People who enjoy working with computers are a bit peculiar.
25. * I would be embarrassed to tell my friends that I would like to join a computer club.
26. * Computers make me uncomfortable because I don't understand them.
27. Given a little time and training anyone could learn to use computers.
28. * I would be unable to learn a computer programming language.

(Items starting with * represent anxiety-laden statements.)

Appendix 8

C.Att.T. after initial refinements and before piloting:

1. Computers are responsible for many of the good things we enjoy.
2. * Soon our lives will be controlled by computers.
3. * I feel intimidated by computers.
4. There are unlimited possibilities of computer applications that haven't even been thought of yet.
5. Computers can eliminate a lot of tedious work for people.
6. The use of computers is enhancing our standard of living.
7. Computers are a fast and efficient means of gaining information.
8. * Computers intimidate me because they seem so complex.
9. Computers are bringing us into a bright new era.
10. * Soon our world will be completely run by computers.
11. Life will be easier and faster with computers.
12. * Computers are difficult to understand and frustrating to work with.
13. * Computers control our world today.
14. * Computers take away the human qualities from society.
15. * Computers are putting people out of work.
16. Computers are interesting machines.
17. Computers are useful in whatever you do when you leave school.
18. Knowing about computing will help me earn a living.
19. Computers can make learning more fun.
20. I enjoy spending my spare time working with computers.

(Statements starting with * represent negative attitude.)

Appendix 9

C.Anx.T. after initial refinements and before piloting:

1. I look forward to using a computer to do my homework or coursework.
2. * I think I would be unable to learn a computer programming language.
3. The challenge of learning about computers is exciting.
4. I am confident that I can learn computer skills.
5. Anyone can learn to use a computer if they are patient and motivated.
6. Learning to operate computers is like learning any new skill-the more you practice, the better you become.
7. * I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.
8. I feel that I will be able to keep up with the advances happening in the computer field.
9. * I dislike working with machines that are smarter than I am.
10. * I feel apprehensive about using computers.
11. * I have difficulty in understanding the technical aspects of computers.
12. * It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.

13. * I hesitate to use a computer for fear of making mistakes that I cannot correct.
14. * You have to be a genius to understand all the special keys contained on most computer terminals.
15. If given the opportunity, I would like to learn about and use computers.
16. * I have avoided computers because they are unfamiliar and somewhat intimidating to me.
17. I feel computers are necessary tools in both educational and work settings.
18. Computers make me uncomfortable because I don't understand them.
19. * I might be considered peculiar if I become a computer expert.
20. Computers are fun to use.

(Items starting with * represent anxiety-laden statements.)

Appendix 10

Final version of the satements used in C.Att.T.:

1. Computers are responsible for many of the good things we enjoy.
2. * Soon our lives will be controlled by computers.
3. * I feel intimidated by computers.
4. There are so many other things that can be done with computers which noone has thought of yet.
5. Computers can eliminate a lot of tedious work for people.
6. The use of computers is improving our standard of living.
7. Computers are a fast and efficient means of collecting information.
8. * Computers intimidate me because they seem so complex.
9. Computers are bringing us into a bright new era.
10. * Soon our world will be completely run by computers.
11. Life will be easier and faster with computers.
12. * Computers are difficult to understand and frustrating to work with.
13. * Computers control too much of our world today.
14. * Computers take away the human qualities from society.
15. * Computers are putting people out of work.
16. Computers are interesting to use.
17. Computers technology is useful in whatever you do when you leave school.
18. Knowing about computing will help me earn a living.
19. Computers can make learning more fun.

20. I enjoy spending my spare time working with computers.

(Statements starting with * represent negative attitude.)

Appendix 11

Final version of the satements used in C.Anx.T.:

1. I look forward to using a computer to do my homework or coursework.
2. * I think I would be unable to learn a computer programming language.
3. The challenge of learning about computers is exciting.
4. I am confident that I can learn computer skills.
5. Anyone can learn to use a computer if they are patient and motivated.
6. Learning to operate computers is like learning any new skill-the more you practice, the better you become.
7. * I am afraid that if I begin to use computers I will become dependent on them.
8. I feel that I will be able to keep up with the advances happening in the computer field.
9. * I dislike working with machines that are smarter than I am.
10. * I feel panicky about using computers.
11. * I have difficulty in understanding the technical aspects of computers.
12. * It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.

13. * I hesitate to use a computer for fear of making mistakes that I cannot correct.
14. * You have to be a genius to understand all the special keys contained on most computer terminals.
15. If given the opportunity, I would like to learn about and use computers.
16. * I have avoided computers because they are unfamiliar and somewhat intimidating to me.
17. I feel computers are necessary tools in both educational and work settings.
18. * I don't like computers because they never work properly for me.
19. * I might be considered peculiar if I become a computer expert.
20. Computers are fun to use.

(Items starting with * represent anxiety-laden statements.)

Appendix 12

The final two insrtruments, C.Att.T. and C.Anx.T. which were used in my survey.

Your School's Name: ..... ☐ 4

For official use
Case Number
☐☐☐
1 2 3

Male ☐ 5/1 Female ☐ 5/2

Age: ..... ☐ 6 Year Group: ..... ☐ 7

Do you have your own computer at home?
yes ☐ 8/1 no ☐ 8/2

PLEASE TICK THE BOX THAT IS MOST APPROPRIATE TO YOU:

1. Computer technology is useful in whatever you do when you leave school.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	9/1/2/3/4

2. Computers are responsible for many of the good things we enjoy.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	10/1/2/3/4

3. Soon our lives will be controlled by computers.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	11/4/3/2/1

4. I feel intimidated by computers.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	12/4/3/2/1

5. There are so many other things that can be done with computers which no one has thought of yet.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	13/1/2/3/4

6. Computers take away the human qualities from society.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	14/4/3/2/1

7. Computers can eliminate a lot of tedious work for people.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	15/1/2/3/4

8. The use of computers is improving our standard of living.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	16/1/2/3/4

9. Computers are a fast and efficient means of collecting information.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	17/1/2/3/4

10. Computers intimidate me because they seem so complex.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

18/4/3/2/1

11. Computers are putting people out of work.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

19/4/3/2/1

12. Computers are bringing us into a bright new era.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

20/1/2/3/4

13. Knowing about computers will help me earn a living.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

21/1/2/3/4

14. Soon our world will be completely run by computers.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

22/4/3/2/1

15. Life will be easier and faster with computers.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

23/1/2/3/4

16. Computers are difficult to understand and frustrating to work with.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

24/4/3/2/1

17. Computers are interesting to use.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

25/1/2/3/4

18. Computers control too much of our world today.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

26/4/3/2/1

19. A computer can make learning more fun.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

27/1/2/3/4

20. I enjoy spending my spare time working with computers.

strongly disagree	disagree	agree	strongly agree
☐	☐	☐	☐

28/1/2/3/4

For official use
Case Number

1	2	3

PLEASE TICK THE BOX THAT IS MOST APPROPRIATE TO YOU :

1. I feel apprehensive about using computers.

strongly disagree	disagree	agree	strongly agree	
				9/4/3/2/1

2. I think I would be unable to learn a computer programming language.

strongly disagree	disagree	agree	strongly agree	
				10/4/3/2/1

3. The challenge of learning about computers is exciting.

strongly disagree	disagree	agree	strongly agree	
				11/1/2/3/4

4. I am confident that I can learn computer skills.

strongly disagree	disagree	agree	strongly agree	
				12/1/2/3/4

5. Anyone can learn to use a computer if they are patient and motivated.

strongly disagree	disagree	agree	strongly agree	
				13/1/2/3/4

6. Learning to operate computers is like learning any new skill - the more you practice, the better you become.

strongly disagree	disagree	agree	strongly agree	
				14/1/2/3/4

7. I am afraid that if I begin to use computers I will become dependent on them.

strongly disagree	disagree	agree	strongly agree	
				15/4/3/2/1

8. I feel that I will be able to keep up with the advances happening in the computer field.

strongly disagree	disagree	agree	strongly agree	
				16/1/2/3/4

9. I dislike working with machines that are smarter than I am.

strongly disagree	disagree	agree	strongly agree	
				17/4/3/2/1

10. I look forward to using a computer to do my homework or course work.

strongly disagree	disagree	agree	strongly agree	
				18/1/2/3/4

11. I have difficulty in understanding the technical aspects of computers .

strongly disagree	disagree	agree	strongly agree	
				19/4/3/2/1

12. It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	20/4/3/2/1

13. I hesitate to use a computer for fear of making mistakes that I cannot correct.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	21/4/3/2/1

14. You have to be a genius to understand all the special keys contained on most computer terminals.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	22/4/3/2/1

15. If given the opportunity, I would like to learn about and use computers.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	23/1/2/3/4

16. I have avoided computers because they are unfamiliar and somewhat intimidating to me.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	24/4/3/2/1

17. I feel computers are necessary tools in both educational and work settings.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	25/1/2/3/4

18. Computers are fun to use.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	26/1/2/3/4

19. I don't like computers because they never work properly for me.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	27/4/3/2/1

20. I might be considered peculiar if I become a computer expert.

strongly disagree	disagree	agree	strongly agree	
☐	☐	☐	☐	28/4/3/2/1

Your School's name: ..... ☐ 4

Sex:

Male ☐ 5/1 Female ☐ 5/2

Age: ..... ☐ 6 Year Group: ..... ☐ 7

Do you have your own computer at home?

yes ☐ 8/1 no ☐ 8/2

Appendix 13

Table a.1
Coding of Variables in Spreadsheet File

Variable Name	Variable Code	Valid Values
Student's gender	GENDER	Male = 1 Female = 2
Student' age	AGE	9 year old = 9 10 year old = 10 11 year old = 11 12 year old = 12 13 year old = 13 14 year old = 14 15 year old = 15 16 year old = 16 17 year old = 17 18 year old = 18
Year group	Y_GRP	Year 5 = 5 Year 6 = 6 Year 7 = 7 Year 8 = 8 Year 9 = 9 Year 10 = 10 Year 11 = 11 6th form = 12
Access to home computer?	H_COMP	Yes = 1 No = 2
Key stage	KS	Key stage 2 = 2 Key stage 3 = 3 Key stage 4 = 4

Appendix 14

Table a.2
Scores on *C.Att.T.*
***n* = 15**

Case Number	Total Score in First Test	Total Score in Second Test
1	48	50
2	62	62
3	59	57
4	62	64
5	53	54
6	52	51
7	60	55
8	71	73
9	48	50
10	63	65
11	64	67
12	58	61
13	63	65
14	55	56
15	54	58
	sd = 6.21	***sd*** = 6.58
	m = 58.13	***m*** = 55.8

sd = Standard Deviation; *m* = Mean

$r_{C.Att.T.} = .94$ ($p < .001$)
$t_{C.Att.T.} = 1.64$ ($df = 14$)

Table a.3
Scores on C.Anx.T.
***n* = 15**

Case Number	Total Score in First Test	Total Score in Second Test
1	56	64
2	69	72
3	56	60
4	64	72
5	56	57
6	56	55
7	57	55
8	70	66
9	46	49
10	67	65
11	66	65
12	58	61
13	65	66
14	57	58
15	59	59
	sd = 6.27	***sd*** = 6.18
	m = 60.13	***m*** = 61.6

sd = Standard Deviation; *m* = Mean

$r_{C.Anx.T.} = .86$ ($p < .001$)
$t_{C.Anx.T.} = 1.64$ ($df = 14$)

Appendix 15

Table a.4
Coding of Variables in SPSS File

Variable Name	Variable Code	Valid Values
School name	SCHOOL	School A = 1 School B = 2 School C = 3
Student's gender	GENDER	Male = 1 Female = 2
Student' age	AGE	9 year old = 9 10 year old = 10 11 year old = 11 12 year old = 12 13 year old = 13 14 year old = 14 15 year old = 15 16 year old = 16 17 year old = 17 18 year old = 18
Year group	Y_GRP	Year 5 = 5 Year 6 = 6 Year 7 = 7 Year 8 = 8 Year 9 = 9 Year 10 = 10 Year 11 = 11 6th form = 12
Access to home computer?	H_COMP	Yes = 1 No = 2

Items 1 to 20	Q1 to Q20	Strongly agree = 4 Agree = 3 Disagree = 2 Strongly disagree = 1 * denotes reverse scoring

Appendix 16

Table a.5

Relationship between Access and Year Group

***n* = 214**

	Year									
	5		6		7		8			
	Yes	No	Yes	No	Yes	No	Yes	No		
Do you have your own computer at home ?	16	13	9	13	18	14	19	13		
	Year									
	9		10		11		6th Form			
	Yes	No	Yes	No	Yes	No	Yes	No	x^2	*p*
Do you have your own computer at home ?	26	8	30	10	10	5	7	3		NS

Appendix 17

Table a.6
Attitude to Computers by Access, chi-square
n = 214

Item		Access				No Access				x^2	*p*
		SD	D	A	SA	SD	D	A	SA		
1.	Computers will be useful after leaving school.	1	24	75	35	2	12	49	16	2.37	NS
2.	Computers are responsible for good things.	6	41	65	23	3	18	49	9	3.95	NS
3.	* Our lives will be controlled by computers.	20	59	48	8	16	36	20	7	3.17	NS
4.	* I feel intimidated by computers.	37	83	13	2	24	45	9	1	.49	NS
5.	Other things can be done with computers.	2	8	92	33	2	10	57	10	6.53	NS
6.	* Computers take away the human qualities.	18	69	41	7	8	32	29	10	5.72	NS
7.	Computers eliminate tedious work.	2	13	81	39	0	7	54	18	2.45	NS
8.	Computers improving standard of living.	3	22	87	23	3	15	49	12	.80	NS
9.	Computers are efficient in collecting information.	2	0	61	72	0	0	42	37	2.24	NS
10.	* Computers intimidate me because they are complex.	39	71	20	5	12	46	20	1	8.21	<.05
11.	* Computers putting people out of work.	15	43	62	15	6	30	28	15	4.68	NS
12.	Computers bringing us into a new era.	2	12	92	29	1	15	50	13	4.86	NS
13.	Computers will help me earn a living.	6	17	79	33	2	14	46	17	1.57	NS
14.	* Our world will be run by computers.	25	80	20	10	16	45	10	8	.72	NS

15.	Life will be easier with computers.	2	26	73	34	4	11	56	8	11.20	<.01
16.	* Computers are difficult and frustrating.	34	70	26	5	11	39	27	2	7.75	NS
17.	Computers are interesting to use.	1	7	79	48	0	1	51	27	2.96	NS
18.	* Computers control too much of our world today.	18	76	33	8	4	45	29	1	8.48	<.05
19.	Computers make learning fun.	3	8	81	43	1	9	49	20	2.87	NS
20.	Enjoy spending spare time working with computers.	6	42	54	33	5	25	36	13	2.20	NS

Table a.7
Attitude to Computers by Year Group, chi-square
n = 214

Item		Year 5				Year 6				Year 7			
		SD	D	A	SA	SD	D	A	SA	SD	D	A	SA
1.	Computers will be useful after leaving school.	2	3	12	12	0	3	17	2	0	0	21	11
2.	Computers are responsible for good things.	2	2	19	6	3	7	9	3	0	12	18	2
3.	* Our lives will be controlled by computers.	12	14	3	0	6	9	5	2	8	15	4	5
4.	* I feel intimidated by computers.	12	12	5	0	8	11	3	0	17	10	5	0
5.	Other things can be done with computers.	1	6	16	6	0	4	15	3	0	2	21	9
6.	* Computers take away the human qualities.	6	12	8	3	2	10	8	2	10	18	2	2
7.	Computers eliminate tedious work.	0	7	20	2	0	4	14	4	0	1	16	15
8.	Computers improving standard of living.	1	4	17	7	0	4	15	3	0	12	15	5
9.	Computers are efficient in collecting information.	0	0	11	18	0	0	10	12	0	0	9	23
10.	* Computers intimidate me because they are complex.	9	12	8	0	3	13	3	3	17	13	2	0
11.	* Computers putting people out of work.	10	15	4	0	3	6	8	5	4	12	13	3
12.	Computers bringing us into a new era.	1	5	20	3	1	6	12	3	0	3	21	8
13.	Computers will help me earn a living.	0	1	17	11	0	1	16	5	1	3	18	10
14.	* Our world will be run by computers.	8	19	1	1	8	10	2	2	12	15	1	4
15.	Life will be easier with computers.	1	0	21	7	2	6	13	1	1	4	17	10
16.	* Computers are difficult and frustrating.	4	19	6	0	2	11	9	0	16	8	7	1

17.	Computers are interesting to use.	0	1	11	17	0	0	15	7	0	1	16	15
18.	* Computers control too much of our world today.	5	18	6	0	3	7	10	2	6	19	7	0
19.	Computers make learning fun.	0	1	16	12	1	0	17	4	0	3	17	12
20.	Enjoy spending spare time working with computers.	1	2	12	14	1	11	7	3	0	7	19	6

		Year 8				*Year 9*				*Year 10*			
Item		**SD**	**D**	**A**	**SA**	**SD**	**D**	**A**	**SA**	**SD**	**D**	**A**	**SA**
1.	Computers will be useful after leaving school.	0	5	18	9	0	11	20	3	0	9	22	9
2.	Computers are responsible for good things.	2	12	13	5	2	10	22	0	0	8	23	9
3.	* Our lives will be controlled by computers.	4	18	8	2	3	13	15	3	3	14	20	3
4.	* I feel intimidated by computers.	9	23	0	0	2	31	0	1	10	24	4	2
5.	Other things can be done with computers.	3	0	23	6	0	1	30	3	0	1	28	11
6.	* Computers take away the human qualities.	4	20	4	4	0	14	19	1	4	16	17	3
7.	Computers eliminate tedious work.	1	0	27	4	0	4	26	4	0	0	20	20
8.	Computers improving standard of living.	2	6	20	4	1	3	29	1	2	5	20	13
9.	Computers are efficient in collecting information.	1	0	20	11	0	0	23	11	1	0	15	24
10.	* Computers intimidate me because they are complex.	8	17	6	1	1	23	9	1	8	23	8	1
11.	* Computers putting people out of work.	3	17	9	3	0	11	16	7	1	7	25	7
12.	Computers bringing us into a new era.	1	9	15	7	0	0	31	3	0	2	26	12
13.	Computers will help me earn a living.	3	6	18	5	1	8	22	3	3	6	22	9
14.	* Our world will be run by computers.	7	22	2	1	1	23	5	5	5	17	14	4

15.	Life will be easier with computers.	0	8	19	5	0	8	22	4	2	9	21	8
16.	* Computers are difficult and frustrating.	5	22	4	1	5	17	11	1	10	18	10	2
17.	Computers are interesting to use.	0	0	20	12	0	0	27	7	1	2	25	12
18.	* Computers control too much of our world today.	3	19	8	2	0	15	17	2	5	27	7	1
19.	Computers make learning fun.	2	4	17	9	1	0	26	7	0	3	24	13
20.	Enjoy spending spare time working with computers.	1	9	13	9	1	15	14	4	4	12	16	8

		Year 11				*6th Form*					
Item		SD	D	A	SA	SD	D	A	SA	x^2	*p*
1.	Computers will be useful after leaving school.	1	4	6	4	0	1	8	1	41.10	<.01
2.	Computers are responsible for good things.	0	3	7	5	0	5	3	2	36.74	<.05
3.	* Our lives will be controlled by computers.	0	10	5	0	0	2	8	0	55.94	<.001
4.	* I feel intimidated by computers.	2	10	3	0	1	7	2	0	48.50	<.001
5.	Other things can be done with computers.	0	2	10	3	0	2	6	2	35.93	<.05
6.	* Computers take away the human qualities.	0	6	9	0	0	5	3	2	48.74	<.001
7.	Computers eliminate tedious work.	1	2	9	3	0	2	3	5	59.45	<.001
8.	Computers improving standard of living.	0	2	11	2	0	1	9	0	34.41	<.05
9.	Computers are efficient in collecting information.	0	0	10	5	0	0	5	5	22.52	NS
10.	* Computers intimidate me because they are complex.	2	10	3	0	3	6	1	0	41.57	<.01
11.	* Computers putting people out of work.	0	4	9	2	0	1	6	3	60.89	<.001
12.	Computers bringing us into a new era.	0	2	9	4	0	0	8	2	35.61	<.05

13.	Computers will help me earn a living.	0	2	10	3	0	4	2	4	31.00	NS
14.	* Our world will be run by computers.	0	12	3	0	0	7	2	1	52.01	<.001
15.	Life will be easier with computers.	0	0	11	4	0	2	5	3	27.64	NS
16.	* Computers are difficult and frustrating.	3	7	4	1	o	7	2	1	36.39	<.05
17.	Computers are interesting to use.	0	1	10	4	0	3	6	1	42.41	<.01
18.	* Computers control too much of our world today.	0	11	3	1	0	5	4	1	32.32	NS
19.	Computers make learning fun.	0	4	8	3	0	2	5	3	29.28	NS
20.	Enjoy spending spare time working with computers.	1	5	7	2	2	6	2	0	41.39	<.01

* negative statement, reverse scores.

Table a.8
Attitude to Computers by Key Stage, chi-square
n = 204

Item		KS 2				KS 3				KS 4				x^2	*p*
		SD	D	A	SA	SD	D	A	SA	SD	D	A	SA		
1.	Computers will be useful after leaving school.	2	6	29	14	0	16	59	23	1	13	28	13	6.59	NS
2.	Computers are responsible for good things.	5	9	28	9	4	34	53	7	0	11	30	14	19.12	<.01
3.	* Our lives will be controlled by computers.	18	23	8	2	15	46	27	10	3	24	25	3	24.39	<.001
4.	* I feel intimidated by computers.	20	23	8	0	28	64	5	1	12	34	7	2	12.29	NS
5.	Other things can be done with computers.	1	10	31	9	3	3	74	18	0	3	38	14	16.07	<.05
6.	* Computers take away the human qualities.	8	22	16	5	14	52	25	7	4	22	26	3	9.14	NS
7.	Computers eliminate tedious work.	0	11	34	6	1	5	69	23	1	2	29	23	24.92	<.001
8.	Computers improving standard of living.	1	8	32	10	3	21	64	10	2	7	31	15	8.60	NS
9.	Computers are efficient in collecting information.	0	0	21	30	1	0	52	45	1	0	25	29	3.13	NS
10.	* Computers intimidate me because they are complex.	12	25	11	3	26	53	17	2	10	33	11	1	3.98	NS
11.	* Computers putting people out of work.	13	21	12	5	7	40	38	13	1	11	34	9	31.76	<.001

12.	Computers bringing us into a new era.	2	11	32	6	1	12	67	18	0	4	35	16	11.66	NS
13.	Computers will help me earn a living.	0	2	33	16	5	17	58	18	3	8	32	12	10.10	NS
14.	* Our world will be run by computers.	16	29	3	3	20	60	8	10	5	29	17	4	24.18	<.001
15.	Life will be easier with computers.	3	6	34	8	1	20	58	19	2	9	32	12	5.23	NS
16.	* Computers are difficult and frustrating.	6	30	15	0	26	47	22	3	13	25	14	3	7.85	NS
17.	Computers are interesting to use.	0	1	26	24	0	1	63	34	1	3	35	16	9.16	NS
18.	* Computers control too much of our world today.	8	25	16	2	9	53	32	4	5	38	10	2	6.47	NS
19.	Computers make learning fun.	1	1	33	16	3	7	60	28	0	7	32	16	6.14	NS
20.	Enjoy spending spare time working with computers.	2	13	19	17	2	31	46	19	5	17	23	10	8.74	NS

* negative statement, reverse scores.

Table a.9
Attitude to Computers by Gender, chi-square
n = 214

Item	Boys				Girls				x^2	*p*
	SD	D	A	SA	SD	D	A	SA		
1. Computers will be useful after leaving school.	2	13	66	32	1	23	58	19	6.28	NS
2. Computers are responsible for good things.	4	27	59	23	5	32	55	9	6.14	NS
3. * Our lives will be controlled by computers.	17	49	38	9	19	46	30	6	1.07	NS
4. * I feel intimidated by computers.	37	65	10	1	24	63	12	2	2.65	NS
5. Other things can be done with computers.	2	10	70	31	2	8	79	12	8.51	<.05
6. * Computers take away the human qualities.	16	50	36	11	10	51	34	6	2.25	NS
7. Computers eliminate tedious work.	2	5	67	39	0	15	68	18	14.11	<.01
8. Computers improving standard of living.	3	20	63	27	3	17	73	8	10.65	<.05
9. Computers are efficient in collecting information.	2	0	47	64	0	0	56	45	5.44	NS
10. * Computers intimidate me because they are complex.	37	53	19	4	14	64	21	2	11.53	<.01
11. * Computers putting people out of work.	9	30	56	18	12	43	34	12	8.67	<.05
12. Computers bringing us into a new era.	1	10	66	36	2	17	76	6	23.68	<.001
13. Computers will help me earn a living.	6	12	63	32	2	19	62	18	6.85	NS
14. * Our world will be run by computers.	17	63	21	12	24	62	9	6	7.35	NS
15. Life will be easier with computers.	4	18	61	30	2	19	68	12	8.14	<.05
16. * Computers are difficult and frustrating.	27	57	24	5	18	52	29	2	3.12	NS

17.	Computers are interesting to use.	1	3	63	46	0	5	67	29	4.81	NS
18.	* Computers control too much of our world today.	14	67	27	5	8	54	35	4	3.51	NS
19.	Computers make learning fun.	1	9	62	41	3	8	68	22	6.41	NS
20.	Enjoy spending spare time working with computers.	4	28	48	33	7	39	42	13	11.08	<.05

* negative statement, reverse scores.

Appendix 18

Table a.10
Inter-correlation of C.Att.T. Items

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q2	.670				
Q8	.633				
Q13	.626				
Q1	.584				
Q19	.552				
Q17	.518				
Q10		.773			
Q4		.658			
Q16		.652			
Q6		.581			
Q20		.523			
Q15		.398			
Q14			.803		
Q3			.791		
Q7				.705	
Q12				.610	
Q9				.515	
Q5					.643
Q18					.503
Q11					.494

Table a.11
t-test of Mean Scores of Subscales by Access

Factor	Mean Rating Access	Mean rating No Access	*t*	*p*
1 : Benefits of Computers	3.05	3.02	.57	NS
2: Fear of computers	2.97	2.81	2.32	<.05
3 : Fear of Future	2.78	2.82	.41	NS
4 : Uses of Computers	3.25	3.18	1.12	NS
5 : effects of Computers	2.78	2.65	1.95	NS

Table a.12
t-test of Mean Scores of Subscales by Gender

Factor	Mean Rating Boys	Mean Rating Girls	*t*	*p*
1 : Benefits of Computers	3.12	2.95	2.82	<.01
2: Fear of computers	2.98	2.82	2.33	<.05
3 : Fear of Future	2.70	2.90	2.04	<.05
4 : Uses of Computers	3.33	3.11	3.96	<.001
5 : effects of Computers	2.74	2.73	.07	NS

Table a.13
ANOVA of Subscales by Year Groups
C.Att.T.

	Mean Rating										
	Year Group										
Factor	5	6	7	8	9	10	11	6th	*F*	*p*	*Tukey's*
1 : Benefits of computers	3.25	3.01	3.11	2.96	2.90	3.08	3.03	2.92	1.95	NS	NS
2: Fear of computers	3.07	2.72	3.21	2.97	2.73	2.83	2.83	2.68	4.43	<.001	7>6, 9, 10, 6th
3 : Fear of Future	3.24	2.98	2.95	2.92	2.53	2.50	2.73	2.40	4.87	<.001	5>9, 10, 6th
4 : Uses of Computers	3.10	3.11	3.44	3.07	3.14	3.43	3.13	3.33	4.36	<.001	7>5, 8; 10>5, 8, 9
5 : Effects of Computers	3.03	2.59	2.91	2.78	2.52	2.73	2.62	2.40	4.56	<.001	5>6, 9, 12; 7>9

Table a.14
ANOVA of Subscales by Key Stage
C.Att.T.

	Mean Rating					
	Key Stage					
Factor	2	3	4	*F*	*p*	*Tukey's*
1 : Benefits of computers				2.15	NS	NS
2: Fear of computers				1.31	NS	NS
3 : Fear of Future	3.13	2.80	2.56	8.90	<.001	KS2>KS3, KS4
4 : Uses of Computers	3.10	3.21	3.35	4.58	<.01	KS4>KS2
5 : effects of Computers				1.25	NS	NS

Appendix 19

Table a.15
Anxiety about Computers by Access, chi-square
n = 214

	Home Computer				No Home Computer					
Item	SD	D	A	SA	SD	D	A	SA	x^2	*p*
*1. I feel panicky about using computers.	28	78	24	5	9	47	22	1		NS
*2. Unable to learn programming.	24	67	39	5	6	51	18	4		NS
3. Learning about computers is exciting.	4	22	79	30	2	10	59	8		NS
4. I can learn computer skills.	0	6	92	37	1	7	60	11		NS
5. Anyone can learn to use a computer.	4	2	83	46	0	4	52	23		NS
6. The more you practice, the better you become in computers.	1	7	76	51	1	1	48	29		NS
*7. I might become dependent on computers.	29	86	18	2	15	49	11	4		NS
8. Keeping up with advances in computing.	7	36	81	11	3	27	42	7		NS
*9. I dislike working with smart machines.	49	73	8	5	17	45	11	6	8.66	<.05
10. I look forward to using a computer.	4	18	80	33	3	12	44	20		NS

*11. Difficulty in understanding technical aspects.	19	67	38	11	4	37	31	7	NS
*12. Destroy information by hitting the wrong key.	21	49	48	17	4	25	36	14	NS
*13. Fear of making mistakes.	29	80	19	7	10	43	22	4	NS
*14. Have to be a genius to understand keys.	40	71	19	5	19	42	16	2	NS
15. I would like to learn about and use computers.	3	14	76	42	0	7	54	18	NS
*16. Computers are unfamiliar and intimidating to me.	42	78	10	5	17	53	8	1	NS
17. Computers are necessary tools in education and work.	3	22	72	38	2	16	45	16	NS
18. Computers are fun to use.	3	9	64	59	2	2	43	32	NS
*19. Computers never work properly for me.	53	64	14	4	21	45	11	2	NS
*20. Computer experts are peculiar.	33	70	21	11	13	50	15	1	NS

* negative statement, reverse scores.

Table a.16
Anxiety about Computers by Year Group, chi-square
n = 214

	Year 5				Year 6				Year 7			
Item	SD	D	A	SA	SD	D	A	SA	SD	D	A	SA
*1. I feel panicky about using computers.	8	13	4	4	3	12	6	1	8	16	8	0
*2. Unable to learn programming.	8	11	9	1	4	11	6	1	2	21	7	2
3. Learning about computers is exciting.	1	0	18	10	1	3	14	4	1	4	20	7
4. I can learn computer skills.	1	1	16	11	0	2	15	5	0	0	23	9
5. Anyone can learn to use a computer.	0	0	16	13	0	3	13	6	0	0	23	9
6. The more you practice, the better you become in computers.	0	3	12	14	0	0	17	5	0	0	18	14
*7. I might become dependent on computers.	4	21	3	1	8	10	3	1	10	21	1	0
8. Keeping up with advances in computing.	2	2	22	3	1	7	12	2	0	12	14	6
*9. I dislike working with smart machines.	12	13	3	1	8	11	1	2	12	18	1	1
10. I look forward to using a computer.	0	3	14	12	1	4	14	3	1	3	19	9
*11. Difficulty in understanding technical aspects.	8	9	7	5	1	12	6	3	2	16	12	2
*12. Destroy information by hitting the wrong key.	0	17	10	2	3	5	9	5	5	11	10	6
*13. Fear of making mistakes.	4	19	5	1	6	10	5	1	7	19	5	1
*14. Have to be a genius to understand keys.	5	19	5	0	8	11	3	0	17	11	4	0
15. I would like to learn about and use computers.	1	0	15	13	0	2	16	4	1	2	19	10
*16. Computers are unfamiliar and intimidating to me.	9	19	0	1	4	15	1	2	15	16	1	0

17. Computers are necessary tools in education and work.	2	2	14	11	0	4	12	6	0	3	20	9
18. Computers are fun to use.	1	0	8	20	1	1	14	6	0	1	11	20
*19. Computers never work properly for me.	17	9	2	1	5	13	4	0	14	16	2	0
*20. Computer experts are peculiar.	7	16	6	0	4	16	2	0	13	14	2	3

	Year 8				*Year 9*				*Year 10*			
Item	**SD**	**D**	**A**	**SA**	**SD**	**D**	**A**	**SA**	**SD**	**D**	**A**	**SA**
*1. I feel panicky about using computers.	4	24	4	0	3	21	10	0	8	24	7	1
*2. Unable to learn programming.	2	20	7	3	3	20	11	0	9	20	9	2
3. Learning about computers is exciting.	0	6	18	8	1	6	25	2	1	6	26	7
4. I can learn computer skills.	0	1	24	7	0	4	27	3	0	2	26	12
5. Anyone can learn to use a computer.	2	1	17	12	1	1	24	8	0	1	23	16
6. The more you practice, the better you become in computers.	1	1	14	16	0	2	23	9	1	0	24	15
*7. I might become dependent on computers.	8	17	4	3	2	23	9	0	8	24	7	1
8. Keeping up with advances in computing.	1	9	19	3	2	11	21	0	3	11	22	4
*9. I dislike working with smart machines.	11	16	5	0	6	22	3	3	12	23	2	3
10. I look forward to using a computer.	1	2	16	13	1	7	23	3	2	5	24	9
*11. Difficulty in understanding technical aspects.	5	15	10	2	0	21	11	2	6	18	13	3
*12. Destroy information by hitting the wrong key.	5	5	17	5	6	7	16	5	2	15	17	6
*13. Fear of making mistakes.	7	12	10	3	1	23	8	2	9	22	7	2
*14. Have to be a genius to understand keys.	10	14	7	1	2	23	8	1	10	20	5	5

15. I would like to learn about and use computers.	1	7	15	9	0	6	20	8	0	2	26	12
*16. Computers are unfamiliar and intimidating to me.	9	21	1	1	3	20	11	0	14	22	2	2
17. Computers are necessary tools in education and work.	2	7	17	6	0	14	16	4	1	5	21	13
18. Computers are fun to use.	0	0	16	16	1	2	21	10	2	3	21	14
*19. Computers never work properly for me.	14	15	0	3	3	23	8	0	14	18	6	2
*20. Computer experts are peculiar.	9	17	2	4	2	18	13	1	7	22	7	4

	Year 11				*6th Form*					
Item	**SD**	**D**	**A**	**SA**	**SD**	**D**	**A**	**SA**	x^2	*p*
*1. I feel panicky about using computers.	2	10	3	0	1	5	4	0		NS
*2. Unable to learn programming.	1	8	6	0	1	7	2	0		NS
3. Learning about computers is exciting.	0	5	10	0	1	2	7	0		NS
4. I can learn computer skills.	0	2	12	1	0	1	9	0		NS
5. Anyone can learn to use a computer.	0	0	13	2	1	0	6	3		NS
6. The more you practice, the better you become in computers.	0	2	9	4	0	0	7	3		NS
*7. I might become dependent on computers.	4	9	2	0	0	10	0	0		NS
8. Keeping up with advances in computing.	0	8	7	0	1	3	6	0		NS
*9. I dislike working with smart machines.	4	8	3	0	1	7	1	1		NS
10. I look forward to using a computer.	0	5	7	3	1	1	7	1		NS
*11. Difficulty in understanding technical aspects.	1	7	7	0	0	6	3	1		NS
*12. Destroy information by hitting the wrong key.	1	9	4	1	3	5	1	1	33.74	<.05

*13. Fear of making mistakes.	4	10	1	0	1	8	0	1		NS
*14. Have to be a genius to understand keys.	4	9	2	0	3	6	1	0	37.32	<.05
15. I would like to learn about and use computers.	0	1	12	2	0	1	7	2		NS
*16. Computers are unfamiliar and intimidating to me.	3	11	1	0	2	7	1	0	47.76	<.001
17. Computers are necessary tools in education and work.	0	3	10	2	0	0	7	3		NS
18. Computers are fun to use.	0	1	10	4	0	3	6	1	41.92	<.01
*19. Computers never work properly for me.	5	8	2	0	2	7	1	0	39.23	<.01
*20. Computer experts are peculiar.	2	10	3	0	2	7	1	0	38.19	<.05

* negative statement, reverse scores.

Table a.17
Attitude to Computers by Key Stage, chi-square
$n = 204$

	KS 2				KS 3				KS 4					
Item	SD	D	A	SA	SD	D	A	SA	SD	D	A	SA	x^2	p
*1. I feel panicky about using computers.	11	25	10	5	15	61	22	0	10	34	10	1	13.50	<.05
*2. Unable to learn programming.	12	22	15	2	7	61	25	5	10	28	15	2		NS
3. Learning about computers is exciting.	2	3	32	14	2	16	63	17	1	11	36	7		NS
4. I can learn computer skills.	1	3	31	16	0	5	74	19	0	4	38	13		NS
5. Anyone can learn to use a computer.	0	3	29	19	3	2	64	29	0	1	36	18		NS
6. The more you practice, the better you become in computers.	0	3	29	19	1	3	55	39	1	2	33	19		NS
*7. I might become dependent on computers.	12	31	6	2	20	61	14	3	12	33	9	1		NS
8. Keeping up with advances in computing.	3	9	34	5	3	32	54	9	3	19	29	4		NS
*9. I dislike working with smart machines.	20	24	4	3	29	56	9	4	16	31	5	3		NS
10. I look forward to using a computer.	1	7	28	15	3	12	58	25	2	10	31	12		NS
*11. Difficulty in understanding technical aspects.	9	21	13	8	7	52	33	6	7	25	20	3		NS
*12. Destroy information by hitting the wrong key.	3	22	19	7	16	23	43	16	3	24	21	7		NS
*13. Fear of making mistakes.	10	29	10	2	15	54	23	6	13	32	8	2		NS
*14. Have to be a genius to understand keys.	13	30	8	0	29	48	19	2	14	29	7	5		NS

15. I would like to learn about and use computers.	1	2	31	17	2	15	54	27	0	3	38	14	NS
*16. Computers are unfamiliar and intimidating to me.	13	34	1	3	27	57	13	1	17	33	3	2	NS
17. Computers are necessary tools in education and work.	2	6	26	17	2	24	53	19	1	8	31	15	NS
18. Computers are fun to use.	2	1	22	26	1	3	48	46	2	4	31	18	NS
*19. Computers never work properly for me.	22	22	6	1	31	54	10	3	19	26	8	2	NS
*20. Computer experts are peculiar.	11	32	8	0	24	49	17	8	9	32	10	4	NS

* negative statement, reverse scores.

Table a.18
Anxiety about Computers by Gender, chi-square
n = 214

	Boys				Girls					
Item	SD	D	A	SA	SD	D	A	SA	x^2	*p*
*1. I feel panicky about using computers.	25	68	16	4	12	57	30	2	9.82	<.05
*2. Unable to learn programming.	17	61	29	6	13	57	28	3		NS
3. Learning about computers is exciting.	0	14	69	30	6	18	69	8	18.62	<.001
4. I can learn computer skills.	0	6	71	36	1	7	81	12	13.10	<.01
5. Anyone can learn to use a computer.	3	1	67	42	1	5	68	27		NS
6. The more you practice, the better you become in computers.	2	6	58	47	0	2	66	33		NS
*7. I might become dependent on computers.	30	68	12	3	14	67	17	3		NS
8. Keeping up with advances in computing.	8	20	71	14	2	43	52	4	19.88	<.001
*9. I dislike working with smart machines.	44	57	7	5	22	61	12	6	8.23	<.05
10. I look forward to using a computer.	5	15	57	36	2	15	67	17	8.25	<.05
*11. Difficulty in understanding technical aspects.	16	55	37	5	7	49	32	13		NS
*12. Destroy information by hitting the wrong key.	18	44	39	12	7	30	45	19	8.85	<.05
*13. Fear of making mistakes.	31	59	20	3	8	64	21	8	15.44	<.01
*14. Have to be a genius to understand keys.	37	50	19	7	22	63	16	0	11.93	<.01
15. I would like to learn about and use computers.	1	8	64	40	2	13	66	20		NS

*16. Computers are unfamiliar and intimidating to me.	39	61	9	4	20	70	9	2		NS
17. Computers are necessary tools in education and work.	3	16	58	36	2	22	59	18		NS
18. Computers are fun to use.	3	6	52	52	2	5	55	39		NS
*19. Computers never work properly for me.	51	45	15	2	23	64	10	4	14.95	<.01
*20. Computer experts are peculiar.	30	53	23	7	16	67	13	5	8.36	<.05

* negative statement, reverse scores.

Appendix 20

Table a.19
Inter-correlation of C.Anx.T.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q17	.670				
Q3	.653				
Q15	.649				
Q6	.601				
Q4	.564				
Q8	.478				
Q10	.465				
Q16		.767			
Q19		.552			
Q18		.5517			
Q1		.5515			
Q13		.482			
Q2			.711		
Q12			.690		
Q11			.640		
Q7				.731	
Q9				.698	
Q20					.695
Q14					.635
Q15					.608

Table a.20

t-test of Mean Scores of Subscales by Access

	Mean Rating Access	Mean rating No Access	*t*	*p*
1 : Enthusiasm for computers	3.08	3.01	1.14	NS
2 : Apprehension about computers	3.13	3.01	1.69	NS
3 : Complexity of computers	2.69	2.49	2.44	<.05
4 : Dislike of computers	3.14	2.94	2.36	<.05
5 : Computer User Characteristics	3.09	3.06	.44	NS

Table a.21

t-test of Mean Scores of Subscales by Gender

	Mean Rating Boys	Mean Rating Girls	*t*	*p*
1 : Enthusiasm for computers	3.15	2.95	3.56	<.001
2 : Apprehension about computers	3.18	2.98	2.91	<.01
3 : Complexity of computers	2.70	2.51	2.48	<.05
4 : Dislike of computers	3.17	2.95	2.73	<.01
5 : Computer User Characteristics	3.09	3.06	.44	NS

Table a.22
ANOVA of Subscales by Year Groups
C.Anx.T.

	Mean Rating Year Group										
Factor	5	6	7	8	9	10	11	6th	*F*	*p*	*Tukey's*
1 : Enthusiasm for computers	3.24	3.01	3.15	3.08	2.88	3.09	2.87	2.93	2.69	<.01	5>9
2 : Apprehension about computers	3.21	2.97	3.28	3.13	2.85	3.08	3.13	2.92	2.55	<.05	7>9
3 : Complexity of computers									.38	NS	NS
4 : Dislike of computers									1.33	NS	NS
5 : Computer User Characteristics	3.16	3.15	3.28	3.07	2.84	3.02	3.07	3.13	2.02	=.054	7>9

Table a.23
ANOVA of Subscales by Key Stage
C.Anx.T.

	Mean Rating Key Stage					
Factor	2	3	4	*F*	*p*	*Tukey's*
1 : Enthusiasm for computers				1.26	NS	NS
2 : Apprehension about computers				.05	NS	NS
3 : Complexity of computers				.25	NS	NS
4 : Dislike of computers				.17	NS	NS
5 : Computer User Characteristics				.85	NS	NS

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