UNIVERSITY OF
CANBERRA
AUSTRALIA'S CAPITAL UNIVERSITY

DIGITAL TECHNOLOGY AND AUSTRALIAN TEENAGERS:

Consumption, Study and Careers

A study commissioned by
The Australian Computer Society

Dr Karen Macpherson
May 2013

THE EDUCATION INSTITUTE

Project Management and Personnel

The project researcher, Dr Karen Macpherson, is a Professional Associate with the Faculty of Education, Science, Technology and Maths at the University of Canberra. Dr Macpherson was a full time academic at the University from 1992 to 2009, lecturing in Communication and Management. She has extensive experience designing and conducting research using both quantitative and qualitative research methods. Her PhD thesis investigated the development of critical thinking and information literacy skills in tertiary students, in the context of end-user computing for information retrieval. Her post-doctoral research has examined critical thinking and clinical decision-making skills in medical students, and in emergency medicine interns and specialists. She has published a range of academic papers in international academic journals ranked in the top 5% of quality worldwide by the Australian Research Council on these and other topics, including peer and group assessment; cognitive maturity; information literacy and learning theory. She has been an Expert Assessor for the Australian Research Council for Discovery and Technology projects since 2005.

As project leader for this study, Dr Macpherson was responsible for all stages of the project, from conception, through research design and implementation to analysis and write up. That work was completed in consultation with the client - the Australian Computer Society Community Engagement Board; a UC Steering Committee; and a Reference Group, to deliver the project outcomes. The University of Canberra Reference Group for this project comprised Professor Louise Watson, Director of the Education Institute; Dr Megan Poore (in initial phase), and Dr Jenny Chesters, Education Institute Post-doctoral Research Fellow.

The Education Institute

The Education Institute (formerly the Lifelong Learning Network) at the University of Canberra is a policy research centre located in the Faculty of Education, Science, Technology and Maths. Established in 1999 the Centre undertakes commissioned research projects in education and training. Over the past twelve years, the Institute has established a reputation for excellence in conducting policy-relevant research in all sectors of education and training. Institute consultants have expertise in many fields including curriculum and pedagogy, quality teaching and national professional standards for teachers and school leaders.

Are you interested in studying IT?

"Yes - it is interesting and an important thing to know."
Year 9 boy

"No – I already know it and it's boring."
Year 11 girl

What do you want to be when you grow up?

"I want to be Prime Minister of a semi-artificial island I'm designing"
Year 7 boy

"I want to be a physicist because I enjoy physics and science, or an architect because I enjoy being creative and I like design."
Year 8 girl

"I like the idea of being a programmer or an investment banker because I like selling things and coding."
Year 9 boy

"Possibly a plumber. The work is interesting and it is generally well paid."
Year 10 boy

"Either a music producer or an author, because I'm interested in it."
Year 12 girl

What do you do after school?

"Usually working on assignments and homework and I try to get those done by the due date and after school cooking dinner, cleaning up the house and that sort of thing and if time maybe Facebook."
Year 9 boy

"Umm… I've got a job so I go to work most afternoons otherwise I go to the gym or do assignments."
Year 10 girl

Do you ever spend time reading or thinking?

"No (laughs) … doing yoga. I have my phone away from me then. But I just like having it with me."
Year 12 girl

EXECUTIVE SUMMARY

Australian teenagers have welcomed digital technologies into their daily lives with open arms. As one Year 12 girl said of her mobile phone, “I just like having it with me”. But the thirst for technology consumption does not translate into an interest in pursuing technology as a career. This desire to consume, yet not to create, should come as no surprise to us. As citizens of a developed country, we enjoy a range of high quality services in such areas as health and education; and a feast of consumer goods and services. But that does not mean that we all want to become doctors, teachers, fashion designers or plumbers.

Yet the need to encourage more young people to take up careers in Information and Communication Technology is real; it is in fact, a question of Australian national interest. Sustaining and increasing productivity in modern economies largely depends on the application of new technology, and current and projected labour force figures suggest we do not have sufficient graduates entering ICT jobs. This study was commissioned by the Australian Computer Society Community Engagement Board, with the purpose of generating detailed primary evidence about high school student use of ICT, perceptions of use of ICT at school, perceptions of ICT as a discipline, and motivations regarding career choices.

The project involved a research study with 202 subjects aged 12-18 years at high schools in the Australian Capital Territory. A purpose-designed survey, and semi-structured interviews, yielded both quantitative and qualitative data to inform our understanding of ICT use; ICT in schools; and ICT as a field of study. In a stratified random sampling method, schools that represented government and non-government sectors; students ages 12-18 years; female and male; and Low, Medium and High ICSEA (a measure of school socio-economic advantage) ranks were approached for participation in the study.

Young people’s engagement with ICT

Communication with friends and family, and relaxation, were the main drivers of technology use in young people. Finding information was also a common usage. However, to create something, such as composing music or blogging, were far less typical uses.

Whereas Facebook and mobile phone use increased almost linearly from the ages of 12 to 18 years, and were not gender-dependent, computer game playing was typified by Year 7-9 boys playing first person shooter games. Interest in gaming waned thereafter.

The most regular activities undertaken by students out of school were spending time with family; doing homework (which includes extensive use of the internet); and

watching television. These activities were followed by doing jobs around the house, and spending time doing a hobby. “Going on Facebook” ranked 9th. Ninety five per cent of students owned a mobile phone, and 64% of students slept with their phone turned on next to their bed either all the time, or “sometimes”. This habit developed with age through the sample, and by 18 years of age, 82% slept with their mobile on “always” or “sometimes”. YouTube was the most frequently used other technology; and peaked at age 15 years.

It would seem that young people are still doing what they have always done after school: spending time with family, doing homework, playing sport; relaxing with friends or watching TV. But today digital technologies have opened new avenues to explore regarding these enduring needs to communicate, to learn and to enjoy leisure, and for many the mobile phone is a constant companion.

Young people today enjoy a kind of “dual citizenship”; for them, one country is the physical space, with a reasonably well understood set of values and expectations; and the other is the digital space, in which expectations are perhaps less clear and well defined. Parents, educators and professional bodies all have a role in assisting young people to make connections regarding values and behaviours in these two environments, and in establishing and maintaining fluency in both “languages”.

Attitudes to ICT learning

Most students liked teachers using technology in the classroom, but a number commented that there was already enough and didn’t want more; or that its use depended on the subject. Some students also remarked on teacher competence as a factor in whether or not ICT should be used in classrooms.

Fifty three per cent of students had studied ICT as a subject at high school, for at least one year. Boys were more likely to have studied ICT than girls. There was a statistically significant relationship between Age, and interest in studying IT, with students aged 12 to 15 years being most likely to be receptive to studying IT. Significantly fewer girls thought they would like to study ICT than did boys.

Although the percentage of students who had already studied IT stating that they “would like to study IT” was higher than the percentage of students making such a statement who had not already studied IT, this difference was not statistically significant. And regardless of whether IT had been studied previously, there were still between 23-31% of students who where at least undecided about whether or not they would like to study IT. This “undecided” group provides an opportunity to interest students in the study of IT.

Students overall were very confident with using technology. The main reasons given for confidence with using technology were “I use IT a lot”; “I know what I’m doing” and “It’s fun”.

Confidence was not influenced by whether or not a student had studied IT as a subject.

Students were also asked about what they would like to learn about computers that didn't already know. The highest numbers of responses to this question centred on learning how computers work, how to fix them, and how to program them. Although these are the sorts of topics that are covered in ICT courses, in another question many students had indicated that they believed they would find the study of ICT "tedious". This suggests that students may not always understand what studying ICT is about; and they have not made the connection between what they want to know, and how they can learn it.

For most students, using the internet at home, every day, was the major method of locating information for homework and assignments. They used Google to locate information, and Wikipedia frequently as a "first port of call" for background. As far as information literacy and internet searching are concerned, significant minorities of students at all ages did not have a clear understanding of who puts information on the internet (apart from schools and governments); or how to evaluate sources for credibility and relevance.

Students' perceptions of careers in ICT

The percentage of students interested in "how computers work" was much closer to figures for liking Maths and Science than were the figures for liking IT as a subject. The greater number of "don't know" responses concerning interest in "how computers work" compared with Maths and Science, suggests some uncertainty, and therefore an opportunity to engage students in this field. The ages of 12-13 years seem to be optimal for these purposes. Importantly, interest in "how computers work" was not statistically related to whether or not students had studied IT as a separate subject.

It may be that a lower rate of interest in Information Technology as a subject of study compared with interest in "how computers work" is simply a matter of student (mis)perception, and a lack of understanding of what the study of ICT entails. This could be a result of a number of factors – including curriculum design, subject availability, course advice and parental influence.

Most students believed that studying ICT at university would be interesting, but not very easy. As there was a statistically significant linear relationship between Age, and belief that studying IT would be interesting, an appropriate age at which this perception should be encouraged is at ages 12-13 years – before interest declines.

Most students understood that there is a range of work involved with being an ICT professional, such as graphic design or managing networks. Interestingly however, fewer understood that they design "faster computers"; or that IT work might also involve designing robotic and computer systems. This suggests that there may be a lack of understanding of the range of work that is available through studying IT.

Most students thought that an IT job would enable creative thinking, and a little more than half of the students believed that working in IT would be fun. In contrast, about half of the students also had a negative perception - that working in IT would mean sitting at a computer all day.

It was important to nearly all students to have a job that was interesting and well paid, and many also wanted to "make a difference" and to use creativity. Given that 62% of students believed that studying IT at university would be interesting, it would be appropriate to capitalise on this interest when seeking to engage students' interest in IT as a field of study.

Importantly in terms of making careers advice available at schools, there was a clear difference in the range of careers that had been considered by students as a function of school ICSEA category. Low ICSEA school students provided limited responses to this question in comparison to High ICSEA school students, whose responses showed a much wider range of choices being considered; and supporting reasons were more differentiated.

Considering students' general goals for a career, the disjunction needs to be highlighted between what students stated that they want in a career (interesting work, good money, creative, to help people); their statements about working in ICT (would allow creative thinking; studying IT would be interesting); and their views on IT in general - only 31% of students had considered IT as a career. It is possible that a number of students are not aware that careers in IT are able to meet their generalised career needs for interesting work, good pay and creativity.

There was a statistically significant difference between girls who had considered an IT career, and boys; but as girls do well in Maths and Science, there is no reason other that attitude that might inhibit their interest in ICT. Although clearly there is much work to be done regarding changing girls' perceptions of IT study and careers, such a task should be attempted. After all, it was not many years ago that girls did not study Law or Medicine.

Conclusions

Findings indicate a range of student misperceptions about the study of ICT; some are related to gender; others to age; others to school ICSEA rank; or a combination of these.

There is considerable scope, particularly in early high school, to take advantage of students' interest in computers; to develop an interest in studying ICT; and to challenge misperceptions about ICT careers. A range of initiatives and interventions can be developed and implemented by professional bodies, educators and other stakeholders to target these opportunities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACKNOWLEDGEMENTS

This project was undertaken under the auspices of the Education Institute at the University of Canberra with funding from the Australian Computer Society Community Engagement Board (ACS). The author is grateful to the ACT Government Education and Training Directorate, the Catholic Education Office in the ACT, and Independent Schools, for their consent to allow participation by schools in the study; and for their support for the research.

The author would like to thank the many School Principals who generously provided access to their students, as well as the Teachers and Administrative staff at the high schools, who spent considerable time arranging parental consent forms, and assisting in the supervision of survey completions. Without the cooperation of these people at every level of the education hierarchy in the ACT, it would not have been possible to conduct this project.

The cooperation of the students participating in this study, and the thoughtfulness of many of their responses on the surveys and in the interviews, are a credit to students and their attitudes in the classroom.

GLOSSARY

ACS	Australian Computer Society Community Engagement Board
CEO	Catholic Education Office
ETD	ACT Government Education and Training Directorate
ICSEA	Index of Community Socio- Educational Advantage
IT/ICT	Information and Communications Technology[1]
STEM	Science, Technology, Engineering, Maths
UC	University of Canberra

[1]Although the acronoym "ICT" is standard useage in industry, in high schools and some parts of the university system, the term "IT" is much more widely used. Therefore in the survey, the term "IT" was used more than the term "ICT" in order that students would understand the research questions more easily.

1. INTRODUCTION

We live in an economic environment in which progress is driven by technological innovation. Australia needs a labour force equipped with the knowledge and skills to create and develop these innovations, but current and projected demand for such skills is not met by supply. The *Dobson Review* (Feb 2012), commissioned by Australia's Chief Scientist Prof Ian Chubb, reported that Information Technology enrolments in tertiary courses have experienced negative growth of 34.5% in the eight years to 2010, and that whilst enrolments "in the … sciences have almost held their ground, … in societies where economic growth is based on innovation and technology driven change, perhaps 'holding ground' is not good enough" (p 13).

This report presents the findings of a project that investigated possible factors involved with this decline in tertiary enrolments, by examining young people's use of digital media and attitudes towards ICT subjects and careers while they are at high school – the years in which young people are deciding what to be when they "grow up". The project investigated patterns of use of ICT; perceptions of ICT; and attitudes to careers in ICT among a sample of teenagers aged 12-18 years attending secondary schools in the Australian Capital Territory.

In the next section of the report, the context of the study is discussed. Subsequent sections present research method, findings and conclusions. Highlights of the report are provided in the Executive Summary.

2. CONTEXT

The Australian economy is now a "patchwork" economy (Chandler Macleod Group 2012), in which a variety of sectors contribute to the ongoing development of the country at different rates. Regardless of how they are characterised, there is a common thread that runs through each of these sectors: the key to sustainable global competitiveness, and therefore to economic growth, is productivity.

2. 1 Innovation and ICT

One of the major levers of control of productivity is innovation: changing the way work is done; changing the work; or doing things differently. The Global Innovation Index (2012) analyses economic strengths and innovation potential of 141 countries. According to the Index, Australia has an overall innovation score or 51.9/100 and is ranked 23rd out of 141 countries. By way of comparison, Switzerland is ranked 1st; Singapore 3rd; USA 10th; and China 34th.

Whilst Australia is ranked 10th on the strength of its institutions such as the political, business and regulatory environment, and 13th on infrastructure including ICT access

and use, and e-participation, our graduates in science and engineering are rated as a weakness, at 64, as is our knowledge diffusion, at 83. This includes computer and communication service exports.

Although Australia's tertiary enrolments overall (11th), and its scientific research institutions (13th) are ranked well on the Global Innovation Index, we need to reverse the decline in the number of science graduates (including ICT) to increase innovation.

2.2 ICT skills shortages

Sustaining and increasing productivity in modern economies largely depends on the application of new technology. Yet there is a growing concern that Australia does not have a labour force with the skills to meet current and projected ICT job demand. According to the *Dobson Review* (2012:18): "The only discipline in which there was a decrease in [university] teaching was Information Technology, which was taught to 15,030 fewer equivalent full time students in 2009 compared with 2002".

Further, the Innovation and Business Skills Australia *Environmental Scan* (2012:1) states that:

> The impact of the trend in declining enrolments in post secondary ICT training is now being felt as organisations recover from the global financial downturn. Increased participation by some groups, including participation by women and people in regional and remote Australia, offers new prospects for meeting future demand for labour which is expected to grow.

Skilled Immigration is an interim solution for any shortfall in professional and other labour force supply. A report on the ICT industry conducted by DEEWR (2011a) for example reported that:

> Employer sponsored migration has been an increasingly important source of supply to the Australian labour market over recent years: young Australian ICT graduates compete with young ICT graduates from other countries for ICT Professional jobs.

Relying on skilled migration is a short term strategy. Longer term, shortfalls must be met through increases in students graduating with ICT qualifications in Australia. There are a number of issues to be dealt with here. Roberts et al (2011) reported that the current shortfall of ICT professionals is the result of baby boom retirements; lack of student commencements (ie, students starting an ICT-related undergraduate degree); and high attrition rates from university courses. Data supporting these elements were from studies conducted from 2007-2009. Roberts et al (2011; 2012) have suggested as the result of their own more recent research that high levels of attrition from

university courses – particularly for women - may also be due to "boring" classes; a pace of teaching that is too fast; and the lack of a "workplace focus" in the course.

Figures with regard to the gender dimension suggest that in 2012, out of Bachelor graduates (under 25) in the field of Computer Science in Australia, 86.5% were male and 13.5% were female (Graduate Careers Australia, 2013). The figures are similar but not quite as marked in the USA; only 20-25% of engineering and computer science graduates are female (Soldner et al, 2012).

The shortage of student commencements into university courses is caused by a range of factors. Chief among them is the "image problem" of ICT courses. There is a pervasive student perception that study in "STEM" courses (Science, Technology, Engineering and Maths) is either uninteresting, or too difficult. A study conducted by the Victorian Government: *Attitudes to ICT careers and study among 14 to 19 year old Victorians* (Department of Innovation, 2009) yielded some relevant findings:

1. The ICT industry has an "image problem" – ICT "entertainment media … plays a role in shaping their views about certain careers".

2. The major career influences on teenagers are: people already in professions; work experience; and parents.

3. The most common reasons for not studying ICT were: other subjects; lack of interest in ICT; or that ICT was not offered as a subject.

4. There was a widespread perception of ICT as boring, repetitive, and providing limited opportunities for human interaction.

5. Significant gaps were identified between what students consider important in a future career; and what they believe an ICT career has to offer.

As mentioned in 2. above, parental influence is important in the decision to study ICT subjects. There is a further problem here in that parents themselves may have negative perceptions of ICT as a career as they may have low expectations or little understanding of the types of jobs that are available in the sector (Department of Innovation, 2009).

2.3 Attitudes of young people to ICT

For education policy, the question of how to produce more ICT graduates is complex and can be addressed at many levels. The specific focus of this study is on young people's attitudes towards, and usage of ICT, recognising that attitudes towards careers in ICT are likely to be formed (and thus may be influenced) during a student's high school years. In exploring these themes among young people, it is important to

recognise that ICT is a broad and eclectic field. Three facets need to be distinguished for the purposes of this study:

The first concept is ICT consumption and engagement. This is the "end-user" aspect, that is, the skill set that all students graduating from Australian high schools should possess regarding "consumption" of technology. Examples of this skill set are competence in using a suite of desktop office productivity tools; and how to use mobile telephony. Students often self-teach applications such as Facebook, or computer games, YouTube or Skype. Some studies in Australia, for example, Walters and Fehring (2009), or Hansford and Adlington (2008), have examined the issue of children's ICT knowledge outside the classroom in order to obtain a clearer picture of the nuances of ICT use amongst young people.

A crucial skill for young people– the "knowledge workers" of the future - to acquire, is an understanding of the unprecedented diversity of information and opinion available to them on the internet. The teaching of information literacy principles and skills is central to students' ability to understand and nature of the digital world. Information literacy is a broad range of skills that leads to the ability to locate and critically evaluate information for a given problem situation. Information literacy skills are superordinate to information technology literacy; they are independent of the digital environment. But successful navigation of the digital environment depends on information literacy skills – an important component of which is that skills sub-set known as critical thinking (Macpherson and Owen, 2010; Macpherson, 2004; Bouhnik and Giat, 2009).

A second concept is ICT-enhanced classroom teaching. This refers to when, why and how ICT should be used in the classroom. Questions on this topic include issues in pedagogy; practicality; access; subject material; teaching outcomes; and class sizes. Research in Australia (Phelps et al 2011) and an Australian review of international literature (Bingimlas, 2009) suggest that many teachers lack the resources and/or expertise to utilise ICT effectively in their classrooms. In Australia, the Federal Government has implemented several projects to address this issue under the ICT Innovation Fund Projects scheme (deewr.gov.au/ict-innovation-fund-projects).

The third concept is ICT as a discrete body of theory, knowledge and skills – a separate discipline of study. Indeed, this aspect of ICT – with students not only as current and future users of technology, but developers of it – is a central plank of the Australian Curriculum, Assessment and Reporting Authority's *Draft Australian Curriculum: Technologies* which is currently under development. Once Ministerial endorsement has been given in late 2013, the Technologies curriculum will be the first separate subject in this field developed for Foundation to Year 8 students in Australia (www.australiancurriculum.edu.au). Questions here relate to how to stimulate students' interest in undertaking further non-compulsory ICT study leading to careers in this important area.

Within this framework, it is timely to evaluate some common assumptions about young people and their ICT abilities. Prensky (2001) for example, suggests that young people, who grew up with texting, computers, social networking and games, are "digital natives", who are not only confident and comfortable with using technology, but also are competent, using technology. On the other hand, Prensky suggests, people who did not grow up with technology are "digital immigrants", and no matter how proficient such people may become with technology, they will always retain an "accent" or a way of thinking in which technology is not completely integrated in the manner that it is for "digital natives". While the uptake of digital technologies for communication, socialising, and gaming, has been rapid among young people, it is not necessarily the case that all young people, or even university students (De Wit et al 2011) are uniformly capable.

Research suggests that children and young people tend to utilise those aspects of ICT that interest them, just as adults view television programs that interest them, but not others. Broadly speaking, teenage boys and even young men enjoy the gaming capabilities of such platforms as Playstation 3; young women tend to be more engaged by social media such as Facebook. Although partially explained by age and gender, uses of ICT can be further broken down by variables such as socio-economic status, school use of ICT, other hobbies and sporting interests, and parental supervision and encouragement (see for example Grimley and Allen, 2010; Emerson, Fear et al, 2012).

Whilst many adolescents are confident in their ability to use digital media, and feel engaged with it, this does not necessarily mean that they have developed the cognitive and critical thinking abilities required for full information literacy to take advantage of these media for the purposes of learning; although there is some evidence (McMahon 2009) that use of ICT does assist in the development of higher order thinking skills.

The current project has arisen out of this context. Its purpose is to generate detailed primary evidence about high school student use of ICT, perceptions of the discipline, and motivations regarding career choices.

2.4 Summary

The Australian economy is now a "patchwork" economy, in which a variety of sectors contribute to the ongoing development of the country at different rates. Regardless of how they are characterised, there is a common thread that runs through each of these sectors: the key to sustainable global competitiveness, and therefore to economic growth, is productivity.

One of the major levers of control of productivity is innovation: changing the way work is done; changing the work; or doing things differently. The Global Innovation Index (2012) analyses economic strengths and innovation potential of 141 countries. Although Australia's tertiary enrolments overall (11th), and its scientific research

institutions (13th) are ranked well on the Global Innovation Index, we need to reverse the decline in the number of science graduates (including ICT) to increase innovation.

Sustaining and increasing productivity in modern economies largely depends on the application of new technology. Yet there is a growing concern that Australia does not have a labour force with the skills to meet current and projected ICT job demand. For education policy, the question of how to produce more ICT graduates is complex and can be addressed at many levels. It is important to recognise that ICT is a broad and eclectic field; three facets need to be distinguished for the purposes of this study.

The first concept is ICT consumption and engagement. This is the "end-user" aspect, that is, the skill set that all students graduating from Australian high schools should possess regarding "consumption" of technology. Information literacy principles and skills are an important component of end-user competence. A second concept is ICT-enhanced classroom teaching. This refers to when, why and how ICT should be used in the classroom. The third concept is ICT as a subject: a discrete body of theory and knowledge, the study of which leads to the ability to develop new technologies for application throughout society.

The current project has arisen out of this context. Its purpose is to generate detailed primary evidence about high school student use of ICT, perceptions of use of ICT at school, perceptions of ICT as a discipline, and motivations regarding career choices.

3. THE RESEARCH

This section discusses the Aims, Research Questions, Method and Instruments used for the study.

3.1 Aims

The aims of the study were to identify possible factors involved with tertiary enrolments in ICT courses at university, through investigating digital media use and attitudes to ICT among students in high school.

The project involved a quantitative and qualitative research study conducted in the Australian Capital Territory. The survey and interview data gathered in the study in the six months to November 2012 investigated three issues: how young people engage with ICT, young people's attitudes towards ICT as a subject of study; and teenagers' perceptions regarding careers in the ICT field.

The research was designed to inform the following research questions:

1. In what ways do Australian teenagers engage with ICT and how does this engagement differ between sub-groups of this population?

2. How can educators best meet the learning needs of teenagers in building ICT competence?

3. How can educators engage with teenagers to inspire them to consider careers in science and technology?

The project was conducted with the consent of the ACT Government Education and Training Directorate, the ACT Catholic Education Office, the Principals of the schools, the students and their parents. The research design was approved by the Committee for Ethics in Human Research at the University of Canberra.

A random sample of students aged 12 to 18 years was selected from eight schools in the Government, Independent and Catholic school sectors. These schools represented a range of values on the socio-economic spectrum as determined by the Index of Community Socio-Educational Advantage (ICSEA) scale.[2]

[2]Developed for the *MySchool* website, the ICSEA scale enables meaningful comparisons to be made across schools. It enables schools serving similar student populations to be identified. Student-level data on occupation and education level of parents, and/or socio-economic characteristics of the areas where students live, location of the school (eg remote or metropolitan), proportion of students from a language background other than English, and the proportion of Indigenous students enrolled at the school are part of the determination of a school's rank (www.myschool.edu.au/).

3.2 Method

The research process was undertaken in the following stages:

Literature Review

The research process was informed by a review of relevant literature on firstly, the employment situation for ICT graduates in Australia; secondly, university enrolment and completion data; and thirdly, on teenagers' engagement with ICT both in and out of school.

Approvals and permissions

Approvals from the University of Canberra Committee for Ethics in Human Research, and relevant Government and Education bodies were sought and obtained. Once all approvals were granted, individual School Principals were approached for permission to conduct the research.

School principals and their staff then arranged to have detailed Participant Information sheets and Informed Consent forms about the project distributed to the parents/guardians of potential participants. Informed Consent forms were returned to schools; and no student was allowed to participate in the study without such written Informed Consent being provided.

Selection of sample

The total sample surveyed in this study was 202 students. The sample was determined by the stratified random sampling technique, in which participants are randomly selected from each stipulated layer (stratum) of a population. This is considered to be an excellent bias-free sampling method (Sproull, 1995). There were four main strata to be sampled in this research; they are described below.

Firstly, subjects were drawn from Government, Catholic and Independent school sectors in the ACT. In order to be representative, students from each of these sectors were sought as 46% of students in the ACT attend non-government schools (ABS Catalogue 1308.8, Dec 2010).

Secondly, within those school categories, a range of Low, Medium and High ICSEA school ranks were sought. The average ICSEA rank across Australia is 1000; but due to the ACT's small size and its characteristic demographic of a highly educated workforce, there are few schools with an ICSEA below 1000. Several schools with an ICSEA at or below 1000 that were approached to participate, were unable to do so. Therefore schools representing Low (1000-1030), Medium (1040-1080) and High (1150-1200) ICSEA rank categories participated in the project. These schools were located in different regions of the ACT; again, to ensure that the sample was as representative as possible.

Ultimately, the three schools in the sample representing Low ICSEA schools had an average rank of 1020. The three Medium ICSEA schools had an average ICSEA rank of 1057; and the two High ICSEA schools averaged 1180.

Thirdly, a mix of female and male students were represented; and finally, the sample needed to represent the full range of ages and school years across the ACT high school and college system.

Survey and Interview

During Terms 3 and 4 2012, a cross section of students aged 12-18 years were surveyed regarding their use of ICT, their perceptions of technology and views on career choices. A smaller sample of students was selected for follow up interviews to obtain rich qualitative data to supplement the quantitative data obtained in surveys.

Data Analysis

In the data analysis stage, the information collected from the surveys and interviews was analysed. The statistical package SPSS, and Excel, were used for numeric data analysis.

3.3 Survey data collection

Data were gathered using a purpose-designed four page survey – see **Appendix A**. An important aspect of survey design is "content validity" - the extent to which the questions in the instrument relate to the objectives of the research (Sproull, 1995). Questions in this survey were carefully designed to gather data relating to the three research questions. The questions were not clustered according to research question. To ensure high content validity of the survey, two or three questions were asked on the same topic in different ways in different sections of the survey to ensure that responses were consistent and therefore likely to be accurate.

The instrument was piloted on a small sample of students, and stakeholders consulted, before finalising the content. The UC Ethics Committee approved the survey.

A range of inferential statistical tests was run to determine whether the variables of Age, Gender, or ICSEA had any impact on the students' use of digital technology; their views on ICT in schools; and their attitudes to study and careers in ICT. Data were analysed using the chi-square goodness of fit test, as data characteristics were categorical, and random sampling was used. The confidence interval was 95%.

3.4 Description of sample

Descriptive statistics for the sample appear at **Table 1** below. For each ICSEA rank, students from years 7/8, 9/10 and 11/12 were surveyed. Forty two per cent of the sample was aged 12-14 years; 30% was aged 15-16 years; and 28% was aged 17-18 years.

With regard to Gender, males are represented more than females as two participating schools were boys' schools. One school was a girls-only school. However, it is important to note that a sample of 77 (females in this case) is sufficient to support meaningful statistical analysis (Sproull, 1995).

Thirty four percent of the sample was in Years 7 and 8; 35% in Years 9 and 10; and almost 30% in Years 11 and 12.

Table 1: Descriptive statistics of the sample

n = 202	%
School Category	
Government	38
Catholic	22
Independent	40
ICSEA	
Low (1000-1030)	19
Medium (1040-1080)	45
High (1150-1200)	36
Age	
12 years	8
13 years	13
14 years	21
15 years	18
16 years	12
17 years	16
18 years	11
Gender	
Female	38
Male	61
not stated	1
School Year	
Year 7	12
Year 8	22
Year 9	15
Year 10	20
Year 11	5
Year 12	24
Not stated	3

3.5 Semi-structured interviews

Nine girls and 11 boys were interviewed; two students from all except two schools, which provided four students each. The total sample was therefore 20 students. As the interviewed students were drawn randomly from the cohorts who completed the survey, they were an accurate representation of the sample. Interviews were taped in all cases except one, where parental consent for taping of the interview had not been given. In that case, notes were taken. Interviews were conducted in all cases immediately after the completion of the survey at the participating school, individually by the researcher, and were of no more than 10 minutes' duration.

Data from the interviews has been used throughout this Report to illustrate results. The interview material is presented in green boxes, and takes the form of quotations from students. **Pseudonymns are used in all cases.** These pseudonymns were chosen by students from a list, at the start of their interviews. Some students chose the same pseudonymns, and these cases are distinguished where necessary.

3.6 Limitations

Gender distribution

As mentioned above, the research sample comprised more males than females. It was the intention to have a roughly equal gender distribution, but due to the unavailability of some schools for the project, this was not possible. In cases where it was judged a possibility that results were being influenced by the number of male respondents, for example, **Table 20:** What subjects do you enjoy? – data were analysed using both the whole sample, and the sample, less a full cohort from a boys' school, to cross-check result validity.

Low ICSEA schools

Low ICSEA schools were in general more difficult to enrol in the study than were other school categories. A number of School Principals cited "research fatigue". Further, for those Low ICSEA schools that did participate, parental consent form return rates were significantly lower than for other school categories.

Gender in school sectors

Overall, Independent schools were represented by males, and Catholic schools by females (but not entirely). However, as these schools are considered part of the same "non-government" school sector, and results were not analysed by school sector, this feature of the sample had no impact on results.

Results are presented in the following three chapters, under the headings "Young people's engagement with ICT"; "Attitudes to ICT learning"; and "Students' perceptions of careers in ICT".

3.7 Summary

The project involved a quantitative and qualitative research study with 202 subjects aged 12-18 years at eight high schools in the Australian Capital Territory. A purpose-designed survey, and semi-structured interviews, were used to gather data in the six months to November 2012 to investigate three issues: how young people engage with ICT, young people's attitudes towards ICT as a subject of study; and teenagers' perceptions regarding careers in the ICT field.

The stratified random sampling technique was used to select participating schools. The schools represented four sampling strata: government and non-government schools; ages 12-18 years; female and male; and Low, Medium and High ICSEA (a measure of school socio-economic advantage) ranks.

4. YOUNG PEOPLE'S ENGAGEMENT WITH ICT

4.1 Out-of-school activities - overview

Respondents were asked to indicate what activities they undertake when not at school, and to indicate how often they do them. The results for the entire sample (n = 202) are summarised in **Table 2** overleaf.

Table 2 suggests that when looking at activities undertaken "every day", spending time with family was the most frequent, followed by going on Facebook, and watching TV.

What do you do after school?
I usually go and feed my dogs and then go on Playstation or do homework… after dinner I might read or watch TV.
"Harry", Yr 8. Aged 13

Figure 1 indicates that when responses "every day" and "several times a week" were combined, the most regular activities were spending time with family, doing homework and watching television. These were followed by doing jobs around the house, and spending time doing a hobby. "Going on Facebook" ranked 9th. "Other" responses included such varied activities as watching sport, exercising, looking after pets, working on cars and writing poetry. Learning an instrument and having a casual job were the least frequent activities out of school when looking at the sample overall.

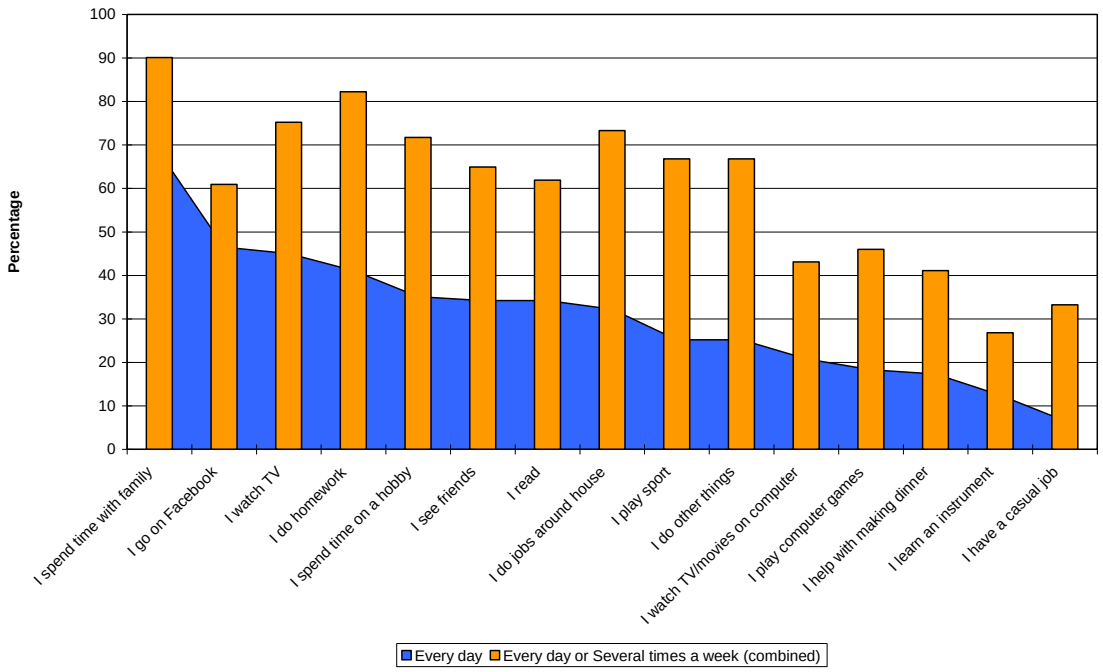


Figure 1: Out of School Activities – Total Sample (n = 202)

Table 2: What do you do when you are not at school?

Activity	n =	Every day	Several times a week	About once a week	Once or twice a month	Not at All	Every day and Several times a week combined
		%	%	%	%	%	%
I spend time with my family	201	68	22	5	3	2	90
I do homework	201	41	41	13	4	1	82
I watch TV	202	45	30	16	6	4	75
I do jobs around the house	201	32	41	18	6	3	73
I spend time doing my hobby	199	35	37	14	6	6	72
I play sport	200	25	42	17	7	8	67
I do other things	200	25	42	17	7	8	67
I see friends	202	34	31	20	13	3	65
I read	202	34	28	15	15	8	62
I go on Facebook	198	47	14	13	6	19	61
I play computer games eg Playstation, Wii, Sims	200	18	28	17	21	14	46
I watch TV or movies on the computer	200	21	22	22	20	14	43
I help with making dinner	201	17	24	25	22	12	41
I have a casual job	200	7	27	10	7	49	33
I learn an instrument	198	12	14	7	9	55	27

There were a number of statistically significant relationships between variables and out-of-school activities. These are summarised in **Appendix B**. Facebook and computer games are discussed separately under sections 4.2.2 and 4.2.3 respectively.

ICSEA school rank was associated with learning an instrument, doing homework, and reading. High ICSEA school students undertook these activities more than did Low or Medium ICSEA school students. Conversely, Low ICSEA school rank students were the most likely to have a casual job, followed by Medium and then High ICSEA school students. Girls helped with dinner "several times a week" statistically significantly more often than did boys, who helped "once or twice a month".

Reading was a more frequent pastime for students aged 12 and 13 years than for students of other ages. Beyond 12-13 years, it is likely that the allure of Facebook, computer games and other activities draw young people away from reading as a leisure activity. For example, the number of students who had a casual job increased almost linearly with Age.

It would seem that out of school, young people do what they have been doing for decades: spending time with family, doing homework, seeing friends, playing sport or doing a hobby. Going on Facebook and playing computer games are relatively new leisure activities that have been added to possible options, most prevalent of which is watching TV for relaxation, which has been a regular leisure activity since the 1960s. Today, all of these activities are conducted with the mobile phone to hand.

4.2 Use of digital technologies when not at school

4.2.1 Mobile phones

Ownership

As **Table 3** suggests, 95% of students owned a mobile phone. Sixty nine percent of students with a mobile, owned a smartphone. Over 66% of students owning any type of mobile phone nominated their frequency of use as either "many times a day" or "all the time". With regard to 24 hour phone access, 191 subjects responded to this question. Sixty four percent of these students slept with their phone turned on next to their bed either all the time (49%), or "sometimes" (15%).

> *Normally when I have a bit of free time I might go on the phone and talk to friends, kick the footie around, or do an hour of homework to keep on top of work. My parents take my phone off me so I'm not distracted by it.*
> "Fred", Yr 10

Table 3: Mobile Phones

	n =	Yes	Sometimes
		%	%
Do you have a mobile phone?	202	95	
Is your mobile a smartphone?	191	69	
Do you have fun using your phone?	191	55	33
Do you sleep with your phone turned on next to your bed?	191	49	15

Interestingly, the habit of sleeping with the phone turned on at the bedside developed with age through the sample: see **Figure 2**. This Figure indicates that at ages 12-13 years, approximately half of the sample did not have their mobile turned on at their bedside; and by age 17 years, the majority of students had the phone turned on all night, either every night, or "sometimes". There was also a slight difference by Gender: 56% of girls, compared to 45% of boys, had the phone on at night.

My phone's on next to my bed, sure. I look at messages if they come in through the night. Even if I'm asleep.
Do you manage a full night's sleep very often?
Not very often (laughs). When I'm older I'm not going to be replying through the night.
"Harriett 2", Yr 12

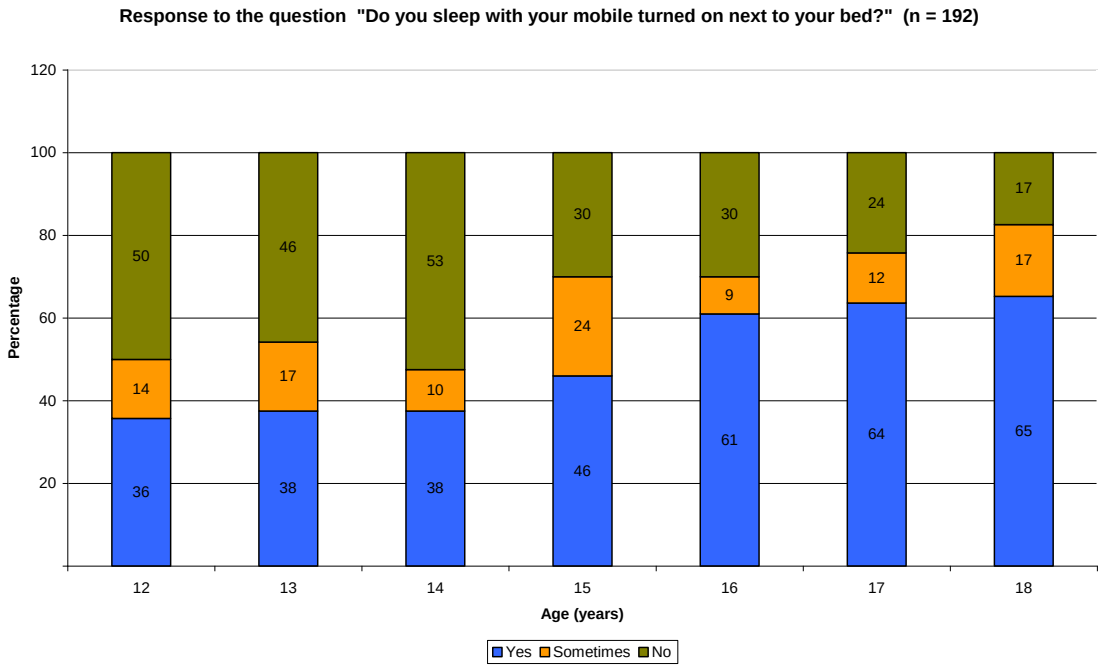


Figure 2: Relationship between Age and Mobile at Bedside

Purpose of use

Table 4 indicates that the main use of mobiles was to text or to make phone calls. Use of phones for entertainment, for example taking pictures, was followed by using the internet to find information. Ninety per cent of students had fun "all the time" or "sometimes" with their mobile phones.

Table 4: Use of mobile phone

Mobile is used to:	
n = 191	**%**
Text	86
Make phone calls	84
Take pictures	61
Use the internet to find information	53
Use Facebook	49
Play games	43
Use the internet for fun	40

Technology in the home

Many subjects had a considerable array of technology available in their homes, as **Table 5** suggests. Laptops, computers and a range of games consoles and other mobile devices were present in many homes.

Table 5: Digital technologies available in the home

Technology	
n = 202	**%**
Laptop	82
Home computer	81
PC	61
Wii	59
Playstation	55
iPad	49
Xbox	36
Mac	24
Tablet	23
other (examples of "other" are Ipod, Nintendo)	18

Figure 3 below indicates the breakdown of digital technology available in the home as a function of school ICSEA. The general trends in ownership of digital technologies was broadly similar; but overall ownership of technologies was lower in Low ICSEA schools, than in High and Medium ICSEA schools, which were approximately the same.

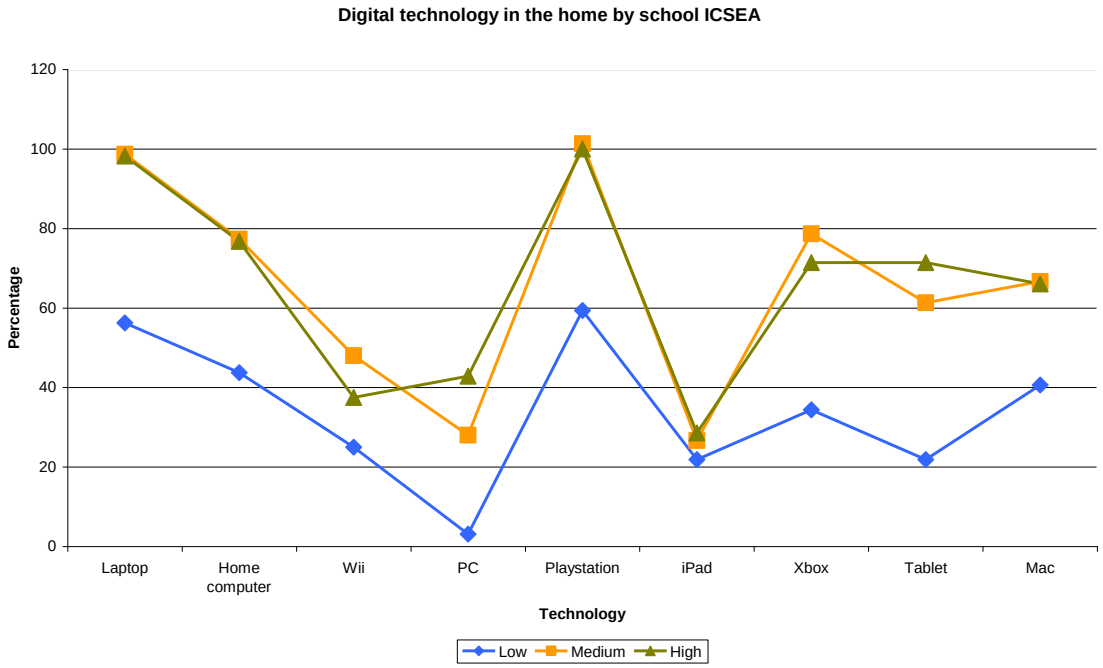


Figure 3: Digital technology in the home by school ICSEA (n = 202)

Table 6 indicates that 99% of the total sample of 202 students had the internet at home. With regard to the question "do you like using digital technologies?", over 99% of subjects responded either "yes" (84%), or "sometimes" (15%).

Table 6: Access to Internet at Home

n = 202	Yes
	%
Do you have the internet at home?	99
Do yo like using digital technologies?	84

4.2.2 Facebook

Data were gathered in two separate groups of questions on the survey regarding Facebook; one in the context of use of technologies; the other in the context of activities undertaken when not at school.

Presence

In response to the question "Are you on Facebook?" One hundred and sixty one students (80%) responded that they are. **Figure 4** below indicates that there is a relationship between Age and Facebook presence – the older the teenager, the greater the likelihood that they will be on Facebook. This relationship is highly statistically significant (p = .000009).

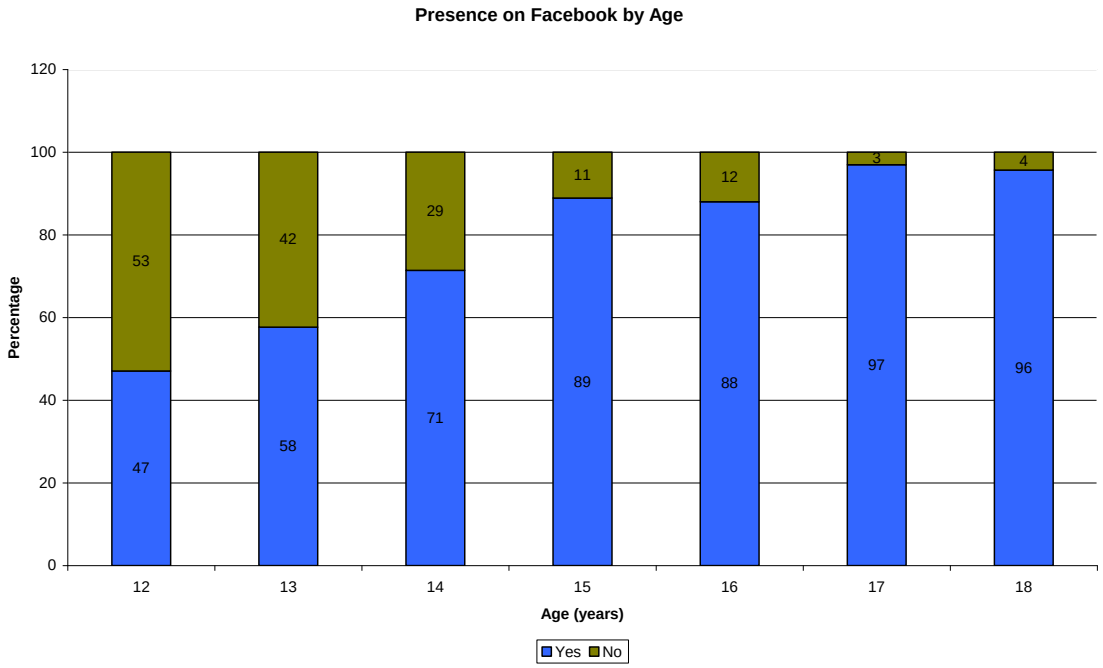


Figure 4: Presence on Facebook by Age (n = 202)

Frequency

Frequency of use for Facebook was rated as "often" (every day) for 67% of students when asked in the context of use of technology. When asked in the context of what students do after school, the "every day" response was 47%, and the "several times a week" response was 14%.

> *I text or Facebook to arrange things with friends. I go on Facebook about once a day, not like very second. At night time.*
> Do you have it on in the background while you study?
> *No, mum would be mad at me.*
> "Ruby", Yr 10

As with presence on Facebook, there was a highly statistically significant relationship between Age and how often Facebook is accessed (p = .000016). By 14 years of age, the most common response had changed from "no response" (53% of students were not on Facebook) at 12 years of age, to "every day" (38%). By 18 years of age, 83% of students indicated that they go on Facebook "every day" - see **Figure 5**.

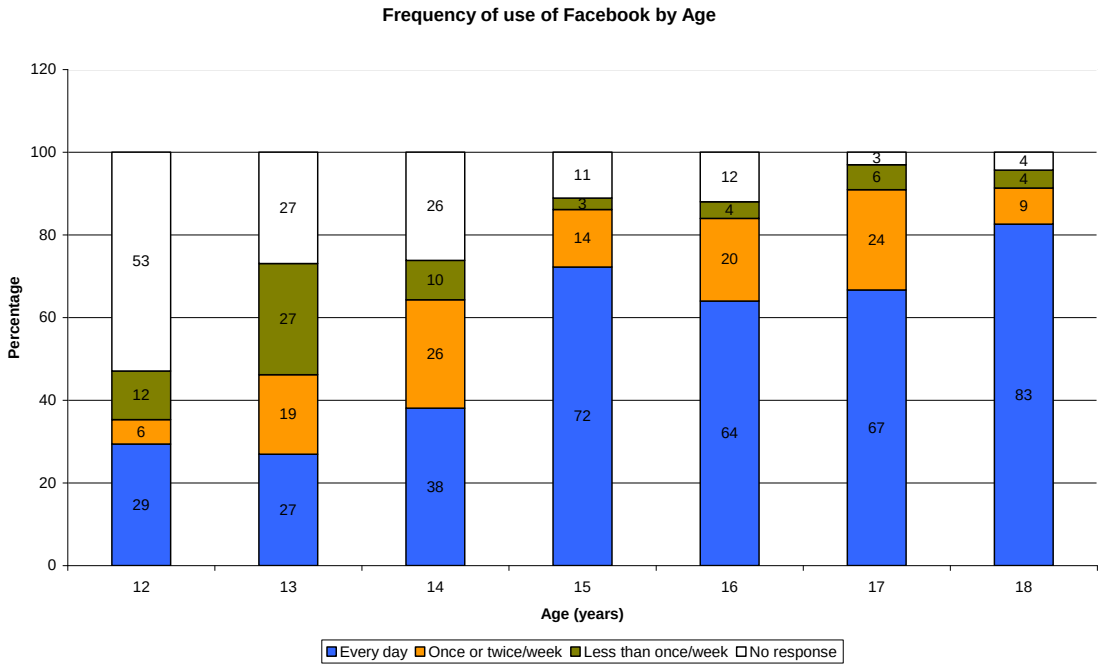


Figure 5: Frequency of use of Facebook by Age (n = 202)

These data were verified by responses the question on out-of-school activities, with nearly half of students aged 12 indicating that they do not go on Facebook at all after school; by the time they are aged 18 years, all students in this sample go on Facebook at least once or twice a month. See **Figure 6** below.

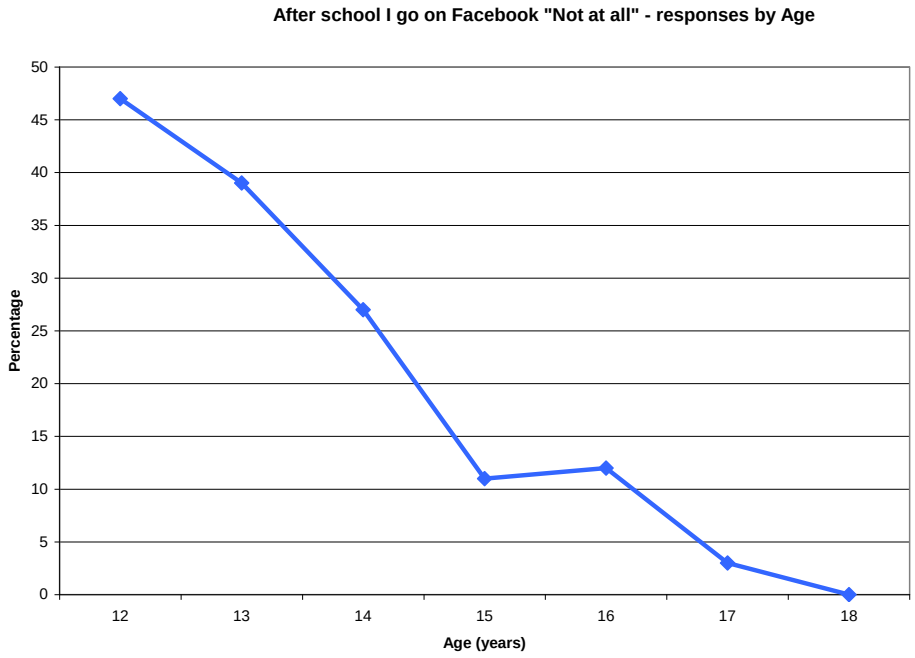


Figure 6: The relationship between Age and Facebook use after school as a function of Age (n = 202)

With regard to *presence* on Facebook as a function of Gender, there were approximately equal percentages: Female = 82%; Male = 78%. However, with regard to *frequency of use* of Facebook as a function of Gender, there was a difference: 65% of girls access Facebook "every day"; compared with 48% of boys, although this difference was not significant.

4.2.3 Games

Types of games

Of the 194 responses to this question, 86% played games on their technology at home (e.g. on Playstation, PC, Xbox). In response to the question "What games do you play?", participants were ranged in two broad camps: "first person shooter games" such as Call of Duty (39%); or imaginative games such as "The Sims" and/or entertainment on their mobile phones such as "Fruit Ninja" (31%). A number of participants played a range of games across different platforms.

> *Uh well I get home around 4-ish and then go outside or play on my Ipod or on my Xbox or when I go to bed I read "Tomorrow when the war began."*
> "Nick", Yr 8, Aged 14

Responses to the statement "I play games with …", suggested that the majority of participants who play games do so in a variety of ways - on their own, with friends, or online.

Frequency

Of the 181 subjects who responded to the question on frequency of playing computer games, 23% indicated that they play games "often" (every day); 41% "sometimes" (once or twice a week); and 26% "less than once a week".

With regard to how often games are played, 10% of girls play "every day"; and 32% play "once or twice a week". Thirty two per cent of boys play "every day"; and 45% "once or twice a week". This difference between the percentage of girls and boys playing computer games "once or twice a week" or more, is statistically significant (p = .000012). This result was also highly statistically significant in the other question on playing computer games in the "Out-of-school activities" cluster of questions (p = .000024).

The statistically significant difference in how often games were played as a function of school ICSEA was reflected in the context of technology use at home, as well as in the "out-of-school activities" section. Students from the High ICSEA school band play games "once or twice a week" more than students from Low or Medium ICSEA school bands (p = .045), although all school ICSEA level students played games "every day" at about the same rate – see **Figure 7**.

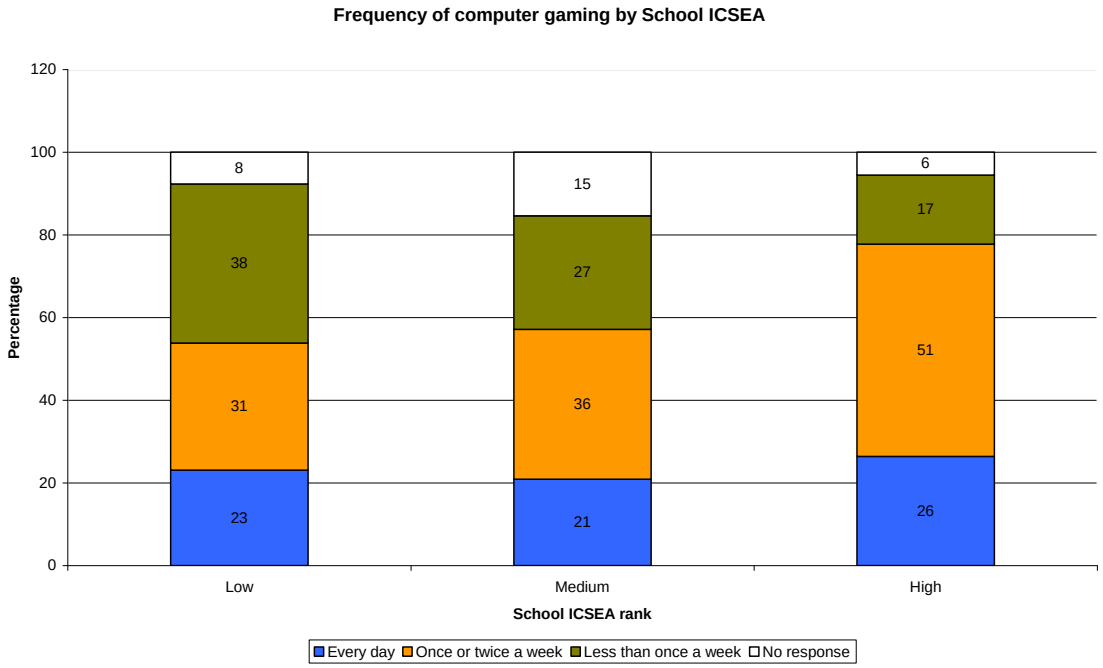


Figure 7: Frequency of Game Playing by School ICSEA (n = 202)

With regard to how often games were played as a function of Age, ages 12 to14 years (ie, school years 7-9) played the most frequently; least frequently were ages 17 and 18 years. These ages correspond to Years 11 and 12 at school, which are important years for most students. Game playing frequency reduced with Age, a statistically significant result (p = .000079); see **Figure 8** below.

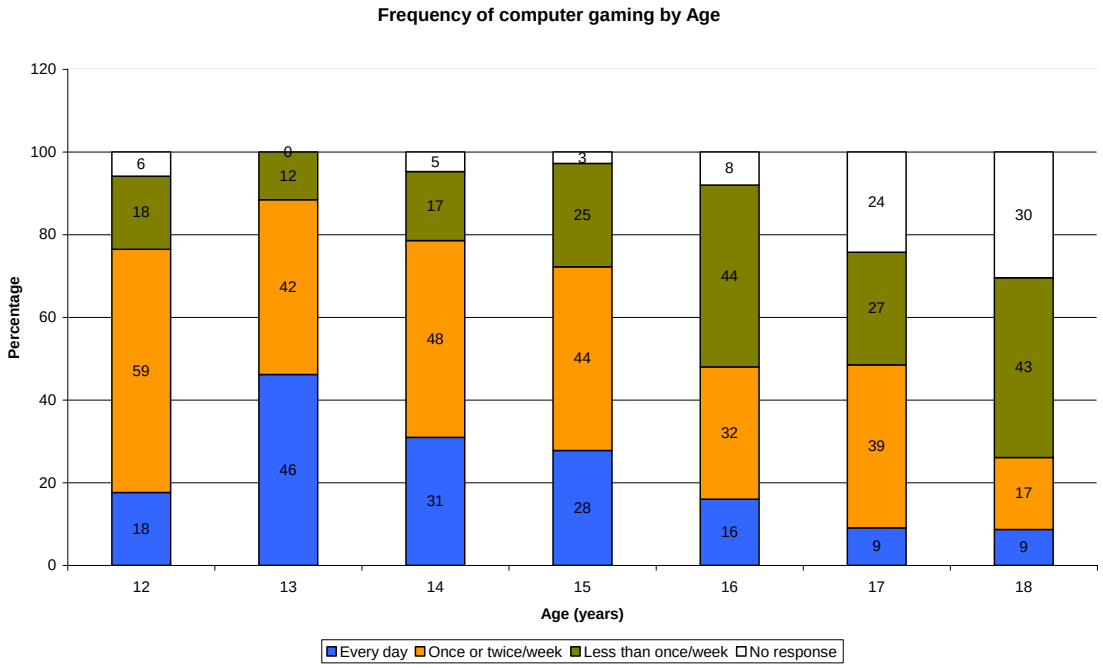


Figure 8: Frequency of Game Playing by Age (n = 202)

Although there was a large Gender difference with regard to frequency of game playing, “going on Facebook” every day, or several times a week, was not greatly different statistically as a function of Gender (**Figure 9**).

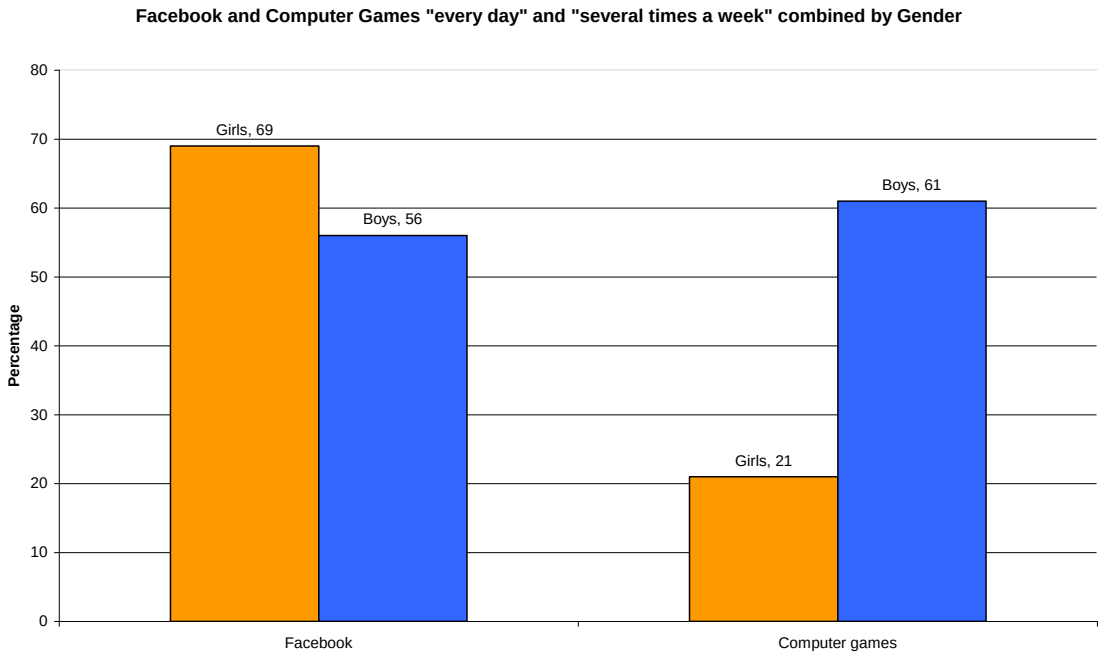


Figure 9: Use of Facebook and Computer Games "every day" and "several times a week" combined, by Gender (n = 202)

High ICSEA school students “went on Facebook” less often than did Low or Medium ICSEA school students; but the reverse was true for playing computer games: High ICSEA school students played computer games “several times a week” more often than did Low or Medium ICSEA school students.

4.2.4 Other technologies

What is accessed and how often

Table 7: Response to question “Sometimes I do things such as…”

n = 202	Every day	Several times a week	About once a week	Once or twice a month	I’ve done this once or twice	Not at all
	%	%	%	%	%	%
I use Skype	7	7	8	21	23	33
I watch YouTube	24	38	24	8	4	1
I upload videos to YouTube	0	1	1	5	21	70
I create a blog for fun	2	3	3	1	7	83
I create a podcast for fun	0	0	0	0	1	97

Table 7 suggests that watching YouTube was the main "other" technology that is used from the available options in the survey. **Figure 10** below highlights the differences in the useage of these technologies for this cohort.

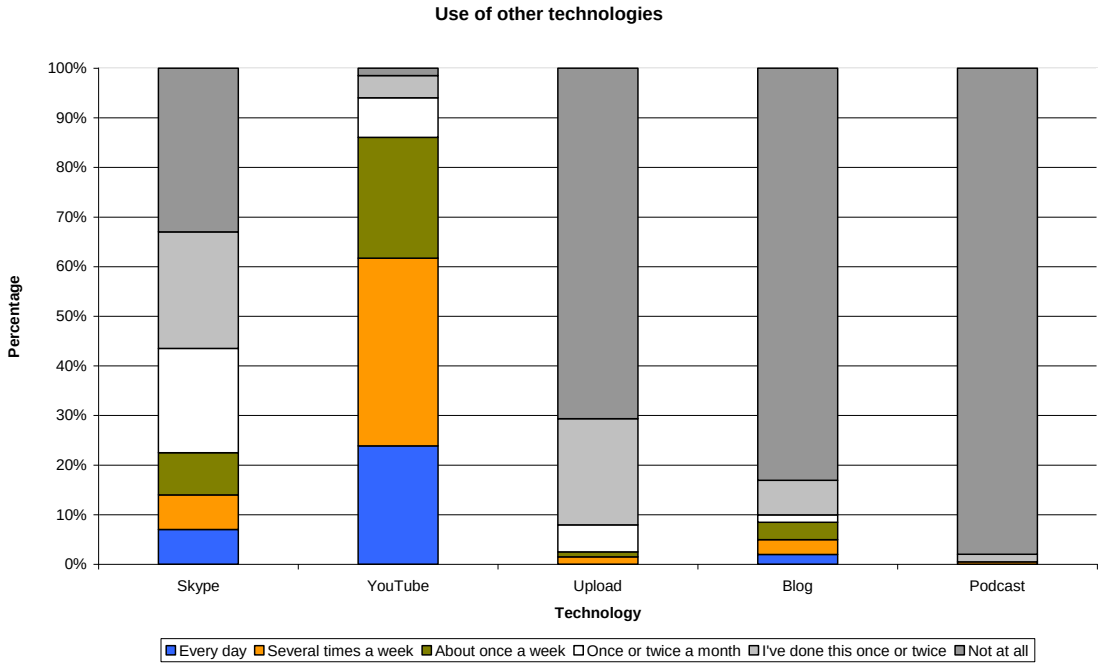


Figure 10: Other uses of Digital Technologies (n = 202)

Correlates

> *Well some days I would swim because I do swimming; I would use the computer but if I had homework I would do that first. [I use] Skype to talk to friends and relatives. It's easier to Skype them than call.*
> "Shirley", Yr 8, Aged 13

YouTube was viewed regularly by all ages; 59% of 12 year olds view it between once and several times a week; 75% of 15 year olds; but there was a decline by 18 years to 48%. Skype was used roughly the same amount at all ages: approximately 20% of students use it "once or twice a month". There was a slightly higher useage for "once a week" with 12 and 13 year olds – again around 20% for these ages, compared to less than 10% in the other age groups. Skype was used much less by Low ICSEA school students than by High ICSEA students (p = .0002).

The other technologies in this cluster included "uploading technology"; "creating a blog" and "creating a podcast". These uses of technology are active and creative, as opposed to passive entertainment (YouTube) or communication (Skype). These creative technologies were far less frequently used. Uploading videos was done little by all age groups; however, students aged 13, 14 and 15 were more likely to have "done this once or twice" than students in other age groups (p = .005). Further,

students from high ICSEA schools were more likely to upload materials than those from other ICSEA categories. Girls were more likely to create a blog than boys, but few of either gender did this.

Purposes of use of technologies

Table 8: Purpose of use of digital technologies

n = 202	Every day	Several times a week	About once a week	Once or twice a month	Not at all
	%	%	%	%	%
Relax, for example: download and listen to music, play games, watch sport or a movie	58	26	10	6	0
Create something, for example: compose music, write stories or blogs, or use applications such as Adobe or Photoshop	10	11	18	22	38
Communicate with my friends	58	28	6	4	3
Communicate with my family	39	26	13	10	10
Find information and learn things	39	38	18	3	2
Find and buy or sell things	8	8	14	36	32

Table 8 indicates that relaxing and communicating with friends and family were the main uses for digital technology. Finding information was also a common usage. However, to create something, such as composing music or blogging, were far less typical uses. Interestingly, a number of students were starting to use the commercial aspects of the internet – buying and selling things.

> *Most of the time I do homework or an assignment or else I'll relax and listen to music on my Ipod or my computer. [I watch] TV sometimes…I like doing card-making and I like seeing my friends, oh and dancing – I like doing ballet and contemporary and I have lessons weekly.*
> "Petal", Yr 8, Aged 13

Correlates

Students aged 15-18 years were much more likely to use technologies to "find information" every day, than were other age groups (p = .019). Fifteen year olds were more likely than other age groups to "create something" every day, or several times a week. Eighteen year olds were more likely to "find and buy or sell things" than other age groups, mostly "once or twice a month".

Whereas girls were more likely to create a blog, boys used technology in general to "create something" more than girls did, including composing music, or using applications such as Adobe or Photoshop; but this difference is not statistically significant.

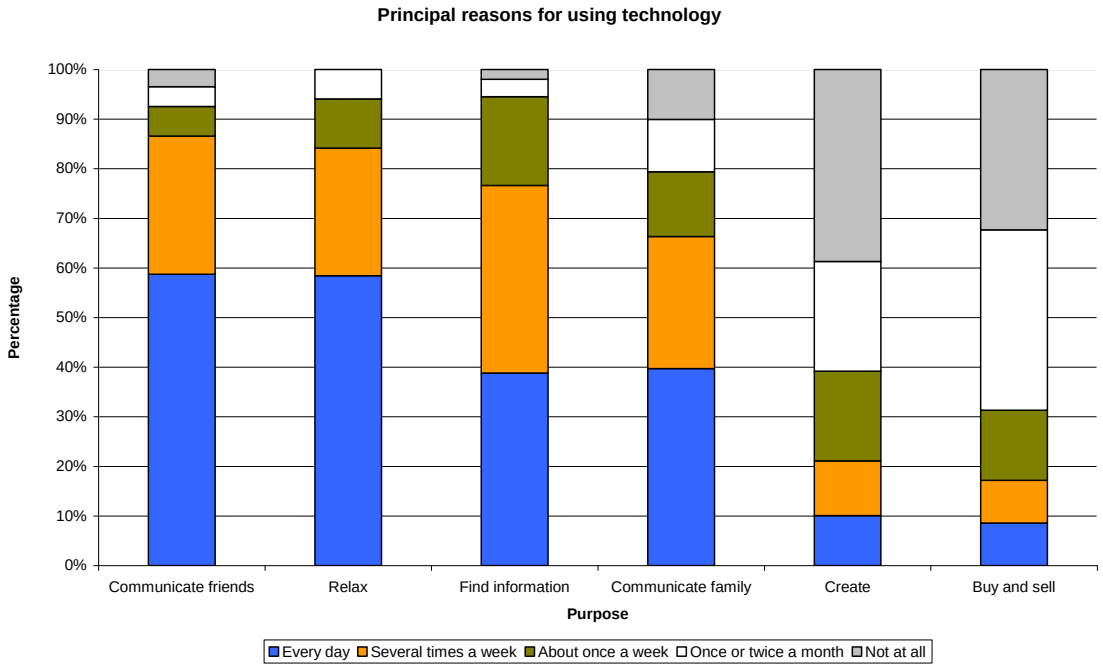


Figure 11: Reasons for using Technologies (n = 202)

Use of digital technologies for creative purposes lagged far behind social, communication and information seeking purposes. **Figure 11** above highlights the patterns in useage: relaxing, communicating with friends, communicating with family, and finding information, are the main reasons for accessing technology on a regular basis.

4.2.5 Favourite activities

When asked to write their "favourite activity" using technology, texting and/or communicating with friends and/or Facebook were given as their "favourite activity" by 34% of students. Twenty six percent listed gaming as their favourite activity when using technologies. Downloading and listening to music was the next most common response (15%). Other responses, such as watching YouTube, were mentioned, but much less commonly. These data support findings summarised at Tables 7 and 8 regarding which technologies are accessed, for what purposes, and how often. Relaxation and communication are the main drivers of technology use in young people.

4.3 Summary – Young People's Engagement with ICT

Out-of-school activities

When looking at activities undertaken "every day", spending time with family was the most frequent, followed by going on Facebook, and watching TV. When responses "every day" and "several times a week" were combined, the most regular activities were spending time with family, doing homework and watching television. These were

followed by doing jobs around the house, and spending time doing a hobby. “Going on Facebook” ranked 9th. “Other” responses included such varied activities as watching sport, exercising, looking after pets, working on cars and writing poetry. Learning an instrument and having a casual job were the least frequent activities out of school when looking at the sample overall. There were a number of statistically significant relationships between variables and out-of-school activities. These are summarised in **Appendix B**.

Mobile phones

Ninety five per cent of students owned a mobile phone. Over 66% of students owning any type of mobile phone nominated their frequency of use as either “many times a day” or “all the time”. With regard to 24 hour phone access, sixty four per cent of students slept with their phone turned on next to their bed either all the time (49%), or “sometimes” (15%). Interestingly, the habit of sleeping with the phone turned on at the bedside developed with age through the sample. By 18 years of age, 82% of subjects “always” or “sometimes” had their mobile turned on all night.

Technology at home

Ninety nine per cent of students had the internet at home. Over 80% of students indicated that they had access to either a home computer or a laptop; a range of other technologies was also available. The general trends in ownership of digital technologies was broadly similar; but overall ownership of technologies was lower in Low ICSEA schools, than in High and Medium ICSEA schools.

Facebook

Eighty per cent of students had a Facebook presence. There was a relationship between Age and Facebook presence – the older the teenager, the greater the likelihood that they will be on Facebook. This relationship was highly statistically significant, as was the same association between Age and how often Facebook was accessed.

Frequency of use for Facebook was rated as “often” (every day) for 67% of students when asked in the context of use of technology. When asked in the context of what students do after school, the “every day” response was 47%, and the “several times a week” response was 14%.

With regard to *presence* on Facebook as a function of Gender, there was no real difference. However, with regard to *frequency of use* of Facebook as a function of Gender, there was a difference: 65% of girls access Facebook “every day”; compared with 48% of boys, although this difference was not statistically significant.

Computer games

Eighty six per cent of students played games on their technology at home (e.g. on Playstation, PC, Xbox). Students tended to fall into two broad categories of game playing. Either they played “first person shooter games” such as Call of Duty; or they

played imaginative games such as “The Sims”. Many entertained themselves on their mobiles with apps such as “Fruit Ninja”. A number of participants played a range of games across different platforms.

Boys played computer games statistically significantly more than did girls. With regard to how often games were played as a function of Age, ages 12 to14 years (ie, school years 7-9) played the most frequently; least frequently were ages 17 and 18 years. Game playing frequency reduced with Age, a statistically significant result.

Although there was a large Gender difference with regard to frequency of game playing, “going on Facebook” every day, or several times a week, was not greatly different statistically as a function of Gender.

High ICSEA school students “went on Facebook” less often than did Low or Medium ICSEA school students; but the reverse was true for playing computer games: High ICSEA school students played computer games “several times a week” more often than did Low or Medium ICSEA school students.

Other technologies

YouTube was the most frequently used other technology; it was viewed regularly by all students, and peaked at age 15 years (75%). Skype was used roughly the same amount at all ages: approximately 20% of students used it “once or twice a month”. Skype was used much less by Low ICSEA school students than by High ICSEA students.

Relaxing and communicating with friends and family were the main uses for digital technology. Finding information was also a common usage. However, to create something, such as composing music or blogging, were far less typical uses.

With regard to their “favourite” use of technology, texting and/or communicating with friends and/or Facebook were listed by 34% of students. Twenty six per cent listed gaming. Downloading and listening to music was the next most common response (15%). Other responses, such as watching YouTube, were mentioned, but much less commonly. These data support findings from this study regarding which technologies are accessed, for what purposes, and how often.

Relaxation and communication are the main drivers of technology use in young people.

5. ATTITUDES TO ICT LEARNING

In this section, students' views on a number of aspects of use of ICT at school, and by teachers, are reported. Students' confidence in using ICT, including sources used for completion of schoolwork, and information literacy skills, are also discussed.

Students' perceptions of ICT as an area of study, and as a future career, are discussed in section 6.

5.1 Use of technology for teaching and learning

5.1.1 Use of technology by teachers

Out of 191 students who responded to this question, 78% would have liked teachers to use more technology in the classroom. Nineteen per cent wanted them to use less. Five students circled both "more" and "less" – depending on the subject to be taught. Although many students liked technology to be used in the classroom, a number commented that there was enough; that it depended on the subject; or that it was useful to make classes more interesting. Twelve students made comments about teachers and their lack of competence with using technology – see **Table 9** below. Responses have not been corrected for grammar or spelling as they provide a more accurate reflection of the student's "voice".

> What's your opinion on teachers using technology in the classroom? *Yep - ... sometimes when we're doing an assignment it'd be nice and handy to visit or explore what's being said. Not to get too sidetracked. I think it's important to get the balance and not to lose the focus of being in the class. It's good to have more from the teacher than from the device.*
> "Luigi", Yr 10

Most reasons for wanting more technology in the classroom included words such as: fun, helpful, entertaining, easier, interactive, interesting. Some students looked at the bigger picture, with comments such as: to "stay up to date'; and "it is quicker and easier, the way of the future".

Table 9: Student comments on teacher use of technology in the classroom

Why or why not, would you like your teachers to use more or less technology in the classroom?
They're not very good with technology usually.
They are too reliant on it and it's annoying when technology fails
because it doesn't always work
The teachers are really bad at using technology
Depends on the teacher and subject. Some subjects (eg Maths) are not suited to technology. Some teachers are incompetent.
It can be distracting and when it fails the (technology) lesson can't go ahead
Because they often don't know how to use it property and it wastes time
sometimes unreliable and time consuming
teachers try to seem impressive using it but don't really know what they're doing; wastes time
Indiffernt really if the teacher is incapaable
It should not take away the actual teacher teaching properly
They are often inept, slowing down learning
(Responses not corrected for grammar or spelling)

Correlates

There was a significant difference between 12-15 year olds and 16-18 years in their views on technology in the classroom (p = .002). For example, although most students in all Age categories would like more technology used by teachers in the classroom, younger students were most keen for this (range between 76% and 88%); whereas 16-18 year old range was 42% (30% wanted less technology; 6 students did not answer) to 68%.

High ICSEA school students wanted more technology to be used (81%) than did Low (72%) or Medium (69%) students. Fewer girls (66%) wanted technology used by teachers more often in classes than did boys (78%).

5.1.2 What should ICT be used for in class?

With regard to students' suggestions about what else technology might be used for at school beyond what they currently experience, representative responses are reproduced in **Table 10** below.

Table 10: Suggestions for use of technology at school

Research	Across all subjects
Playing COD: MW3 or Minceraft or skyping	Teaching
EVERYTHING	Learning and work
Reacher tasks, creat (word)	I woundn't want ot because I'd get distracvted
nearly everything, use laptops with drawing tablets	Taking notes etc
watching videos and doing assignments	Research, improvement in technology
Work	Computer Aided Drawings Couras
finding information	Computer studies, reasearch
playing games	assignments, homework and in-class tasks
Maths	Mainly to type work up
Make writting a lot eaiser	Taking notes and interacting with tachers
Games	Researching and learning with the aid of media (like YouTube)
Doing assignments	to interact with students
Gaming	Typing up work. Assignments
lerning, play games	Games and helpful information
Creative purposes	Science laboratory to design and try out interesting experiments
Videos	*(Responses not corrected for grammar or spelling)*

These responses suggest that students, although mostly in favour of using more technology, do not have any specific uses in mind. The broad categories that responses fall into are: doing assignments/research; typing up notes; or creative purposes.

5.2 Developing competence in end-user ICT skills

5.2.1 ICT as a subject

Correlates

One hundred and six students (53%) had studied ICT as a subject at high school, for at least one year. Most of these students studied ICT in Years 7, 8 or 9 – see **Table 11**. Students least likely to have studied ICT at school were from the High ICSEA school category (43%), compared with Medium (59%) and Low (54%) ICSEA schools. Boys were more likely (57%) to have studied ICT than girls (47%).

Table 11: ICT studied in high school

n = 202	%		%
Year 7	19	Years 7 and 8	2
Year 8	7	Years 7, 8, 9	2
Year 9	10	Years 8,9	1
Year 10	3	Years 9,10	3
Year 11	1	Years 10,11; or 11,12	2
Year 12	0	Years 10,11,12	1

There was a statistically significant relationship between Age, and interest in studying IT (p = .007). **Figure 12** indicates that ages 12 to 15 were the ages at which students were most likely to be receptive to studying IT, as it was in this age range that more students responded "Yes" or "I don't know" to the question.

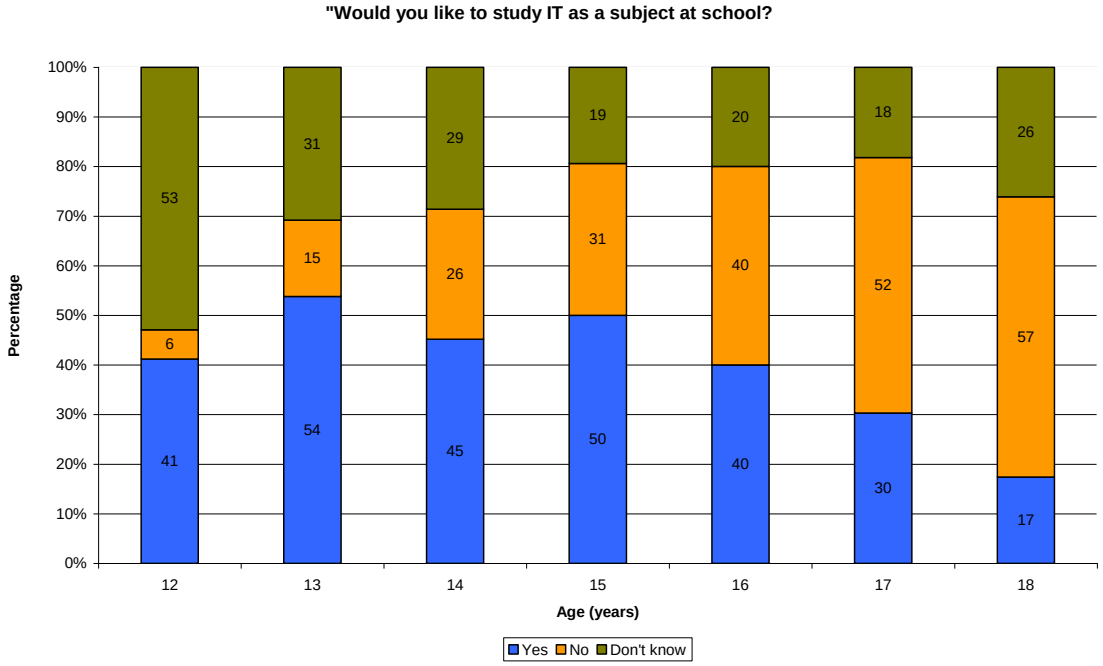


Figure 12: Students who "would like to study IT as a subject at school" by Age (n = 202)

There was a significantly lower percentage (p = .006) of Low ICSEA school students (18%) who were interested in studying IT than Medium (45%) or High ICSEA (47%) school students. Although there was no statistical significance between the number of girls and boys who had studied IT, significantly fewer girls (25%) said they would like to study IT than boys (51%); (p = .002). Typical reasons for wanting or not wanting to study IT are summarised in **Table 12** below.

Table 12: Reasons for wanting to study (or not to study) IT at school

Reasons for wanting to study IT at school	Reasons for not wanting to study IT at school
Because we have a lot of IT today and it's good to learn	Its a bit hard
Its fun and creative	Cause it's not interesting
I find it interesting and its one of my strengths	not that interested
I like computers	I reather learn otehr things but I would if I did nothing else
It is interesting and an important thing to know.	I'm not interested in IT
So I learng how to use the computer well	Not Sure what I want to do with IT
I like using computers	It tends to be tedious plus I don't feel a large benefit from it.
Because I like to understand what happens "behind the scenes"	doesn't look enjoyable
I think it is very fun	Not the place I want to be
to learn new things	*Responses not corrected for grammar or spelling*

Reasons for wanting to study IT contained components of positive emotion (enjoyment, fun, liking); interest; and also evidence of thinking about wider issues such as "an important thing to know". Reasons for not wanting to study IT centred on the individual: lack of interest; perception of difficulty ("hard"); and/or emotion ("tedious").

Effect of prior study of IT

Although the percentage of students who had already studied IT stating that they "would like to study IT" was higher than the percentage of students making such a statement who had not already studied IT, this difference was not statistically significant. Three was a higher percentage of students undecided about studying IT if they had not studied the topic previously, than if they had. **Figure 13** indicates that regardless of whether IT had been studied previously, there was still between 23-31% of students who were at least undecided about whether or not they would like to study IT.

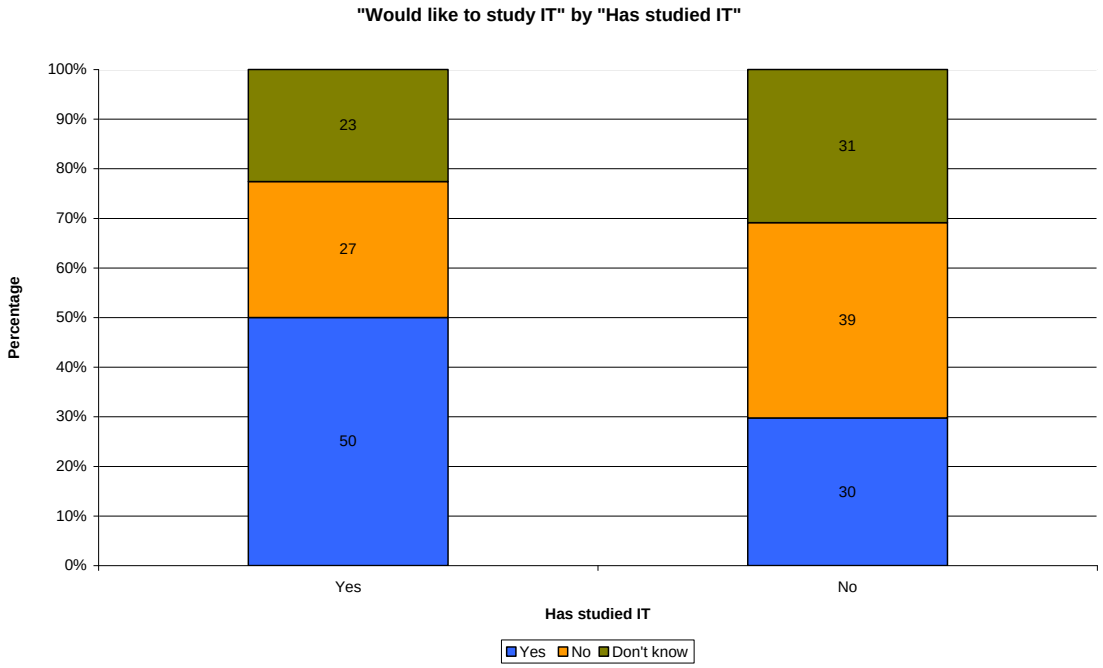


Figure 13: "Would like to study IT" by "Has studied IT" (n = 202)

5.2.2 Confidence in using technology

Of the 199 students who provided a response to this question, 53% "always" felt confident using technology; and 35% "mostly" felt confident. No student chose the "I don't feel confident" option. **Table 13** summarises responses to this question. The main reasons given for confidence with using technology were "I use IT a lot"; "I know what I'm doing" and "It's fun".

Table 13: Confidence in using technology

n = 199			
Option	**%**	**Reasons for Confidence**	**%**
Always confident	53	I use IT a lot	16
Mostly confident	35	I know what I am doing	14
Sometimes confident	4	It's fun	13
It depends what I'm doing	9	It's easy to learn	9
I don't feel confident	0	I like trying out new things	7
	100	*(Respondents were able to choose multiple reasons)*	

Some students commented that their confidence depended on what they were doing. Reasons included "I don't use IT a lot"; I don't enjoy it; I'm not sure I know what I'm doing" and "it's not easy to learn how to use IT".

Correlates

Confidence using IT was high at all ages covered in the study. When "always" and "mostly" responses were combined, there was an almost linear relationship between confidence and Age. Seventy per cent of 12 years olds were confident using computers

"always" or "mostly"; rising to 91% of 17 and 18 years olds. Confidence was approximately the same by Gender. Interestingly, confidence was not influenced by whether or not a student had studied IT as a subject.

What would you like to learn about IT that you don't already know?

A question related to confidence on the survey was: "what would you like to learn about computers and technology that you don't already know?" Responses fell into three broad categories: see **Table 14** below.

Table 14: Aspects of computers that students would like to learn about

n = 120	%
Nothing – no gaps; "not sure"	29
Would like to learn about how they work; programming and codes; how to improve computer performance; "how to fix it if it breaks"	42
Would like to learn about applications such as Photoshop; building websites; graphic design; animation	29
	100

The highest frequency of response to this question concerned learning how computers work, how to fix them, and how to program them.

5.2.3 Sources of information for completion of homework

As **Table 15** suggests, the major source of information for assignments was using the internet at home, every day. Combined with using school computers, 93% of students used the internet to locate information, every day. Teachers were consulted about information for homework and assignments about once to several times a week by students. Friends were consulted on a daily basis by more students than were teachers – although teachers were ahead on weekly consultations.

Table 15: Where do you find information for your homework and assignments?

n = 202	Every day %	Several times a week %	About once a week %	Once or twice a month %	Not at All %
I use the internet at home	71	23	5	0	0
I use the school computers and internet	22	34	23	17	3
I ask my friends	19	36	23	15	6
I ask my teachers	14	35	31	17	4
I use books at home	13	15	22	25	24
My parents help me	12	30	24	17	13
I use the school library	6	17	28	33	15

Where do you find information for homework? *Well firstly I'll check Wikipedia to get my brainwaves then research further through Google and collect information and stick it into a document.*
"Leo", Yr 10

Apart from the options provided in the question, few other means of finding information for assignments were mentioned. Family; grandparents; documentaries; cheating (one response); common sense; consulting people with knowledge; and the News; were noted as possible sources.

5.2.4 Searching on the internet

Favourite "sites" for students when searching for information on the internet were overwhelmingly Google, and Wikipedia. A number of students indicated that they were aware that they "shouldn't use Wikipedia" because it "can be changed by anyone".

Considering the extensive use of the internet to locate information for homework and assignments, and the almost universal use of Wikipedia and Google, the results for the next question were informative.

Origin of information on the internet

Students were asked to select responses from a range of possible sources of information on the internet (**Table 16**).

Table 16: Where does information on the internet come from?

Option (n = 202)	%
Schools and universities	88
Individual people who want to share information, ideas or hobbies	88
Governments	83
Organisations that are "not for profit" eg charities	66
Businesses that want to sell something to make money	60
Other organisations or people, such as: ……	21

There were two interesting findings from this question. Firstly, only 60% of students mentioned "businesses that want to sell something" as a source of information on the internet. The understanding that such sources (usually ending in .com) on the internet may be selective in terms of content is an important one for students to develop.

The second point is that only 21% of students suggested that "other organisations or people" might have content on the internet. Indicative responses are shown in **Table 17** below.

Table 17: What "other organisations or people" put information on the internet?

Response
People who have an intrest in the topic
People who write blogs or articles
Drs, politicians cyropractors
randoms
Online Shops
bad Nigerians conning people
people who pirate stuff, people who put games up
anywhere possible
Anyone with an internet connection
I don't know, it's the internet
(Responses have not been corrected for grammar or spelling)

Correlates

There were no statistically significant correlates on this question, but it is worth noting that students aged 13 were least likely to think that information on the internet comes from Schools (65%) or Governments (72%). Eighteen year olds were most likely (96% and 96%). There were similar results for Business – although only 84% of 18 year old indicated that businesses put information on the internet.

Overall girls were more aware than boys that information on the internet is also provided by not-for-profit organisations and by "other" organisations.

5.2.5 Information Literacy

The ability to evaluate sources on the internet for credibility and relevance are important skills for students to develop. Part of that skill set includes being aware of possible sources of information on the internet (Tables 16 and 17); another is the set of thinking skills known as information literacy. Information literacy encompasses activities that are both technology and non-technology related.

How do you search for information on the internet? *I just type in like the thing I want into Google, I guess.*
How do you decide which link to follow? *Probably if it's just on the first page.*
How do you know it's good information to use? *I just go 'if it's not Wikipedia then I can use it' ☺*
What does .com mean? *I don't know.*
"Fred 2", Yr 9, Aged 14

With regard to their ability to search for and evaluate information located on the internet, **Table 18** below suggests that only approximately half of the students were able to correctly identify concepts or ideas to use in searching; and to evaluate sources located for credibility.

Table 18: Information literacy for searching on the internet

	n	Correct %
Correct identification of main idea or concept	197	52
Correct response for determining factors in scope, credibility and accuracy of information	198	48
Correct response for evaluation of relevance of information on the internet	197	62

Correlates

The ability to determine relevance of sources increased almost linearly from the age of 12 (29%) to the age of 18 (87%). This correlate was statistically significant (p = .001). With regard to concept identification, 18 year olds performed best (65%); 14 and 16 year olds performed worst (40%). Determining credibility of sources was answered best by 13 year olds (65%); and most poorly by 15 year olds (39%), but the result was not of statistical significance.

Girls (60%) performed better than boys (45%) on concept identification, but not significantly.

5.3 Summary – Attitudes to ICT Learning

Results for this research question were interesting. Questions were directed toward determining uses for ICT in the classroom for teaching and learning purposes; and towards gauging students' end-user ICT skills in the context of locating and using information.

Technology in the classroom

Most students indicated that they would like more technology to be used by teachers in the classroom; however, this varied as a function of Age. There was a significant difference between 12-15 year olds and 16-18 year olds, with younger students most in favour of greater use of classroom technology. Although many students liked technology in the classroom, a number commented that there was already enough and didn't want more; that its use depended on the subject; or that it was useful to make classes more interesting. Some students also remarked on teacher competence as a factor in whether or not ICT was used in classrooms. One student commented, "It should not take away the actual teacher teaching properly".

Although mostly in favour of using more technology in the classroom themselves, students generally did not have any specific uses in mind. The broad categories that responses fell into were: doing assignments/research; typing up notes; or creative purposes.

ICT as a separate subject at school

Fifty three per cent of students had studied ICT as a subject at high school, for at least one year. Students least likely to have studied ICT at school were from the High ICSEA category; and boys were more likely to have studied ICT than girls.

There was a statistically significant relationship between Age, and interest in studying IT, with students aged 12 to 15 years being most likely to be receptive to studying IT. Significantly fewer girls thought they would like to study ICT than did boys.

Effect of prior study of IT

Although the percentage of students who had already studied IT stating that they "would like to study IT" was higher than the percentage of students making such a statement who had not already studied IT, this difference was not statistically significant. And regardless of whether IT had been studied previously, there were still between 23-31% of students who where at least undecided about whether or not they would like to study IT. This "undecided" group provides an opportunity to interest students in the study of IT.

Free-text responses about reasons for wanting to study ICT contained components of positive emotion (enjoyment, fun, liking); interest; and also evidence of thinking about wider issues such as "an important thing to know". Liking and enjoyment were common reasons given for why students feel confident in using ICT.

Reasons for not wanting to study ICT in general centred on the individual: (a) lack of interest; (b) perception of difficulty ("hard"); and/or emotion ("tedious"). There was a clear difference between students' perceptions of ICT as enjoyable when viewing technology as an end-user (the great majority of students enjoy using technology); and perceptions of studying ICT as a subject in school.

Confidence using technology

Students overall were very confident with using technology. Fifty three per cent of students "always" felt confident; and 35% "mostly" felt confident. The main reasons given for confidence with using technology were "I use IT a lot"; "I know what I'm doing" and "It's fun".

Although confidence was approximately the same by Gender, with Age, there were some differences. Confidence was high at all ages covered in the study, but when "always" and "mostly" responses were combined, there was an almost linear relationship –confidence grew with Age.

Confidence was not influenced by whether or not a student had studied IT as a subject.

Students were also asked about what they would like to learn about computers that didn't already know. The highest numbers of responses to this question centred on learning how computers work, how to fix them, and how to program them. Although

these are the sorts of topics that are covered in ICT courses; in another question many students had indicated that they believed they would find the study of ICT "tedious". This suggests that students may not always understand what studying ICT is about; and they have not made the connection between what they want to know, and how they can learn it.

Searching on the internet

For most students, using the internet at home, every day, was the major method of locating information for homework and assignments. They used Google to locate information, and Wikipedia frequently as a "first port of call" for background. As far as information literacy and internet searching are concerned, significant minorities of students at all ages did not have a clear understanding of who puts information on the internet (apart from schools and governments); or how to evaluate sources for credibility and relevance.

Data gathered in this study suggest that only approximately half of the students were able to correctly identify concepts or ideas to use in searching; and to evaluate sources located for credibility. The ability to determine relevance of sources increased almost linearly from the age of 12 to the age of 18 years. This correlate was statistically significant.

6. STUDENTS' PERCEPTIONS OF CAREERS IN ICT

In order to provide the fullest information possible on this topic, students were asked a range of questions that fell into three broad categories. The intention was to determine the gap (and therefore the opportunity) between the number of students interested in Maths, Science and Technology subjects, and those who had considered ICT as a career.

Firstly, to determine discipline interests, students were asked about the subjects they liked to study. Secondly, in order to find out what students know about studying ICT, they were asked a series of questions about their perceptions of such study, to establish whether their understanding of ICT as an area of learning was accurate.

Thirdly, students were asked questions to gauge their understanding of the breadth of work available in an ICT career, and what their current perceptions of such a career might be. Finally, questions were asked to determine what students might want from their career generally, and what they might already be considering.

6.1 What subjects do students like to study?

Over the course of their secondary schooling, students study core subjects such as English, Maths, Science and Studies of Society and the Environment (SOSE), Sport or Physical Education. Depending on which school year students are in, and to a certain extent, which school, elective subjects might include such areas as Cooking, IT, Geography or Law. The following discussion should be read with these differences in mind.

Three questions were asked about favourite subjects at school. These questions were not presented in sequence, in order to triangulate response consistency. **Table 19** summarises the first set of responses to this question, in which students needed to write their own choice, without prompts. Physical Education was the favourite subject, followed by Maths and Science.

Table 19: What are your favourite subjects at school?

Subject **n = 202**	**%***
PE	35
Maths	29
Science	25
English	22
History, SOSE	22
Computer studies	17
(Respondents were able to list multiple subjects)	

Results for the "free text" responses above were broadly similar to the second set of responses in "tick the box" format, summarised in **Table 20**. That is, Sport/PE, Maths, Science English and History were all mentioned as the top five most enjoyed subjects, although not in the same order. The lower percentages represented in **Table 19** may be due to the fact that students had to hand-write their responses; and they did not have the "prompt" of a number of subjects already listed for them, as they did for the responses in **Table 20**.

Table 20: What subjects do you enjoy?

Subject n= 202	%	Subject n = 202	%
Sport	68	IT	31
Science	59	Languages	31
English	54	Other*	29
History	53	Psychology	28
Maths	52	Geography	27
Cooking	44	Law	18
Design	42		
		*eg Drama, Music, Art	

As the number of male respondents to the survey was much larger than females, data were also analysed removing all 38 subjects from a participating boys' school. Results were unchanged regarding inclusion of the same five subjects in terms of enjoyment – for both **Table 19** and **Table 20**. Results excluding one male cohort were: Sport 65%; Science 59%; English 54%; Maths 52%; History 51%.

Correlates

It should be kept in mind when interpreting these data that IT as a subject has been studied by 53% of the sample, as opposed to 100% of the sample having studied Maths and Science. Therefore the percentage of students indicating that they enjoy IT would be correspondingly lower. Unsurprisingly, there was a statistically significant relationship between students who had studied IT, and students who enjoyed studying IT (p = .000051). With regard to enjoyment of IT, there was a very large statistically significant difference between girls and boys: 13% of girls enjoyed IT; compared with 42% of boys (p = .000069).

In response to the question "what subjects do you enjoy? (Table 20), students enjoyed studying IT least at ages 12 and 17. The ages at which there was most interest in IT were 13, 14 and 15 (p = .001). Years 8, 9 and 10 were the school years in which IT was most "liked" by students (p = .006) – see **Figure 14.**

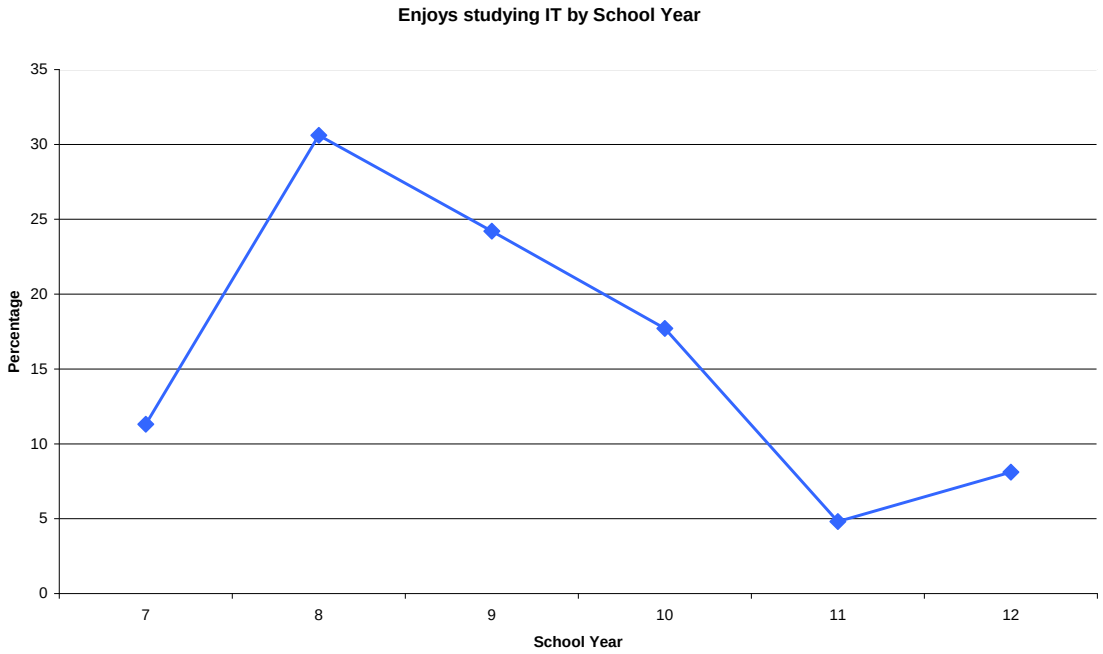


Figure 14: Enjoys studying IT by School Year (n = 62)

Approximately 47% of girls enjoyed Maths, compared with 55% of boys. But there was a statistically significant difference in Science, which was enjoyed by 49% of girls, and 66% of boys (p = .030). With regard to enjoyment of IT, there was a very large difference between girls and boys: 13% of girls enjoyed IT; compared with 42% of boys (p = .000).

Interest in subjects was also gauged by a third cluster of questions, summarised in **Table 21** below.

Table 21: Interest in Science, Maths and Computers

	n	Yes %	No %	Don't Know %
Do you like studying Science?	200	64	24	12
Do you enjoy doing Maths?	201	60	31	9
Are you interested in how computers work?	202	52	28	20

The percentages of students interested in Science and Maths were broadly comparable to the percentages represented in **Table 20**. However, there was a difference of more than 20 percentage points between positive responses to enjoyment of IT as a school subject (31% - **Table 20**); and interest in "how computers work" (52% - **Table 21**).

This could partly be accounted for by the fact that IT is not usually a "core" subject as is the case with Maths and Science; yet the data in **Table 21** suggests that the relationship is not so simple. The percentage of students interested in "how computers work" is much closer to figures for liking Maths and Science than in either **Table 19** or **Table 20**, and the number of "don't know" responses compared to Maths and Science suggests some uncertainty, and therefore an opportunity to engage students in this field. Further, as **Table 21** indicates, there was a higher percentage of students who "don't know" if they are interested in "how computers work" (20%) compared with students giving the same answer with regard to Science (12%) or Maths (9%).

It may be that a lower rate of interest in Information Technology as a subject of study may simply be a matter of student perception, and a lack of understanding of what the study of ICT entails. This could be a result of a number of factors – including curriculum design, subject availability, course advice and parental influence.

Correlates

The following three Figures summarise trends in student enjoyment in studying Science, studying Maths, and interest in "how computers work", as a function of Age.

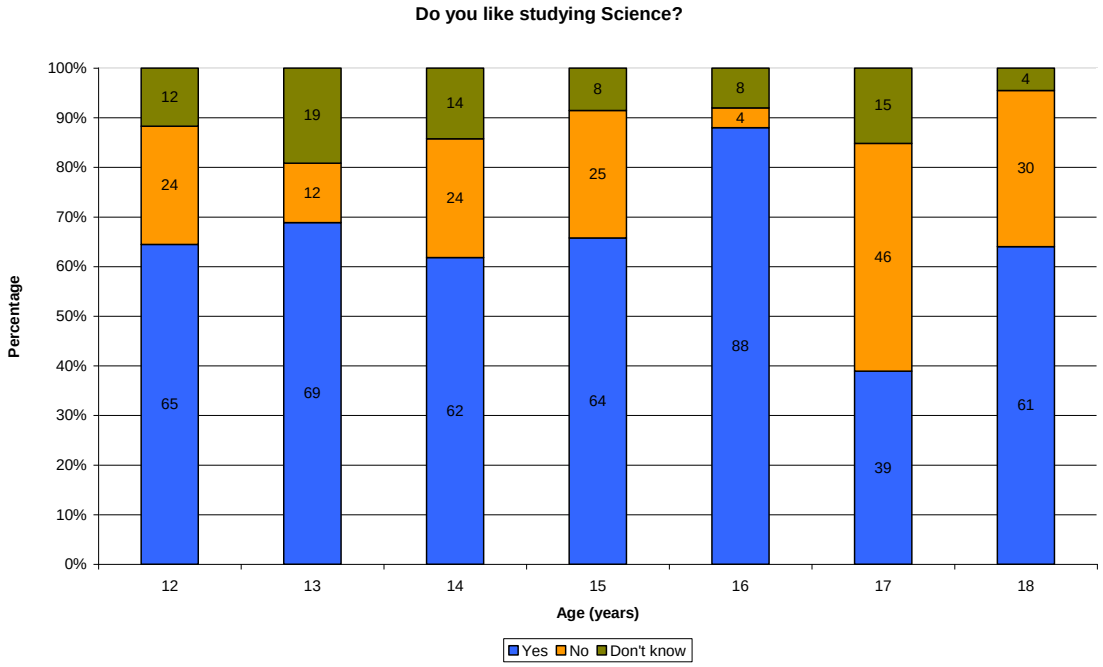


Figure 15: Response to "Do you like studying Science?" by Age (n = 202)

> *I want to do something in IT or game development – I'm really good at IT and find it really easy. Maths and Science – I'm good at both. I can remember formulas and it's really easy for me to get high marks. I'm good at Chemistry. And Biology, and get reasonable marks in Psych as well. I find it interesting about how things develop*
> "Stanley", Yr 9, Aged 15

With regard to Science (**Figure 15**), there was a peak in interest at 16 years (88% "Like studying Science"); but this interest dropped off dramatically by 17

years of age. There is a possible age for which Science teaching is crucial to the development of future interest: at 13 years, 19% of students “don’t know” if they like Science. This was the highest percentage of students as a function of Age that was undecided. Perhaps Science promoted to this age group in particular could help undecided students become part of older aged cohorts who “like studying Science”, rather than those who do not “like studying Science”, in later years.

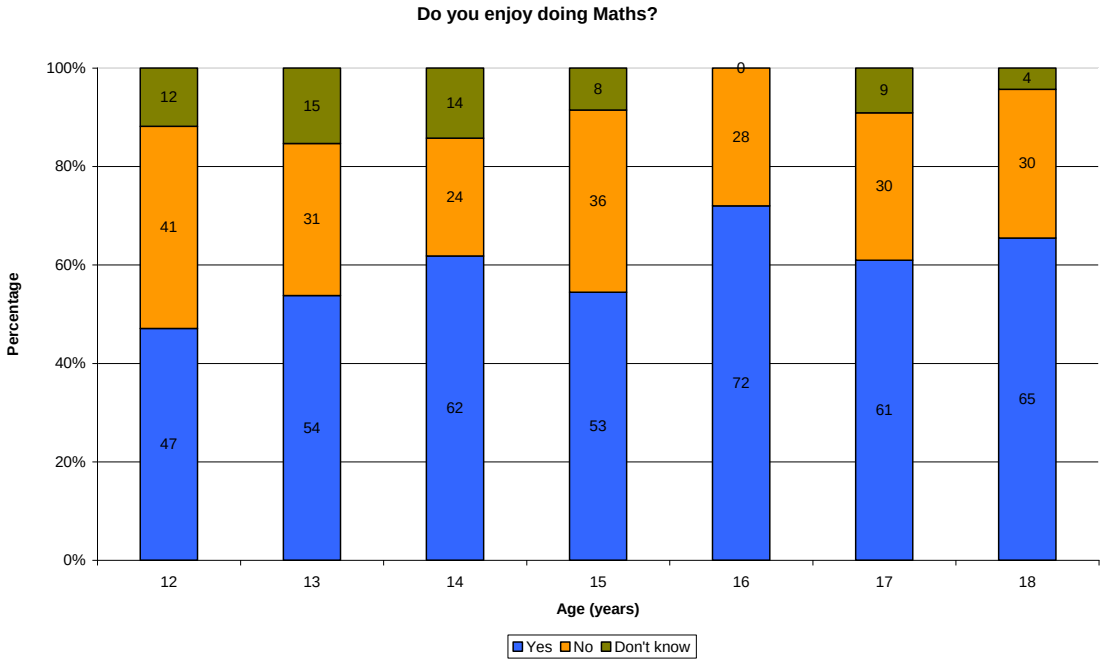


Figure 16: Response to "Do you enjoy doing Maths?" by Age (n = 202)

With regard to Maths (**Figure 16**), a high percentage of students did not enjoy Maths at Age 12, which again as in the case of Science, converted to a high percentage of “do enjoy” by Age 16 (72%). Interest in Maths did not drop off at ages 17 and 18, as was the case with Science. Interest in Maths was more polarised than in the case of Science; but again at age 13 years, there might be an opportunity to interest students in Maths, as in this year, and at age 14, the “undecided” cases were highest. Also at age 14, the response “do not enjoy” to this question was the lowest.

> *Well, Maths isn’t my greatest subject but I really like Science, which is my greatest subject.*
> “Trinity”, Yr 7, Aged 12

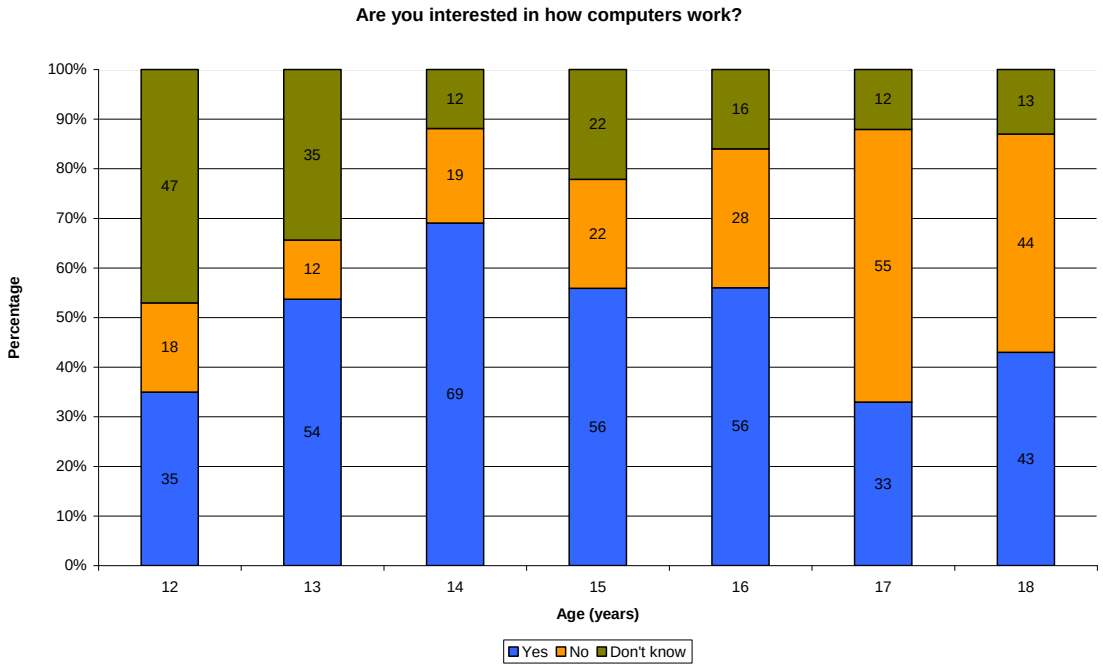


Figure 17: Response to "Are you interested in how computers work?" by Age (n = 202)

With regard to the question “Are you interested in how computers work?” (**Figure 17**), the relationship with Age was statistically significant (p = .001). The same significant relationship was reflected in the analysis by School Year, with students in Years 8 and 9 being most interested in “how computers work” (p = .003). Importantly, interest in “how computers work” was not statistically related to whether or not students had studied IT as a separate subject.

Figure 18 below indicates the trends in response to the two key questions “Are you interested in how computers work?” and “Would you like to study IT as a subject at school?” as a function of Age. At all ages except 12 years, interest in how computers work is either equal to, or exceeds, an interest in studying IT at school.

In the case of capturing students’ interest in “how computers work”, and encouraging the study of IT at school, the opportunity seems to be at ages 12 and 13, when high percentages of students are either interested, or undecided, with regard to computers and study of IT. By age 14 years, 69% of students were still interested in how computers work; but the number of students interested in studying IT at school had declined from 54% to 45%. Importantly however, 29% of students at the age of 14 years were still “undecided” about whether they would like to study IT at school.

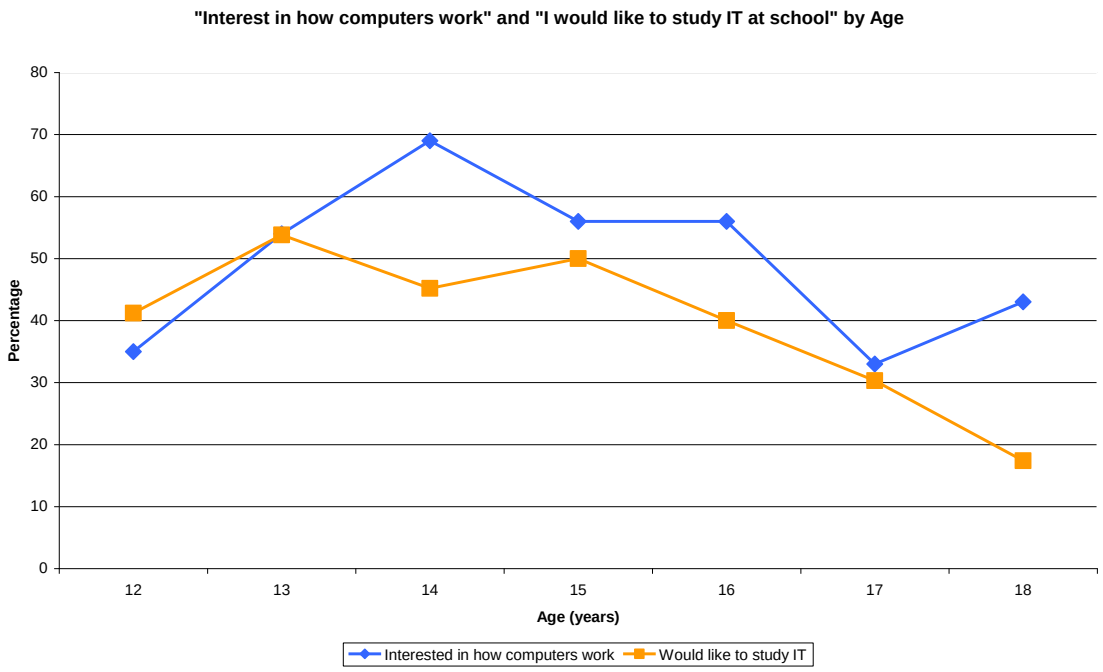


Figure 18: "Interest in how computers work" and "I would like to study IT at school" by Age (n = 202)

In Medium ICSEA schools, “like Science” was lowest of the three ICSEA school categories (58%), compared with 72% for Low ICSEA and 64% for High ICSEA schools. A negative response was highest in Medium ICSEA schools (33%), compared with 15% for Low ICSEA and 18% for High ICSEA schools. This result was statistically significant (p = .043).

With regard to Maths, the results were similar for each ICSEA category, with around 60% liking it, and around 30% not liking it. However, Low ICSEA school students disliked Maths (36%) more than the other categories; and High ICSEA school students had the highest percentage of undecided responses (13%). These results were similar for “Are you interested in how computers work”. The highest level of “don’t know” responses was 26% in High ICSEA school students; the highest level of “dislike” responses was 33% in Low ICSEA school students.

There was a statistically significant difference in interest in Science between females (53%) and males (69%) (p = .008). There was no difference with regard to Maths. But, as with Science, there was a significant difference with regard to interest in “how computers work” (p = .000), with 31% of girls being interested, compared with 64% of boys. Interestingly, almost double the percentage of girls (29%) responded “don’t know” to this question than did boys (15%).

6.2 Perceptions of studying ICT at university

Most students believed that studying ICT at university would be interesting (62%), but not very easy (55%). **Figure 19** sets out the data on these issues.

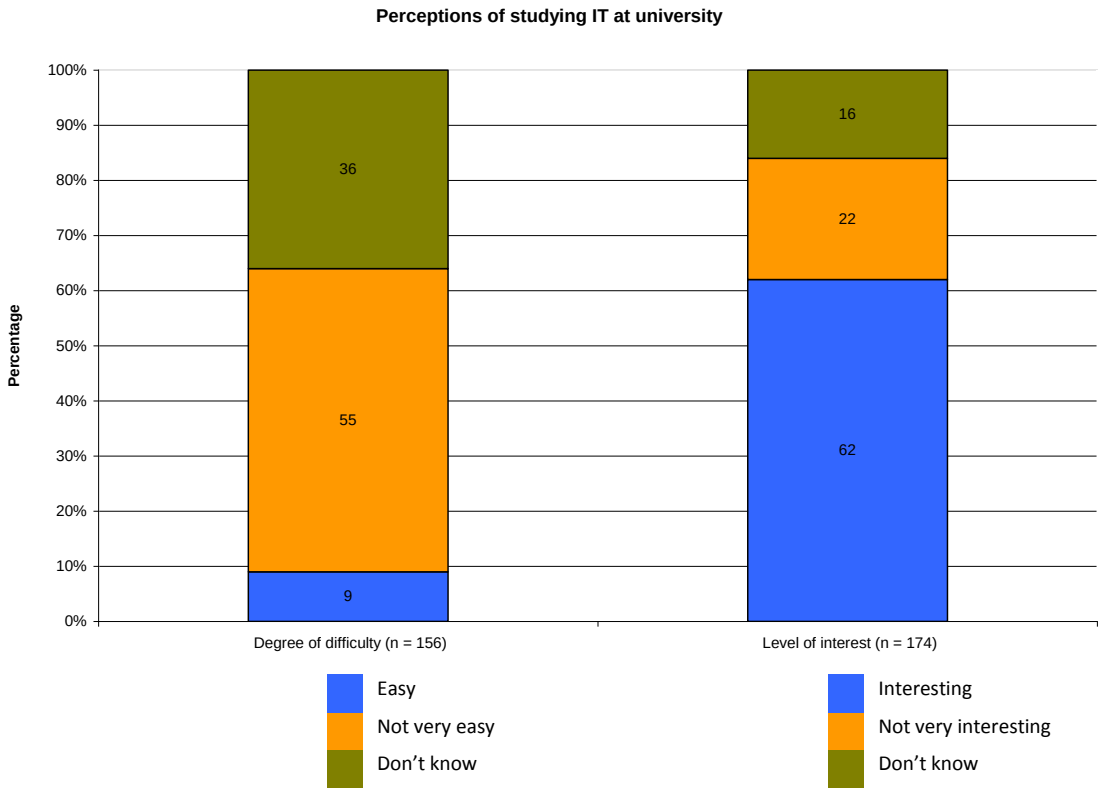


Figure 19: Perceptions of Difficulty and Interest in studying IT at university

Correlates

There was a statistically significant linear relationship between Age, and belief that studying IT would be interesting (p = .022). At age 12 years, the highest percentage of students thought that IT study would be interesting (80%); no students thought that the study of IT would be uninteresting, and 20% "don't know". By the time they were 18 years old, only 38% of students thought studying IT would be interesting; 38% thought it would not be very interesting, and 24% "don't know". An appropriate age at which this perception should be challenged is at ages 12/13 years – before interest declines.

There was a statistically significant linear relationship between ICSEA and perception of studying IT as being interesting (Low = 46%; Medium = 62%; High = 70%) (p = .022). Far more boys (76%) believed that studying IT would be interesting, than did girls (44%) (p = .001).

6.3 Do students have a clear understanding of what an ICT career is about?

Most students understood that there is a range of work involved with being an ICT professional, such as graphic design or managing networks. Interestingly however, fewer understood that they design "faster computers" (64%); and only 44% understood that IT work might also involve designing robotic and computer systems; or designing automated landing systems (40%). Again, this suggests that there may be a lack of understanding of the range of work that is available through studying IT (see **Table 22** below).

Table 22: What do you think a person who works in an ICT job does?

Response options n = 202	%
1. They do graphic design, make websites and design computer games	68
2. They design newer, better, faster computers, microchips and mobiles	64
3. They write software, computer programs and apps	76
4. They are computer network managers and analysts and they program computers	78
5. They design robots and computer systems to help doctors	44
6. They manage big computer databases in businesses	71
7. They design things like automatic landing systems for planes	40

Correlates

With regard to response options 2, 5 and 7, Age and ICSEA were the correlates that affected response. Students aged 14 years (50%) and 17 (49%) were least likely to indicate that IT professionals designed faster computers; or robotic systems (33% and 33%); or things such as automated landing systems (33%; 30%).

High ICSEA school students were less likely to indicate their understanding of IT professionals' work as including activities suggested in options 2, 5 and 7. In fact, for these three questions, percentage responses were linear (downwards) from Low to High ICSEA schools – see **Table 23**.

Table 23: Perception of IT work by ICSEA

ICSEA n = 202	2. Faster computers (%)	5. Design robots (%)	7. Landing systems (%)
Low	77	56	46
Medium	62	45	44
High	60	36	32

6.4 Perceptions of ICT work

Most students (80%) thought that an IT job would enable creative thinking, and a little more than half of the students believed that working in IT would be fun (52%). In contrast, 54% students also had a negative perception - that working in IT would mean sitting at a computer all day (**Table 24**).

Table 24: Responses to questions on perceptions of IT jobs

	n	Yes %
Would having a job in IT let you think creatively?	193	80
Would working in IT be fun?	189	52
Would working in IT mean sitting at a computer all day?	192	54

6.5 What students want from a career

Data summarised in **Figure 19**, and **Table 22** and **Table 24** about perceptions of ICT study and work contrasts with data in **Figure 20** about what was important to students in a career generally. It was "important", or "moderately important", to nearly all students to have a job that was interesting and well paid. The great majority also wanted to "make a difference" and to use creativity. In contrast, a significant minority (34%) of students indicated that it was "not very important" whether they used IT, Science or Maths; and over half (57%) did not feel it was important whether they used these subjects or not.

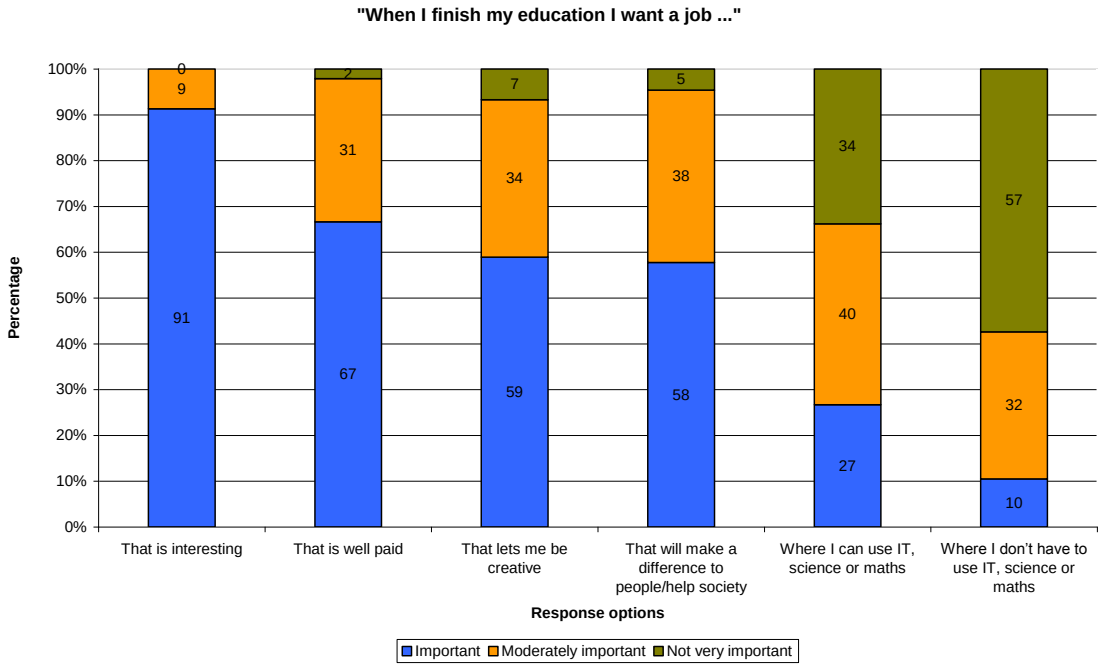


Figure 20: Responses to "When I finish my education and start my career, I want a job…"

Correlates

There was a statistically significant relationship between Age, and wanting a job that "makes a difference"; older students were more interested in "making a difference" than were younger students (p = .012). There was a relationship between Age and the importance of a job that allowed creativity; 71% of 12 year olds wanted creativity, compared with 48% of 18 year olds. Interest in a well paid job peaked at 14 years (74%) and was lowest at 18 years (52%).

Girls were more interested than boys in a job that allowed creativity, was interesting, and "makes a difference". Boys were more interested than girls in a job that was well paid.

Have you considered ICT as a career?

Considering general goals for a career discussed above, it is important to note the disjunction between what students stated that they want in a career (interesting work, good money, creative, to help people); their statements about working in ICT (would allow creative thinking; studying IT would be interesting); and their views on IT in general - only 31% of students had considered IT as a career. It is possible that a number of students are not aware that careers in IT are able to meet their generalised career needs for interesting work, good pay and creativity.

Correlates

With regard to who has considered IT as a career, there was a statistically significant difference between girls who had considered an IT career (16%) and boys (68%) (p = .000). As girls do well in Maths and Science, they might also do well in ICT; but clearly there is much work to be done regarding girls' perceptions of IT study and careers.

As **Table 25** suggests, many students had already thought about future careers; some of them were quite certain about what they would do. Many students had a particular career in mind. Responses to the question "Do you know what you want to be when you grow up?" ranged from "Not sure yet" to "Maxial facial surgeon". The sample responses below indicate the importance of "interest" and "enjoyment" to students in their choice of career. Given that 62% of students believed that studying IT at university would be interesting (**Figure 19**), the suggestion that there are opportunities to engage students' interest in IT beyond current interest as measured in this survey, is supported.

Table 25: Sample responses to the question "What do you want to be when you "grow up"?

I want ot work in international law or become a neurologist.	Prim Minister of a semi-artificial island I'm designing or programmer
physiotherapist because I want to help people	Not sure yet
Physiotherapy, I want to help people in physical pain/discomfort	physiotherapist or Personal trainer.
physcistrist	No I don't.
Hairdresser or vet. They are just what I've alays wanted to do.	(Mechanic) I have worked with cars since I was 4 yo
I want to be a games developer as computer games are my primary hobby.	Maxial facial surgeon
Writer of psychologist – something I enjoy	Not sure yet
Medical Researcher – because I enjoy Science	Yes, I have researched hard
Primary school teacher – because I love kids!	Possibly a plumber. The work is interseting and it is generally well paid.
Navy or firfighter I want to help people	engineer cause it's interesting and I'm good at math and you can earn a lot of money
Computer science or software engineer. I enjoy it.	Web and Graphic Designer, AFP Federal Agent
I want to be in the designing industry … I love creating things.	Mechanical Engineer
Performer	I've always wanted to be a psychologist because it's interesting
forensic scientis, so I can help others, the topic interests me	Economist - Because it's commerce on a glocal scale.
I would like to be a computer programer or work in it	Combat Engineer
I like the idea of being a programmer or an investment banker because I like selling things and coding	joing the army and later the SAS
Solder, phycologist, telemarketer	Phsyciatrist, Policeman, Teacher -= the careers interest me
IT I enjoy it.	I wish to be a history teacher. It seems interesting.
Embassador Because I can speak 3 languages	I'm thinking maybe a Graphic Designer or VFX programmer, because that is what I enjoy doing.
Muscian, because music is my life. That's why.	Behaioural forensics - I enjoy breaking down an instance using phycology
Military engineer and a soldier.	Architec, beause i love desing house
Astranaut	builder for money
Carpenter because im interested in it.	*(Responses are not corrected for grammar or spelling)*

Correlates

There was a distinct difference in the range of careers that had been considered by students as a function of school ICSEA category.

For example – Year 7 and 8 students from a Low ICSEA school provided limited responses to this question. Three students were not able to suggest a career they had thought of yet. Only two students provided a reason for their choice.
In comparison, High ICSEA school responses for the same age group showed a much wider range of choices being considered; and supporting reasons were more differentiated, for example" "I like the atmosphere in the hospital"; "everyone deserves a happy life"; "it's fun arguing with people". **Table 26** provides examples of these differences.

Table 26: Comparison High and Low ICSEA Years 7 and 8 - Careers

Low ICSEA Years 7 and 8	High ICSEA Years 7 and 8
I love animals, so I think I might want a career in animal care.	Prim Minister of a semi-artificial island I'm designing or programmer
Maybe a chef or an author of a bestseller, I don't know	I want to be an architecture beuse I love designing houses
Not really.	Doctor. I like the atmosphere in the hospital
.	I want to be something to do with horses or a history teacher
no.	I would like to be a lawyer, it's fun arguing with people.
Police women, lawyer, nurse because I think I would enjoy it.	I want to be a defender of human rights because everyone deserves a happy life :)
I would love to be a cheff or pe teacher	Scientist, programmer, author or Music teacher
	I would like to be in a job to do with sport (eg: Sports statistician).
(Responses are not corrected for grammar or spelling)	I would like to be a doctor when I grow up as it will let me communicate with the society and meet new people. However I wouldn't mind having a job in IT either.

These differences were still evident in Year 11 and 12 students in Low and High ICSEA schools; see **Table 27** below.

Table 27: Comparison High and Low ICSEA Years 11 and 12 - Careers

Low ICSEA Years 11 and 12	High ICSEA Years 11 and 12
navy or firfighter I want to help people	land developer/Dentist-orthodontist
Nope	In The Milatary or Videogame designer
Builder find it interesting and satisfying	An engineer (perhaps involved with IT) allows me to solve problems.
No	Dentist, my dad works in the medical feild and it seems interesting.
strength and conditioner. Interested in human movement	Embassador Because I can speak 3 languages
Computer science or software engineer. I enjoy it.	doctor, I enjoy biology and chemistry
Physcatric nurse, Because I'm good at that field and I'm a caring person and I believe I could do very well.	An engineer (perhaps involved with IT) allows me to solve problems.
A writer/author, because I enjoy reading and creative writing	Engineer (Aerospace)
something to do with sport or Navy or electrition or mines	Director, Screenwriter
No	IT running an IT business or group
Hairdresser	Polititon
Photographer or psychologist because they interest me greatly	Property Developer
Sport Science, Biomechanics. Because I like sport and want to do it as a job.	
	(Responses are not corrected for grammar or spelling)

6.6 Summary – Students' Perceptions of Careers in ICT

This question focussed on aspects of engaging students as future ICT professionals.

Unsurprisingly, there was a statistically significant relationship between students who had studied IT, and students who enjoyed studying IT. With regard to enjoyment of IT, there was a very large statistically significant difference between girls and boys: 13% of girls enjoyed IT; compared with 42% of boys. The ages at which there was most interest in IT were 13, 14 and 15. Years 8, 9 and 10 were the school years in which IT was most "liked" by students.

There was a difference of more than 20 percentage points between positive responses to enjoyment of IT as a school subject (31%); and interest in "how computers work" (52%). The percentage of students interested in "how computers work" was much

closer to figures for liking Maths and Science than were the figures for liking IT as a subject. The number of "don't know" responses concerning interest in "how computers work" compared to Maths and Science suggests some uncertainty, and therefore an opportunity to engage students in this field. Further, there was a higher percentage of students who "don't know" if they are interested in "how computers work" (20%) compared with students giving the same answer with regard to Science (12%) or Maths (9%).

It may be that a lower rate of interest in Information Technology as a subject of study may simply be a matter of student perception, and a lack of understanding of what the study of ICT entails. This could be a result of a number of factors – including curriculum design, subject availability, course advice and parental guidance.

With regard to Science, there was a peak in interest at 16 years; but this interest dropped off dramatically by 17 years of age. There is a possible age for which Science teaching is crucial to the development of future interest: at 13 years, 19% of students "don't know" if they like Science. This was the highest percentage of students as a function of Age that was undecided. Perhaps Science promoted to this age group in particular could help undecided students become part of older aged cohorts who "like studying Science", rather than those who do not "like studying Science", in later years.

With regard to Maths, a high percentage of students did not enjoy Maths at Age 12, which again as in the case of Science, converted to a high percentage of "do enjoy" by Age 16. Interest in Maths did not drop off at ages 17 and 18, as was the case with Science. Interest in Maths was more polarised than in the case of Science; but again at age 13 years, there might be an opportunity to interest students in Maths, as in this year, and at age 14, the "undecided" cases were highest.

With regard to the question "Are you interested in how computers work?", the relationship with Age was statistically significant. The same significant relationship was reflected in the analysis by School Year, with students in Years 8 and 9 being most interested in "how computers work". Importantly, interest in "how computers work" was not statistically related to whether or not students had studied IT as a separate subject.

At all ages except 12 years, interest in how computers work is either equal to, or exceeds, an interest in studying IT at school.

In the case of capturing students' interest in "how computers work", and encouraging the study of IT at school, the opportunity seems to be at ages 12 and 13 and even 14 years, when high percentages of students are either interested, or undecided, with regard to computers and study of IT. Twenty nine per cent of students at the age of 14 years were still "undecided" about whether they would like to study IT at school.

With regard to Gender, there was a statistically significant difference in interest in Science between females and males. There was no difference with regard to Maths. But, as with Science, there was a significant difference with regard to interest in "how computers work", with 31% of girls being interested, compared with 64% of boys. Almost double the percentage of girls (29%) responded "don't know" to this question than did boys (15%).

Perceptions of studying ICT at university

Most students believed that studying ICT at university would be interesting (62%), but not very easy (55%).

There was a statistically significant linear relationship between Age, and belief that studying IT would be interesting. At age 12 years, the highest percentage of students thought that IT study would be interesting (80%); no students thought that the study of IT would be uninteresting, and 20% "don't know". By the time they were 18 years old, only 38% of students thought studying IT would be interesting; 38% thought it would not be very interesting, and 24% "don't know". An appropriate age at which this perception should be challenged is at ages 12/13 years – before interest declines.

Far more boys (76%) believed that studying IT would be interesting, than did girls (44%), and this was a statistically significant result.

Do students have a clear understanding of what an ICT career is about?

Most students understood that there is a range of work involved with being an ICT professional, such as graphic design or managing networks. Interestingly however, fewer understood that they design "faster computers" (64%); and only 44% understood that IT work might also involve designing robotic and computer systems; or designing automated landing systems (40%). Again, this suggests that there may be a lack of understanding of the range of work that is available through studying IT.

Most students (80%) thought that an IT job would enable creative thinking, and a little more than half of the students believed that working in IT would be fun (52%). In contrast, 54% students also had a negative perception - that working in IT would mean sitting at a computer all day.

What students want from a career

It was "important", or "moderately important", to nearly all students to have a job that was interesting and well paid. The great majority also wanted to "make a difference" and to use creativity.

There was a statistically significant relationship between Age, and wanting a job that "makes a difference"; older students were more interested in "making a difference" than were younger students. There was a relationship between Age and the importance of a job that allowed creativity; 71% of 12 year olds wanted creativity,

compared with 48% of 18 year olds. Interest in a well paid job peaked at 14 years (74%) and was lowest at 18 years (52%).

Many students had already thought about future careers. Responses to the question "Do you know what you want to be when you grow up?" ranged from "Not sure yet" to "Maxial facial surgeon". "Interest" and "enjoyment" were very important to students in their choice of career. Given that 62% of students believed that studying IT at university would be interesting, there appear to be opportunities to engage students' interest in IT.

There was a distinct difference in the range of careers that had been considered by students as a function of school ICSEA category. Year 7 and 8 students from a Low ICSEA school provided limited responses to this question. In comparison, High ICSEA school responses for the same age group showed a much wider range of choices being considered; and supporting reasons were more differentiated, for example" "I like the atmosphere in the hospital"; "everyone deserves a happy life"; "it's fun arguing with people". These differences were still evident in Year 11 and 12 students in Low and High ICSEA schools.

Have you considered ICT as a career?

Considering general goals for a career discussed above, it is important to note the disjunction between what students stated that they want in a career (interesting work, good money, creative, to help people); their statements about working in ICT (would allow creative thinking; studying IT would be interesting); and their views on IT in general - only 31% of students had considered IT as a career. It is possible that a number of students are not aware that careers in IT are able to meet their generalised career needs for interesting work, good pay and creativity.

There was a statistically significant difference between girls who had considered an IT career, and boys; but as girls do well in Maths and Science, there is no reason other that attitude that might inhibit their interest in ICT. Although clearly there is much work to be done regarding changing girls' perceptions of IT study and careers, such a task should be attempted. After all, it was not many years ago that girls did not study Law or Medicine.

7. CONCLUSIONS

The results of this study provided confirmation in some areas, and detail in other areas, of our understanding of a range of issues surrounding attitudes toward and use of digital technologies, and the study of ICT. In other aspects, new information was brought to light.

Despite the widespread use of digital technologies at home for communication, relaxation and school work, teenagers still spend most of their time doing what they have done for generations: spending time with family, doing homework, playing sport, doing jobs around the house, and since the 1960s, watching TV. But technologies add more immediate, constantly connected, ways of interacting with friends, or entertainment. Young people today enjoy a kind of "dual citizenship"; for them, one country is the physical space, with a reasonably well understood set of values and expectations; and the other is the digital space, in which expectations are perhaps less clear and well defined. Parents, educators and professional bodies all have a role in assisting young people to make connections regarding values and behaviours in these two environments, and in establishing and maintaining fluency in both "languages".

We know that students are confident using technology, but some results of this study suggest that they are not necessarily as proficient in its use as they feel. This has important ramifications for teaching and curriculum design.

Students are eager for technology to be used in school; and enjoy a range of subjects. We know that despite many being either not interested, or undecided, about ICT as a subject of study, many students do have an interest in "how computers work". They have thought about their futures but may not have sufficient information on some career choices to enable full consideration of options, given their stated interest in certain subjects, and their desire for jobs that are interesting and meaningful. These findings have important ramifications for both professional bodies and for educators.

Data in this study also suggest that consideration of career options by students is constrained by socio-economic factors and possibly by the limitations of parental guidance, and perhaps access to suitable role models or practicing professionals.

But there are many opportunities to encourage the uptake of ICT study and careers that have been suggested in this study. Students do not have a rigid 'mental set' against taking up ICT as an area of study; many in fact, particularly in their early teen years, are either interested, or undecided about the area. Many students think that studying ICT at university would be interesting. Nearly all students would like a career that is interesting to them, and that would "make a difference". This means that with thoughtfully-constructed interventions and structured experiences at the right time in their education, positive student perceptions about ICT should be able to be encouraged. Some of these will translate into an interest in studying in the field.

BIBLIOGRAPHY

Australian Bureau of Statistics (Dec 2010) *In fACT - Statistical Information on the ACT and Region*, No. 1308.8

Australian Curriculum, Assessment and Reporting Authority (ACARA) (2012), *The Shape of the Australian Curriculum: Technologies*, available at www.acara.edu.au

Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum General Capabilities*, available at http://www.acara.edu.au/curriculum/general_capabilities.html

Australian Curriculum, Assessment and Reporting Authority (ACARA), *MySchool* website available at: http://www.myschool.edu.au/

Bingimlas, KA (2009) Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature, *Eurasia Journal of Mathematics, Science & Technology Education,* 5:3, 235-245

Bouhnik, D and Giat, Y (2009) Teaching High School Students Applied Logical Reasoning, *Journal of Information Technology Education,* Vol 8; 16 pages

Canberra Times, The (2012) Australia losing its place in low-carbon economy race: report, 19 March

Chandler Macleod Group (2012), *Leadership in a Patchwork Economy*, White paper available at: http://chandlermacleod.com/-622135/357047leadership-in-a-patchwork-economy

Department of Education, Employment and Workplace Relations (2013) ICT Innovation Fund Projects, available at http://deewr.gov.au/ict-innovation-fund-projects

Department of Education, Employment and Workplace Relations (2011a) *ICT Labour Market Indicators*

Department of Education, Employment and Workplace Relations(2011b) *Skill Shortage List, Australia,* June

De Wit, K, Heerwegh, D and Verhoeven, JC (March 2011) Changes in the basic ICT skills of freshmen between 2005 and 2009: Who's catching up and who's still behind? *Educ Inf Technol* Springer; published online

Department of Innovation, Industry and Regional Development (2009) *Attitudes to ICT careers and study among 14 to 19 year old Victorians,* State Government of Victoria, available at www.mmv.vic.gov.au

Dobson, IR (Feb 2012) *Unhealthy Science? University Natural and Physical Sciences 2002 to 2009/10,* A study commissioned by the Chief Scientist, ISBN 978 1 921916 37 3

Emerson, L, Fear J, Fox, S, and Sanders, E (2012). *Parental engagement in learning and schooling: Lessons from research*, A report by the Australian Research Alliance for Children and Youth (ARACY) for the Family-School and Community Partnerships Bureau: Canberra

Global Innovation Index (2012) World Intellectual Property Organisation (WIPO), available at http://www.wipo.int/econ_stat/en/economics/gii/index.html

Graduate Careers Australia (2013), available at http://www.graduatecareers.com.au/Research/GradJobsDollars/BachelorU25/ComputerScience/index.htm

Grimley, M and Allan, M, 2010 Towards a pre-teen typology of digital media, *Australasian Journal of Educational Technology,* 26:5, 571-584

Hansford, D and Adlington, R (2008) Digital spaces and young people's online authoring: Challenges for teachers, *Australian Journal of Language and Literacy,* 32:1, 35-68

Innovation and Business Skills Australia, *Environmental Scan - 2012: Information and Communications Technologies Industry* available at http://www.ibsa.org.au/Portals/ibsa.org.au/docs/Research%20&%20Discussion%20Papers/Escan/EScan2012/IBSA%20Escan%202012%20-%20ICT.pdf

Macpherson, KJ & Owen, C (2010) Assessment of critical thinking ability in medical students, *Assessment & Evaluation in Higher Education,* 35:1, 45-54

Macpherson, KJ (2004) An information processing model of undergraduate electronic database information retrieval, *Journal of The American Society for Information Science and Technology,* 55:4, 333-347

McMahon, G (2009) Critical Thinking and ICT Integration in a Western Australian Secondary School, *Educational Technology & Society,* 12:4, 269–281

Phelps, R, Graham, A and Watts, T (2011) Acknowledging the complexity and diversity of historical and cultural ICT professional learning practices in schools *Asia-Pacific Journal of Teacher Education,* Feb, 39:1, 47–63

Prensky, M (2001) Digital Natives, Digital Immigrants, from *On the Horizon,* NCB University Press, Oct, 9:5, (15 pages) available at: http://www.albertomattiacci.it/docs/did/Digital_Natives_Digital_Immigrants.pdf

Roberts, M, McGill, T and Hyland, P (2012) Attrition from Australian ICT Degrees – Why Women Leave, *Proceedings of the Fourteenth Australasian Computing Education Conference* (ACE2012), Melbourne, Australia

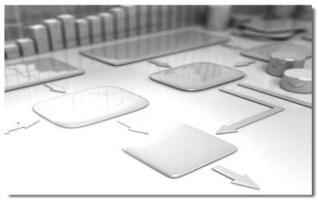
Roberts, M, McGill, T and Hyland, P (2011), Why students leave their ICT degrees: a gender comparison, *ACIS 2011 Proceedings.* Paper 41 http://aisel.aisnet.org/acis2011/41

Soldner, M, Rowan-Kenyon, H et al (2012) Supporting Students' Intentions to Persist in STEM Disciplines: The Role of Living-Learning Programs Among Other Social-Cognitive Factors, *The Journal of Higher Education,* 83:3, 311-336 (May/June)

Sproull, NL (1995) Handbook of Research Methods, 2nd ed, The Scarecrow Press, New Jersey

Youth Central Victorian Government Initiative accessed Jan 2013 available at http://www.youthcentral.vic.gov.au/Jobs+%26+Careers/Industry+profiles/Information+%26+communications+technology/

Walters, M and Fehring, H (2009) An investigation of the incorporation of Information and Communication Technology and thinking skills with Year 1 and 2 students, *Australian Journal of Language and Literacy,* 32:3, 258–272



APPENDIX A

SURVEY: USING DIGITAL TECHNOLOGIES OUTSIDE SCHOOL

Many teenagers use mobile phones and computers when they're not at school for fun, catching up with friends, playing games, doing homework - for lots of different reasons.

We'd like to ask you about what type of apps, games and technologies you use so that we can design programs in school that build on what you know and enjoy about technology.

Please answer these questions as honestly as possible.
There are no right or wrong answers, and this is not a test!

Question 1: About you

1.1 How old are you? ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18
1.2 Are you: ☐ Female ☐ Male
1.3 My school year is: ☐ Yr 7 ☐ Yr 8 ☐ Yr 9 ☐ Yr 10 ☐ Yr 11 ☐ Yr 12

Question 2: About mobile phones

2.1 Do you have a mobile phone? ☐ Yes ☐ No *(If you don't have a mobile, go to question 3).*

2.1.2 Is your mobile a smartphone? ☐ Yes ☐ No
(Smartphones let you use such features as WiFi, download apps, use iTunes, Facebook or gmail. Examples of smartphones are iPhone and Android).

2.1.3 How often do you use your mobile? *(tick one answer)*

☐Once or twice a day ☐Many times a day ☐All the time ☐Hardly ever

2.1.4 What do you use your mobile for? *(tick as many as you like)*

☐ text friends and family
☐ games, eg Drawsomething
☐ use internet to find information
☐ take pictures
☐ phone calls
☐ use Facebook
☐ use internet for fun
☐ other things, like - …… .. .

2.1.5 Do you have fun using your phone? ☐ Yes ☐ No ☐ Sometimes
2.1.6 Do you sleep with your phone turned on next to your bed? ☐ Yes ☐ No ☐ Sometimes

Question 3: About using digital technologies when you're not at school

3.1 Here is a list of some kinds of digital technologies (computers). Do you have any of these at home? *(tick as many as you need to)*

☐ home computer ☐ PC ☐ Xbox ☐ Mac ☐ laptop
☐ netbook, ☐ tablet ☐ Wii ☐ iPad ☐ Playstation ☐ other.....

3.2 Do you have the internet at home? ☐ Yes ☐ No
3.3 Do you like using digital technologies? ☐ Yes ☐ No ☐ Sometimes
3.4 Are you on Facebook? ☐ Yes ☐ No

3.4.1 How often do you go on Facebook?

☐ Often (every day) ☐Sometimes (once or twice a week) ☐ Less than once a week

3.5 What are your favourite apps and services? .....

3.6 Do you play games on your technology (eg on Playstation, laptop, PC, Xbox)? ☐ Yes ☐ No

3.6.1 What games do you play?.....

3.6.2 Do you play those games ☐ with friends ☐ on your own ☐ both ☐ online

3.6.3 How often do you play games?

☐ Often (every day) ☐ Sometimes (once or twice a week) ☐ Less than once a week

3.7 Do you use ☐ Google Maps ☐ Wikipedia ☐ news websites such as ninemsn?

3.8 Sometimes I do things such as: *(for each question, tick the box that most applies to you)*

		Every day	**Several times a week**	**About once a week**	**Once or twice a month**	**I've done this once or twice**	**Not at all**
3.8.1	I use Skype						
3.8.2	I watch YouTube						
3.8.3	I upload videos to YouTube						
3.8.4	I create a blog for fun						
3.8.5	I create a podcast for fun						

3.9 I use digital technologies to: *(for each question, tick the box that most applies to you)*

		Every day	**Several times a week**	**About once a week**	**Once or twice a month**	**Not at all**
3.9.1	Relax, for example: download and listen to music, play games, watch sport or a movie					
3.9.2	Create something, for example: compose music, write stories or blogs, or use applications such as Adobe or Photoshop					
3.9.3	Communicate with my friends					
3.9.4	Communicate with my family					
3.9.5	Find information and learn things					
3.9.6	Find and buy or sell things					

3.10 What is your favourite activity using digital technology? .....

3.11Do you feel confident using computers and technology?
☐ Always ☐ Mostly ☐ Sometimes ☐ It depends what I'm doing ☐ I don't feel confident

3.11.1 If you feel confident, why do you think that is? *(tick as many as you like)*

☐ I use IT a lot ☐ I like trying out new things ☐ I know what I am doing
☐ It's fun ☐ It's easy to learn how to use IT

3.11.2 If you don't feel confident, why do you think that is? *(tick as many as you like)*

☐ I don't use IT a lot ☐ I don't enjoy it ☐ I don't like trying out new things
☐ I'm not sure know what I am doing ☐ It's not easy to learn how to use IT

3.12 What would you like to learn about computers and technology that you don't already know?

.....

Question 4: What do you do when you are not at school?

		Every day	Several times a week	About once a week	Once or twice a month	Not at all
4.1	I play sport					
4.2	I see friends					
4.3	I spend time with my family					
4.4	I go on Facebook					
4.5	I play computer games eg Playstation, Wii, Sims					
4.6	I learn an instrument					
4.7	I do homework					
4.8	I do jobs around the house					
4.9	I have a casual job					
4.10	I read					
4.11	I watch TV					
4.12	I watch TV or movies on the computer					
4.13	I help with making dinner					
4.14	I spend time doing my hobby					
4.15	I do other things, like ……..					

Question 5: About when you're at school

5.1Would you like your teachers to use ☐ more, or ☐ less, technology in the classroom?
Why or why not? .....

5.2What are your favourite subjects at school? .....

5.3If you had a choice, what would you like to use technology at school for?

…….. ……..

5.4 Have you ever studied IT as a subject at high school or college? ☐ Yes ☐ No

5.4.1 In what school year(s)? ☐Year 7 ☐Year 8 ☐Year 9 ☐ Year 10 ☐ Year 11 ☐Year 12

5.5 Would you like to study IT as a subject at school? ☐ Yes ☐ No ☐ Don't know

Why or why not? …….. .....….

5.6 Do you like studying science? ☐ Yes ☐ No ☐ Don't know

5.7 Do you enjoy doing maths? ☐ Yes ☐ No ☐ Don't know

5.8 Are you interested in how computers work? ☐ Yes ☐ No ☐ Don't know

5.9 What subjects do you enjoy? *(tick as many as you like)*

☐ maths ☐ English ☐ science ☐ geography ☐ psychology ☐ cooking
☐ design ☐ IT ☐ sport ☐ languages ☐ law ☐ history ☐ other

Question 6: Where do you find information for your homework and assignments*?*

		Every day	Several times a week	About once a week	Once or twice a month	Not at all
6.1	I use the school library					
6.2	I use the school computers and internet					
6.3	I use books at home					
6.4	I use the internet at home					
6.5	I ask my teachers					
6.6	I ask my friends					
6.7	My parents help me					
6.8	I use other ways to find information, such as ……..					

Question 7: About searching on the internet

7.1 When I'm looking for information on the internet, some of my favourite sites are:

7.2 Information on the internet comes from: *(tick as many as you like)*

☐ schools and universities
☐ businesses that want to sell something to make money
☐ governments
☐ organisations that are "not for profit" eg charities
☐ individual people who want to share information, ideas or hobbies
☐ other organisations or people, such as:

For the next three questions, tick the answer that you think is most correct:

7.3 What is the main idea in the topic: **"the effect of temperature on plant growth"**

1. ☐ effect
2. ☐ temperature
3. ☐plant growth

7.4 The internet:

1. ☐ contains all information available on any given topic
2. ☐ contains only well-researched and accurate information
3. ☐ contains some information that is not true or correct
4. ☐ none of the above

7.5 The relevance of information found on the internet should be evaluated by considering:

1. ☐ the website on which the information is found
2. ☐ the year in which the information was written
3. ☐ the purpose for which you need the information
4. ☐ 1 and 3
5. ☐ 1, 2 and 3

Question 8: Thinking about the future

8.1 What do you think a person who works in an Information and Communication Technology (IT) job does? *(tick as many as you like):*

8.1.1 ☐ they do graphic design, make websites and design computer games
8.1.2 ☐ they design newer, better, faster computers, microchips and mobiles
8.1.3 ☐ they write software, computer programs and apps
8.1.4 ☐ they are computer network managers and analysts and they program computers
8.1.5 ☐ they design robots and computer systems to help doctors
8.1.6 ☐ they manage big computer databases in businesses
8.1.7 ☐ they design things like automatic landing systems for planes

8.2 Do you think studying IT (information technology) at university would be -

8.2.1 ☐ easy ☐ not very easy ☐ don't know
8.2.2 ☐ interesting ☐ not very interesting ☐ don't know

8.3 Do you think having a job in IT would let you think creatively? ☐ Yes ☐ No
8.4 Do you think having a job in IT means sitting at a computer all day? ☐ Yes ☐ No
8.5 Do you think having a job in IT would be fun? ☐ Yes ☐ No
8.6 Have you ever thought about working in an IT job as your career? ☐ Yes ☐ No
Why or why not? .....

8.7 When I finish my education and start my career, I want a job:

		Important	**Moderately important**	**Not very important**
8.7.1	That lets me be creative			
8.7.2	That is interesting			
8.7.3	That will make a difference to people/help society			
8.7.4	That is well paid			
8.7.5	Where I can use IT, science or maths			
8.7.6	Where I don't have to use IT, science or maths			

8.8 Do you know what you want to be when you "grow up"? (eg teacher, hairdresser, scientist, environmentalist, mechanic, manager, doctor/nurse, computer designer, plumber, etc). Why?

.....

Thank you for your help!

APPENDIX B

Summary of Statistically Significant Correlates for Out-of-School Activities

Variable	Activity	Conclusion	Probability
ICSEA	I go on Facebook	High ICSEA school students go on Facebook less often than do Low or Medium school students	.000
Age	I go on Facebook	There is an almost linear relationship between age and "going on Facebook"	.011
ICSEA	I play computer games	High ICSEA school students play computer games 'several times a week' more often than do Low or Medium school students	.041
Age	I play computer games	Playing computer games peaks at ages 13-15; and decreases by the ages of 17-18 years	.011
Gender	I play computer games	Boys play computer games more often than do girls	.000
Age	I play sport	17 year old students play no sport significantly more than do students of other ages	.054
Gender	I play sport	Boys are more likely to play sport than girls	.052
ICSEA	I learn an instrument	High ICSEA school students learn an instrument more often than do Low or Medium school students	.022
ICSEA	I do homework	High ICSEA school students do homework more often than do Low or Medium school students	.006
ICSEA	I have a casual job	Low ICSEA school students are the most likely to have a casual job, followed by Medium, and then High ICSEA school students	.000
Age	I have a casual job	There is an almost linear relationship between age and whether or not the student has a casual job. The older the student, the more likely that they will have a casual job	.000
ICSEA	I read	High ICSEA school students read more often every day than do Low or Medium school students	.016
Age	I read	Students aged 12 and 13 are the more likely to read than older students	.044
Gender	I help with dinner	Girls help with dinner "several times a week" more than do boys	.048