GIFTED TECHSPECTATIONS

A Report On Information And Communications Technology Usage And Expectations Of Irish Gifted And Talented Students For The Irish Centre For Talented Youth

Angelos Alexopoulos, Neil Bruton, Louise Gorman, Kieran Linehan, Theo Lynn and Mícheál O'Leary

Leadership, Innovation and Knowledge Research Centre

Dublin City University

Dublin 9, Ireland

SEPTEMBER 2010

THE LEADERSHIP, INNOVATION AND KNOWLEDGE (LINK) RESEARCH CENTRE
http://link.dcu.ie

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Contact: theo.lynn@dcu.ie

Contact: theo.lynn@dcu.ie

1. Foreword

The Centre for Talented Youth in Ireland (CTYI) was delighted to team up with the LInK Research Centre to participate in this research study. In the current economic climate it is vital that we have well trained computer literate students coming through the education system. Furthermore it is imperative that these students have access to the latest technology to broaden their academic experience. High ability students have often been the innovators and leaders in terms of testing and using this new technology and this study reflects this experience.

However the study also highlights the need for adequate training for teachers in school to make best use of the latest technology advances. The study also demonstrates the need for greater access to technology for students from lower socio-economic backgrounds. Finally it illustrates the importance of allowing students to use their personal laptops in class or ideally the provision of one to one computing for every student in the country. The educational benefits of working with technology can't be overemphasised. At the moment high ability students seem to be compensating for the lack of facilities in school by training themselves in the latest technological advances. Unfortunately the research shows that the students are often not making the greatest academic use of these advances. Surely it would be better if the school could be the provider of these resources. Working with high ability students in a university context shows that they are capable of achieving much higher objectives if they are allowed to be given greater access to learning materials and if they have more control over their learning. This report illustrates the need for schools to follow suit and allow this to happen in their school environment.

I would like to thank Dr. Lynn and the team at LInK for highlighting these issues in this excellent piece of research which goes some way towards explaining what we need to do in relation to high ability students and technology.

Dublin, September 2010

Colm O'Reilly
Centre for Talented Youth in Ireland

Contact: theo.lynn@dcu.ie

Gifted Techspectations is the first of a series of reports based on research by the DCU Leadership, Innovation and Knowledge Research Centre (LInK) based in DCU Business School. With its roots in an Irish business school, it is no surprise that LInK's mission is to strengthen the competitiveness, productivity, innovation and entrepreneurial capacity of the Irish economy. Ireland's next generation transformation will be enabled by information and communication technologies (ICT) and digital participation by members of Irish society. As a university research centre we have an important role to play in supporting education, industry and government to accelerate this transformation.

With support from DCU Business School, Enterprise Ireland's Innovation Voucher Programme, DCU's Learning Innovation Unit, Cambridge University Press and the Nominet Foundation amongst others, LInK has undertaken a wide variety of activities to accelerate digital participation. These include applied research projects, seminar programmes, workshops and occasional research papers. In the last twelve months, 22 seminars, 5 workshops, and two 3-week courses have been held and over 200 Irish businesses and schools have benefited from LInK-related digital participation activities. Influenced by the US ECAR and Pew Internet and American Life projects, these digital participation activities were brought together under the *Techspectations* initiative in June 2010. The objective of *Techspectations* is to create both a body of research and analysis on ICT usage and expectations by Irish society and an interface for Irish education, industry and government institutions.

Study of Gifted and Talented Students

The US federal definition of "gifted and talented" when used in respect to students, children, or youth means:

> *"…students, children, or youth who give evidence of high performance capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities."* (P.L. 103–382, Title XIV, p. 388)

In Ireland, the Centre for Talented Youth in Ireland (CTYI) is the primary vehicle for providing those services and activities. Irish schools and their teachers often do not have the necessary resources, time and training to identify and support individual high potential students who may perceive the world in a fundamentally different way than other students or indeed their teachers. These students often require accelerated and specialised learning opportunities at an early age and over sustained period of time. Unfortunately, State resources and funding for such children with a very different set of special education needs is severely limited. And yet if our vision of Ireland in the future is one of a "Smart Economy", the "Innovation Island", an "Ideas Economy" then central to that are hyper-skilled workers who comfortably deal in abstract, creative and non-routine thinking – the gifted and talented. If a society is ultimately judged by how it treats its weakest and most vulnerable members, we may come to judge knowledge economies on how they treat those members with the most intellectual potential.

In his opening address to the World Summit on the Information Society, Kofi Annan, the then Secretary-General of the United Nations, defined the information society as:

> *"…one in which human capacity is expanded, built up, nourished and liberated, by giving people access to the tools and technologies they need, with the education and training to use them effectively."* (WSIS, Tunis, 16 November 2005)

ICT are fundamental building blocks of Ireland's future economy and indeed our society. Yet we know little about the ICT usage and needs of our existing and future workforce including the gifted and talented students.

Contact: theo.lynn@dcu.ie

This study of student ICT usage and expectations was a collaborative project with CTYI and is the first of an ongoing survey of gifted and talented student practices and expectations of ICT. The project was derived from internal studies of a similar nature carried out by DCU Business School designed to guide school-based technology strategy for teaching and learning. In 2008, CTYI approached LInK to sponsor a three week summer course for gifted and talented children on *21st Century Skills* to be delivered in 2009. This study is the cornerstone for future planning of the course but also provides a reference point for CTYI technology strategy and indeed technology strategy for supporting gifted and talented students generally by parents, schools and other stakeholders.

Sharing Similarities, Defining Differences

The findings of this initial study are detailed in the remainder of the report. Yet it is worthwhile commenting on some general areas of concern. While students seem to have access to electronic devices at home or school, by and large they are not used for educational purposes. Where there is insufficient support for gifted and talented students in the school system, surely technology can contribute to the solution. Unfortunately, the findings of this study indicate that student expectations on the use of technology in the classroom are neither being met nor do student perceive their teachers as having the skills to meet them.

Skills matter. All students expected to work and live in a society permeated by technology should have basic digital literacy skills; gifted and talented students certainly should. It would seem that IT training is a key factor in student attitudes towards technology and their future skills requirements. However, almost three quarters of students surveyed had not completed a formal IT training course such as the European Computer Driving License.

Gender matters. With regards to gender, early adoption of technology by boys, primarily through gaming, while representing a threat for many parents and teachers, may also represent a substantial opportunity for engagement. Research suggests certain types of games have latent educational value particularly with regards to strategic thinking, collaborative working and problem solving. While boys use electronic devices for entertainment, girls are using them for communication. Both boys and girls are widely using social networking applications and services. Both schools and CTYI need to explore how gaming technologies and social networking can be used, possibly together, to support gifted and talented students moving forward. We do not need to reinvent the wheel but merely build educational resources around the technology that already exists and is being used by students.

School matters. It may not take a significant investment of resources to improve the experience and support for gifted and talented students in the classroom. Many gifted and talented students have access to the infrastructure at home but are, both literally and figuratively, disconnected from the opportunity to learn at their pace once they enter the classroom. Students report low levels of familiarity of common education technologies such as learning management systems and only a few schools actively encourage one-to-one computing initiatives. Teacher prohibition of laptop use in the classroom is the primary reason that they do not bring or use their laptop at school. In overcrowded classrooms with students of different academic abilities, I can empathise with the teacher. However, technology could provide a solution. Both CTYI and schools need to investigate whether it is possible to provide a national learning platform with both materials and tools for gifted and talented students. Identified gifted and talented students should be allowed to access this learning platform on approved devices, whether personal or school-owned, under the supervision of teachers, or if at home, parents. This does not necessarily mean additional training requirements for the teacher but merely the facilitation of access to a moderated platform.

Contact: theo.lynn@dcu.ie

And Finally

This study was a result of the work of a wide range of people in both CTYI and LInK. In particular, the project was initiated and sponsored by Colm O'Reilly at CTYI and supported by his team. Dr. Angelos Alexopoulos was the primary research interface in LInK and was supported by Louise Gorman, Kieran Linehan, Neil Bruton and most recently Micheal O'Leary. We also owe our gratitude to Professor Kathy Monks who supported our work in CTYI while Director of LInK, and indeed the other members of LInK for giving their time and support to both this research and the *21st Century Skills* programme. Finally, we would like to thank our various colleagues in DCU who gave their time for proof-reading this report and especially Dr. Padraig Murphy and Dr. Francoise Blin.

Gifted Techspectations is the first of a series of reports on ICT usage and needs. Future publications will continue highlighting similarities and differences between diverse groups of learners as well as progress over time and help towards greater digital participation. Time will tell.

Dublin, September 2010

Dr. Theo Lynn
Dublin City University

Contact: theo.lynn@dcu.ie

2. Executive Summary

The Leadership, Innovation and Knowledge Research Centre (LInK) was commissioned by the Irish Centre for Talented Youth (CTYI) to conduct quantitative research among gifted and talented (G&T) students enrolled in CTYI's 17th annual summer programme that was held in Dublin City University in 2009. This report presents the findings of this research aimed at understanding the role of information and communication technologies (ICT) in the daily life and school learning experience of Ireland's G&T youth.

The research objectives of *Gifted Techspectations* were twofold:

- First, to examine CTYI students' ownership, usage of, and skills with ICT.
- Second, to investigate CTYI students' experience with, and expectations of ICT use in the school environment.

The key findings, based on the responses of 378 CTYI students who participated in this study by completing a questionnaire survey, are summarised below.

ICT Ownership, Usage, and Skills

ICT Ownership and Internet Access

- The typical CTYI student owns six electronic devices, including mobile phone (96%), portable audio player (87%), desktop PC (82%), printer (82%), game console (82%), and digital video camera (79%).
- Males and younger students from middle socioeconomic backgrounds are more likely to own gaming electronic devices than females and older students from lower and higher socioeconomic backgrounds.
- The majority of CTYI students (59%), particularly females (66%), "can not imagine living without" their mobile phone.
- Most CTYI students connecting to the Internet use a home broadband connection (87%), and only 5% used a dial-up connection. However, home broadband usage is significantly higher among females and those from higher socioeconomic backgrounds than males and those from lower socioeconomic backgrounds.
- School Internet access through a wired network is higher among males, those from higher socioeconomic backgrounds, and those enrolled in subjects in Science, Technology and Engineering, compared to females, those from lower socioeconomic backgrounds, and those enrolled in subjects in the Humanities and Social Sciences.

Technology Adoption Profile

- Almost half of CTYI students (48%) describe themselves as either innovators (15%) or early adopters of new ICT (33%), compared to only 16% of students describing themselves as late adopters of new ICT (14%) or laggards (2%).
- 30% of students from lower socioeconomic backgrounds describe themselves as innovators compared to only 11% of students from higher socioeconomic backgrounds.

ICT Usage

- CTYI students spend on average at least five hours per week listening to music on a personal music player (60%), watching TV (53%) and using text messaging from their mobile phones (50%). In particular, listening to music is more common among older than younger students, while text messaging is more common among females than males.

Contact: theo.lynn@dcu.ie

- CTYI students use the Internet at home mainly for communication (86%) and entertainment (82%). However, a substantial percentage of students (79%) also use the medium for school- as well as non-school-related learning activities.
- CTYI students' Internet activities at home differ in intensity based on gender, age, and socioeconomic status. More females than males use the medium for communication and school-related learning purposes, while more males than females use it for entertainment purposes, particularly online gaming. Online gaming is also more prevalent among younger than older students. Finally, students from higher socioeconomic backgrounds use the Internet significantly more frequently for social networking and instant messaging compared to those students from middle and lower socioeconomic backgrounds.
- While CTYI students' attitudes towards the Internet are generally positive, older students and those from higher socioeconomic backgrounds hold more positive perceptions of the usefulness of the medium than younger students and those from middle and lower socioeconomic backgrounds.
- On average, CTYI students have been using the Internet for more than six years, with the typical student reporting first usage of the medium at the age of nine years.

IT Training

- Around three-quarters of CTYI students have had no formal IT training, while the remaining 27% have completed successfully an IT training course, the most common of which is the European Computer Driving Licence (19%).
- More male students than female students have completed some form of IT training.

Mobile Internet Activities

- More than 60% of CTYI students access the Internet with a mobile device for communication and information seeking and gathering purposes, followed by 45% for social networking purposes.
- Social networking is more common among females and students from higher socioeconomic backgrounds than males and students from lower and middle socioeconomic backgrounds.

Social Media

- Online social networks are very popular among CTYI students, with 70% of them reporting membership in a social network platform, such as Bebo (62%), Facebook (17%), and Twitter (8%). Blog reading and writing, and personal website editing are, on the other hand, among the top three least frequent Internet activities among CTYI students.
- Online social networks are used more frequently by females, older students, and students from higher socioeconomic backgrounds than males, younger students, and students from lower and middle socioeconomic backgrounds.

ICT in the School Learning Experience

The Role of ICT in School Education

- CTYI students generally agree that ICT use in school education is advantageous as it prepares them well for the university life and, more generally, it prepares them to contribute fully in a technology-led society.
- CTYI students from lower socioeconomic backgrounds perceive the learning and educational benefits of ICT usage in school as less important compared to students from middle and higher socioeconomic backgrounds.

Contact: theo.lynn@dcu.ie

- Interest in, and engagement with classes that require use of ICT are more prevalent among male students and those enrolled in subjects in Science, Engineering and Technology than female students and those enrolled in subjects in the Humanities and Social Sciences.

Access, Competence, and Motivation for Using ICT in School

- Around four out of ten CTYI students agree that their schools are well-equipped with computers connected to the Internet.
- Only 11% of CTYI students agree that their teachers are competent in using ICT and applying it for teaching purposes.
- CTYI students who have completed IT training are more motivated to use ICT in school compared to those with no prior IT training.

Digital Resources for a Successful School Experience

- CTYI students view digital resources, especially material they find in the Internet, as particularly helpful for their daily schoolwork, with search engines and Wikis being rated as the top two most helpful online tools.
- CTYI students with more than four years Internet use experience find Wikis, Microsoft Office, email, online class notes and electronic books more helpful compared to students with less than four years Internet use experience.

ICT-enabled School Activities

- Around one-third of CTYI students use PCs in a group during classes, followed by 17% using PCs on their own during classes, and 12% using PCs out-of-class.
- PC use, both in class and out-of-class, is lower among students with no prior IT training, low motivation to use ICT in school, and those from lower socioeconomic backgrounds, compared to those with IT training, high motivation, and those from middle and higher socioeconomic backgrounds.
- Less than one-third of CTYI students who own a laptop use it frequently in the classroom. In particular, laptop use is more frequent among those students with longer Internet use experience and high motivation to use ICT in school.
- While the majority of CTYI students acknowledge the learning benefits of laptop use in class, teachers' prohibition is seen by the majority of them (70%) as the main barrier to laptop use in class.
- Only 15% of CTYI students have ever used a Learning Management System. However, this is considerably higher among those students with IT training (25%) compared to those students with no IT training (11%).
- Less than 10% of CTYI students agree that one-to-one computing initiatives are encouraged by their schools. Importantly, one-third of them do not know what one-to-one computing is.

The Impact of ICT-enabled School Activities on Student Learning

- CTYI students moderately agree that ICT use in school has improved their learning.
- Significantly higher levels of agreement are, however, expressed by those students: (1) who bring their laptop to class at least once a week, (2) who have used a Learning Management System, and (3) whose school encourages one-to-one computing.

Ideal Online Learning Environment

Contact: theo.lynn@dcu.ie

- In CTYI students' view, the key features of an ideal online learning environment are enjoyment, usability, interaction, support and collaboration, user autonomy, and content relevance.

Contact: theo.lynn@dcu.ie

3. Study Background

3.1 Digital Competence for the Gifted and Talented

The effective integration of ICT in secondary education has emerged over the last decade as a key priority in the policy agenda of the European Union (EU). This has been accompanied by significant investments in ICT infrastructure and access with the majority of secondary schools in most EU countries being now equipped with computers connected to the Internet (European Commission, 2006; OECD, 2009). Certainly, this is reflective of the overall improvements in ICT access and use rates across the developed world, with Ireland ranked seventeenth, just one place behind the U.S., in the international ICT Development Index for the year 2007 (International Telecommunication Union, 2009).

However, while ICT penetration is continuously increasing, there is a growing realisation among policymakers and educators that if schools are to prepare students for living and working in a world permeated by technology, compulsory as well as vocational education and other applied curricula should also support the development of digital competence. Defined as the "confident and critical use of Information Society Technology (IST)" (European Commission, 2009: 16), digital competence has been identified as one of the building blocks of employability, lifelong learning, and active participation in a knowledge-based society. Informed, at least partly, by the results of the latest PISA survey (PISA, 2006), the recent focus on digital competence signifies the growing trend in educational reforms across Europe towards developing a "broad foundation of knowledge, skills and competences which promotes talent and creativity from an early age and is updated throughout adulthood" (European Commission, 2009: 10).

As underpinned by an emphasis on critical thinking and high-level information management and communication skills, the proposed digital competence framework of the EU shares many similarities with the notion of digital literacy (Gilster, 1997). This, in turn, is often associated with the education of gifted and talented (G&T) youth (Burkhardt et al., 2003). Digitally literate students are those who can "proficiently apply an array of technological tools to analyse current knowledge, relate that knowledge to new problems, produce novel solutions, and generate a new comprehension" (Besnoy, 2007: 1). Scholars argue that G&T students' above-average ability to absorb, synthesise, and evaluate large amounts of information quickly, to think creatively and critically, and to generate and communicate original ideas and solutions enables them to take full advantage of the information resources and collaborative tools available via digital technologies (Sheffield, 2007; Siegle, 2005). Indeed, recent research has shown that access to, and use of digital content and resources from the Internet is recognised by G&T pupils as particularly beneficial to extending their learning by allowing them to be autonomous learners, and undertake more sophisticated levels of research (Passey et al., 2004).

Yet, as Besnoy (2007: 1) points out, "it is not enough to simply sit gifted students in front of a computer. Rather, teachers of the gifted must strategically design IT learning activities that meet their students' intellectual needs". In this regard, it can be argued that the design of differentiated models of G&T instruction is in some respect analogous to the more personalised approaches to learning by students with special educational needs (Baker, 2001). In light of the EU's call for school curriculum adaptation to ensure that "*all* learners benefit from innovative methodologies" (European Commission, 2009: 3), understanding the digital habits, preferences, and expectations of G&T students is a prerequisite for designing and implementing ICT initiatives for teaching and learning purposes that are found beyond the confines of regular instructional programs (Renzulli & Reis, 1997). However, while the merits of incorporating ICT in gifted curricula have been underscored in the literature (Siegle, 2004), there is little empirical work focusing on G&T students' ownership,

Contact: theo.lynn@dcu.ie

usage of ICT, both at home and school, and more importantly understanding how these may be further influenced by student characteristics, including their sociodemographic background as well as their skills and experience with ICT. The goal of this report is, therefore, to shed light on some of these characteristics in the context of G&T youth.

3.2 New Digital Natives, New Digital Divides

There is little doubt that, as result of growing up in a technologically-rich environment and supported by a still-growing computer industry, today's youth are surrounded by and using increasingly digital tools, such as computers, video games, cell phones, and digital music players, to name a few (Prensky, 2001). ICT, and particularly Internet technologies, have to a large extent become a seamless part of their everyday activities of communication and entertainment. This has also impacted their learning expectations in the school environment so that they anticipate their teachers to have the ability and resources to integrate ICT into their instruction (Wenglinsky, 2006). This is, however, not to say that all students view or use technology the same way. In contrast to the image of a homogeneous generation of digital natives having developed an innate ability over previous generations to understand and use digital technologies (cf. Prensky, 2001), a growing body of empirical work suggests that young people may differ in their actual use of, and attitudes towards ICT (Facer & Furlong, 2001; Kirkwood & Price, 2005; Bennett, Maton, & Kervin, 2008; Helsper & Eynon, 2010). The key issue at stake here is that labelling young people as digital natives usually fails to unveil how ICT may differently be experienced by a heterogeneous body of young people who are actually living with it. In this report, we examine these differences surrounding the relationship of G&T students with ICT within the so-called digital divide debate.

The notion of the digital divide is generally understood as the gap between ICT haves and have-nots, and hence shifts attention to the disparities in the diffusion of, and access to ICT. From a public policy standpoint the provision of universal access to ICT, and particularly the Internet, can be viewed as a "practical embodiment of the wider theme of social inclusion" that has recently become part of the policy rhetoric of governments in western nations (Selwyn, 2004: 343). Several researchers have, however, argued that a deeper understanding of digital inequalities requires a move beyond dichotomous classifications of ICT haves versus have-nots to examine in more detail the types of activities in which individuals are involved when using ICT, the locus of those activities, as well as individuals' skills and experience in using ICT (Ching, Basham, & Jang, 2005; DiMaggio et al., 2004; Hargittai & Hinnant, 2008). Central to this is the need to distinguish between ICT access and use, and recognise that access to, and ownership of ICT does not necessarily lead to meaningful use of, or engagement with ICT. A key issue here, as Selwyn (2004: 349) argues, is to understand "how people develop relationships with ICT and how they are capable of making use of the social resources which make access usable".

3.3 Great Techspectations

The distinction between ICT access and use holds particular importance in the context of teaching and learning practice. According to recent research by the OECD on the new millennium learners (CERI, 2009), while the availability of school ICT infrastructure – as measured by broadband penetration – in most OECD countries has been shown to be impressive, on average one out of two primary and secondary school students in EU countries declared not to have used a computer in class. However, as the 2006 PISA survey indicates, 86 percent of pupils aged 15 years stated frequent computer use at home (OECD, 2007b). These statistics highlight the "contradiction and perplexity that students may experience when realising that digital technologies are so important in their daily lives…except when they are in classrooms" (CERI, 2009: 6). This shifts attention to the issue of how ICT affects the educational performance and learning expectations of students in secondary education.

Contact: theo.lynn@dcu.ie

The existing empirical evidence regarding the impact of ICT use on the learning of secondary school students has so far been inconsistent, with some studies suggesting a positive correlation between ICT availability and use, on the one hand, and educational attainment, on the other (Cox et al., 2003; National Centre for Educational Statistics, 2001), whereas other studies demonstrating the exact opposite (Angrist & Lavy, 2002). The analysis of the 2003 PISA survey results show, however, that a weak yet positive correlation can be established in four respects (CERI, 2009):

- *Access:* students with limited ICT access obtained below-average PISA results on reading, mathematical and scientific literacy
- *Previous experience:* students with less than one year ICT experience were only capable of the simplest maths exercises
- *Frequency of use:* students with moderate ICT use had the best results
- *Confidence:* students who were less confident in their ability to use a computer or the Internet had worse results than more confident students

Of particular interest is the finding that the relationship between home ICT use and educational attainment in many OECD countries was stronger than in the case of school ICT use. Specifically, the effect of ICT availability in Irish schools on students' academic achievement was only marginal.

The PISA survey results are helpful for shedding light on the complex relationship between ICT availability in school and academic attainment by clarifying the circumstances under which ICT access and use correlate with educational attainment. Yet they say little about students' expectations of the actual teaching and learning practice, particularly in the realm of Web 2.0 and social media which enable students to create and share information and digital content through a variety of interactive platforms and social application tools such blogs, wikis, social networking sites, and virtual worlds. While their implications are yet to be seen, there is little doubt that the collaborative nature of these ICT tools may have a strong impact upon students' learning habits and expectations which, in turn, may challenge some of the core principles of current teaching and learning practice. In this regard, the results of a national English survey by Ipsos Mori highlight the mismatch between students' learning preferences and predominant teaching and learning practices in secondary education. According to this research, copying from the board or a book was reported as the most common classroom activity (52%), whereas working on a computer was reported only by 16 percent of students. On the other hand, 55 percent of students stated they prefer to learn in groups, 35 percent with friends, and 31 percent by using computers, whereas 19 percent stated they prefer to learn from their teachers and 8 percent by copying (Ipsos Mori, 2007).

3.4 Gifted Techspectations: Research Objectives

As part of LInK's wider *Techspectations* programme of research**,** the LInK research team, in conjunction with the CTYI, sought to explore the role of ICT in the daily life and school learning experience of Ireland's talented youth with the aim to inform educational leaders, teachers, parents, and all those involved in gifted education on some of the key challenges and opportunities of incorporating ICT into the gifted curriculum. The research objectives of this study are twofold:

- First, to examine CTYI students' ownership, usage of, and skills with ICT. Our aim here was not only to document the types of ICT students own and use in their daily lives but also to provide a detailed and comparative mapping of how ICT ownership, usage and skills may be patterned along student sociodemographic characteristics, including age, gender, socioeconomic background, and Internet use experience, as well as along the subject

Contact: theo.lynn@dcu.ie

(discipline) of the courses in which CTYI students were enrolled during the summer programme.

- Second, to investigate CTYI students' experience with, and expectations of ICT use in the school environment. Our aim here was to gauge students' perceptions of: the role of ICT in the school education; the access, motivation, and their instructors' competence to use ICT in school; the importance they ascribe to digital resources for their daily schoolwork; the intensity of ICT-enabled activities at school in which they are involved, including laptop use in class and familiarity with Learning Management Systems; the learning benefits of ICT use in school; and finally, their ideal online learning environment.

Contact: theo.lynn@dcu.ie

4. Methodology

This report is based on a survey of gifted and talented students, aged 12 years to 16 years, enrolled in CTYI's 17th summer programme that was held in Dublin City University in 2009. Since its inception in 1993, more than 15,000 teenagers from both Ireland and abroad have taken part in this intensive and structured three-week programme offering students the opportunity to develop their learning abilities and skills by studying at a self-paced style advanced courses covering twenty-seven academic subjects within the Humanities and Social Sciences, and Science, Engineering and Technology. Eligibility for participation in CTYI's summer programme is based on applicants' scores on scholastic aptitude tests (SAT, PSAT, ACT) taken through CTYI's Talent Search or independently by the applicants.

4.1 Data Collection

A questionnaire survey of all students (n=464) participating in CTYI's 2009 summer programme was conducted. The survey was administered to the students by their instructors on the third week of July 2009. The voluntary nature of participation was emphasised. The confidentiality of responses and the anonymity of respondents were also guaranteed. CTYI instructors were briefed by members of the LInK research team on the survey and were present in each classroom to provide assistance to students if needed. 384 questionnaires were returned to CTYI instructors and forwarded to the LInK research team two days after their administration to the students. After screening the questionnaires for incompleteness and abnormalities (Tabachnick and Fidell, 2007), we obtained a total sample of 378 fully completed questionnaires, which represents an 81.5 percent response rate.

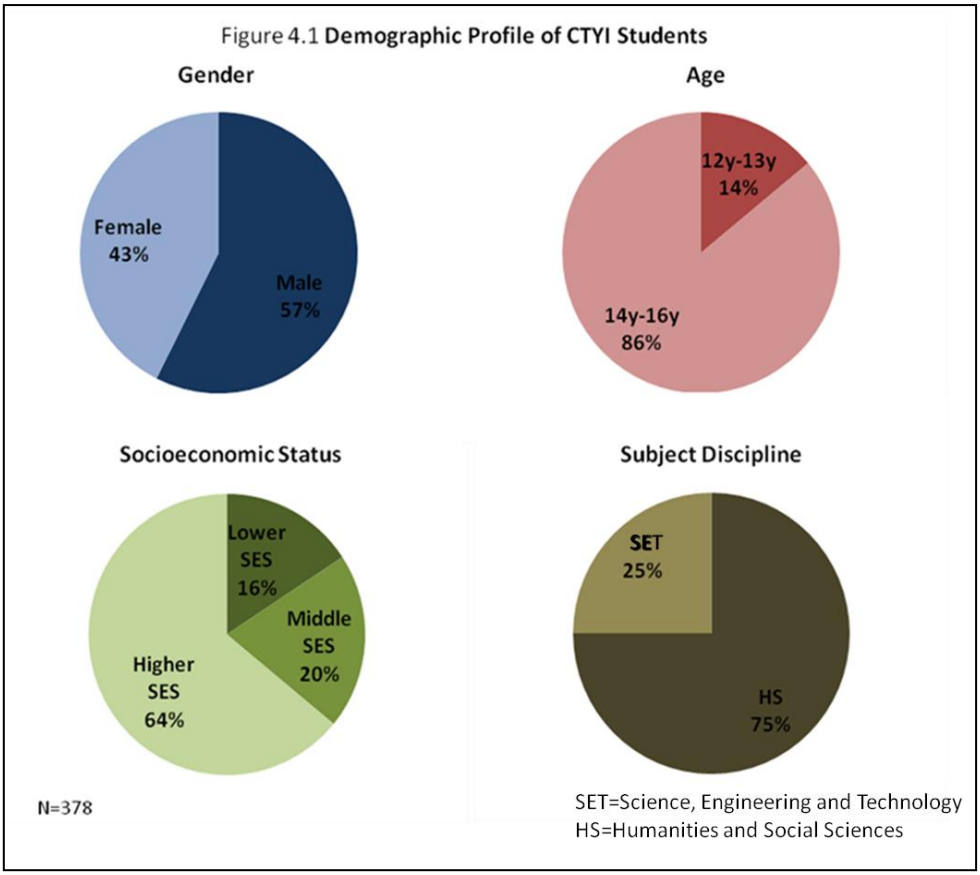
4.2 The Questionnaire

A 30-minute paper questionnaire survey provided the quantitative data for this study. The questionnaire was designed drawing on an instrument used in other studies included in the wider *Techspectations* programme of research, and was therefore adapted to the characteristics of the sample. In total, the questionnaire comprises over 60 closed and open-ended items on ICT ownership, access, and usage at home and school. It also includes questions on ICT skills, attitudes towards the Internet, mobile Internet activities, social media use, and preferences of technology providers, products, and services. Most of the questionnaire items are drawn from previously validated instruments used in studies on technology and education some of which discussed in the previous chapter. This report concentrates on the responses of students concerning ICT ownership, usage and skills, and their perceptions of ICT-related activities at school. The questionnaire was pretested with three CTYI instructors in order to evaluate the clarity of the instructions and items, and minor modifications were made accordingly.

4.3 Respondent Characteristics

Figure 4.1 presents the demographic profile of the students in the study sample. Of the respondents, 57% were males and 43% females. The majority of the respondents (86%) were between 14 and 16 years old, and the remaining 14% were between 12 and 13 years old. Around two-thirds (64%) of the respondents were of a higher socioeconomic status, followed by 20 percent and 16 percent of middle and lower socioeconomic status, respectively. Finally, three-quarters of the respondents were enrolled in courses within the Humanities and Social Sciences, and the remaining quarter of the students were enrolled in courses within Science, Engineering and Technology.

Contact: theo.lynn@dcu.ie



4.4 Data Analysis

In line with the research objectives outlined in the previous section, the quantitative data were analysed in a straightforward manner. The results are presented in terms of frequencies using means and percentages. To examine the relationship between the variables of interest, basis statistical analyses (Pearson chi-squared test, t-test, and analysis of variance) were performed.

Contact: theo.lynn@dcu.ie

5. ICT Ownership, Usage and Skills

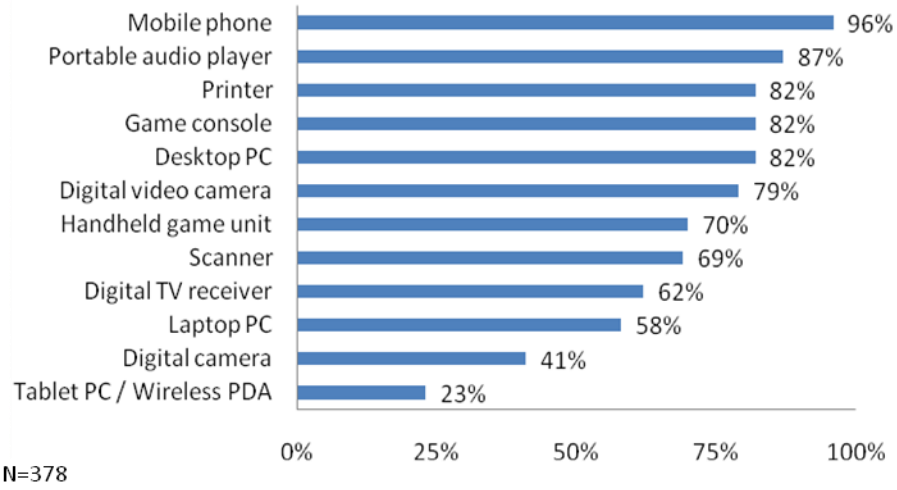
In this chapter, we first explore CTYI students' ownership of ICT devices, their access to the Internet, and their technology adoption profile. This is followed by examining their ICT activities, including Internet activities at home, attitudes towards the medium, as well as their IT training. In the final part of the chapter we take a closer look at two key emerging trends in ICT: mobile Internet activities and social media usage.

5.1 ICT Ownership

5.1.1 Devices

CTYI students reported ownership of a wide variety of ICT devices, ranging from mobile phones and wireless PDAs to desktop and laptop PCs, digital cameras and game consoles. The median number of device ownership per student was six. In general, our results indicate that device ownership among CTYI students was relatively higher compared to that reported in recent studies of American teenagers (Lenhart, Purcell, Smith, & Zickuhr, 2010; Rideout, Foehr, & Roberts, 2010). More specifically, and as shown in Figure 5.1, almost all CTYI students owned a mobile phone (96%), followed by portable audio player (87%), desktop PC (82%), printer (82%), game console (82%) and digital video camera (79%). Seven out of ten students owned a handheld game unit (70%), followed by scanner (69%), digital TV receiver (62%), and laptop PC (58%). Around four out of ten students reported ownership of a digital camera (41%), while wireless PDAs and/or tablet PCs were owned by 23% of students.

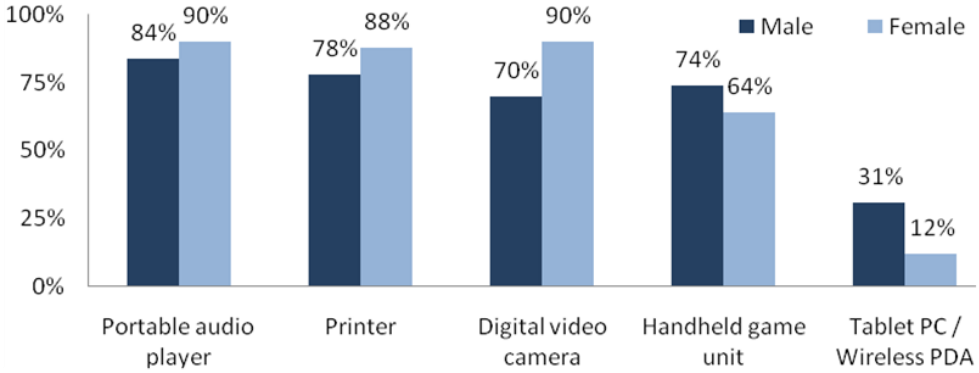
Figure 5.1 **Device Ownership**



Contact: theo.lynn@dcu.ie

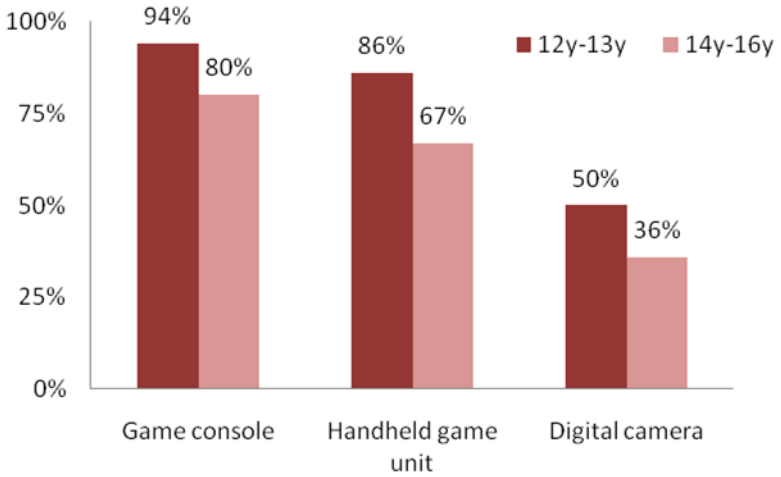
Our study shows that ownership of various ICT devices was relatively more common among certain sociodemographic groups. First, on the one hand, female students were more likely to own portable audio players, printers and digital video cameras than male students, while on the other hand, male students reported higher ownership of handheld game units and wireless PDAs and/or tablet PCs than female students (see Figure 5.2). Second, as shown in Figure 5.3, we found that ownership of game consoles, handheld game units and digital cameras was more prevalent among younger students (ages 12y-13y) than older ones (ages 14y-16y). This is in line with research suggesting that younger teens are more likely to own portable gaming devices than older teens (Lenhart, Purcell, Smith, & Zickhur, 2010). Interestingly, though, we found no significant differences in device ownership among students with different socioeconomic status.

Figure 5.2 **Device Ownership: Gender Differences***



N=378
* All within-group differences are significant at p<.05.

Figure 5.3 **Device Ownership: Age Differences***



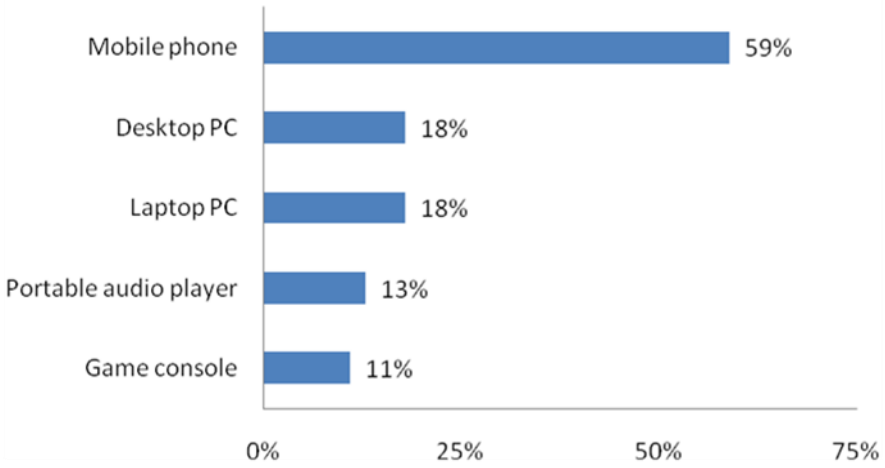
N=378
* All within-group differences are significant at p<.05.

When asked to indicate their favourite ICT device, students reported that "they couldn't imagine living without" their mobile phone (59%), desktop or laptop PC (18%), portable audio player (13%), and game console (11%) (see Figure 5.4). Again, a number of sociodemographic differences were

Contact: theo.lynn@dcu.ie

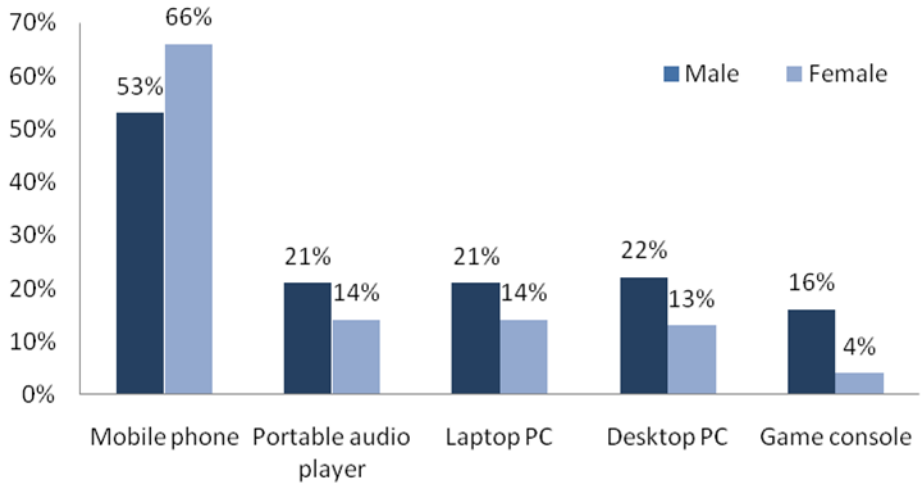
found. In particular, as shown in Figure 5.5, female students reported higher preference for mobile phone than male students, while the opposite was found to be the case for the other four devices. This finding is consistent with previous research in which gender differences in ICT ownership have been found to be associated with gaming activities for boys and communication activities for girls (Kvavik & Caruso, 2005). In addition, as shown in Figure 5.6, our study also reveals that students with a middle socioeconomic status had a significantly stronger preference for game consoles compared to those with either lower or higher socioeconomic status.

Figure 5.4 **Top Five Favourite Devices**



N=378

Figure 5.5 **Favourite Devices: Gender Differences***



N=378

* All within-group differences are significant at p<.05.

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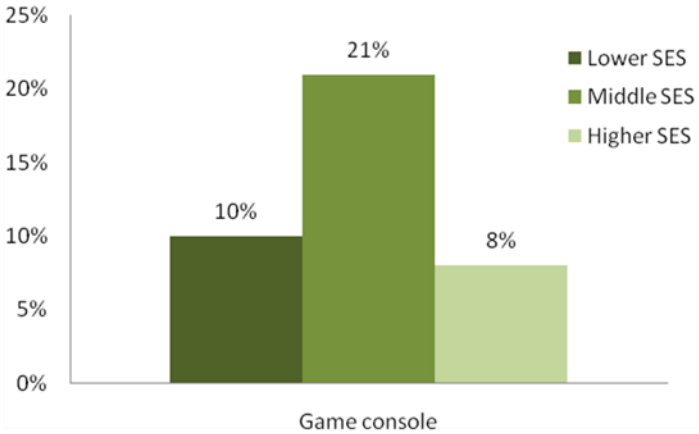
Figure 5.6 **Favourite Devices: SES Differences***

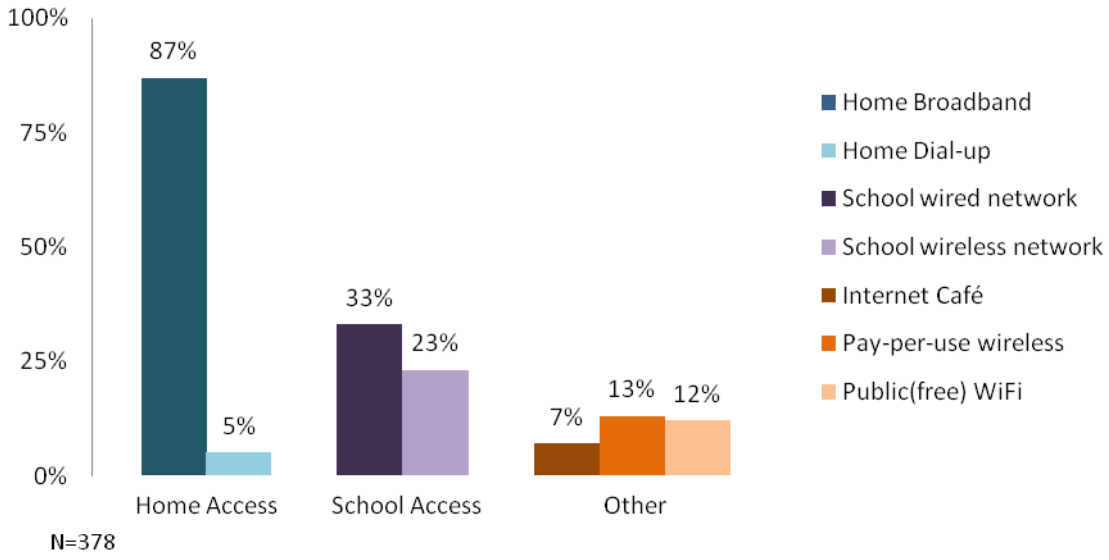


N=378
* All within-group differences are significant at p<.05.

5.1.2 Internet Access

In line with recent trends in home broadband adoption both in Ireland (CSO, 2009) and internationally (Dutton, Helsper, & Gerber, 2009; Jones & Fox, 2009), our results show that 87 percent of students connecting to the Internet used a home broadband connection, whereas only 5 percent used a dial-up connection (see Figure 5.7). Regarding out-of-home Internet access, one-third of students reported using the school wired network, followed by 23 per cent using the school wireless network. Considerably fewer students reported access to the Internet at an Internet café (7%), or by paying-per-use (13%) or using public (free) Wi-Fi (12%).

Figure 5.7 **Internet Access**



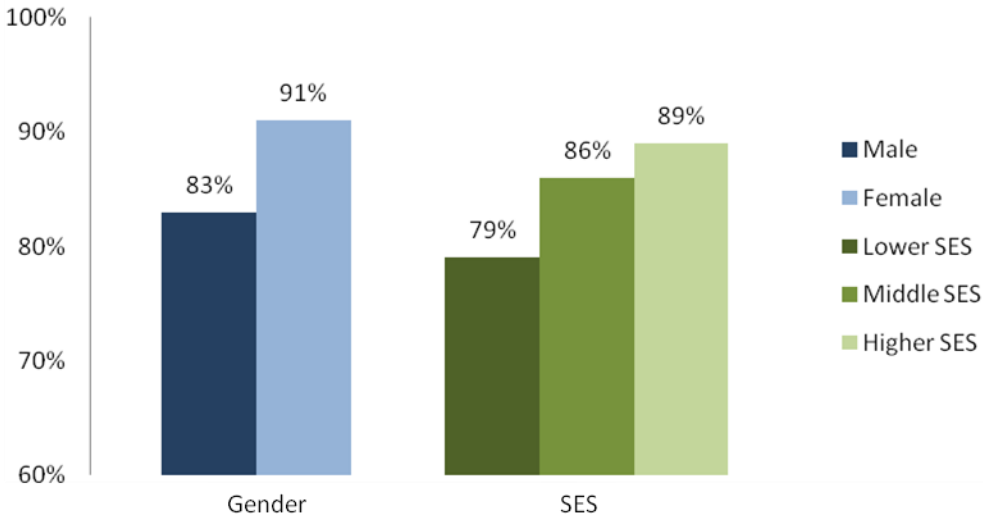
N=378

Despite high levels of home broadband adoption, the results also indicate a broadband usage gap between students in terms of gender and socioeconomic status. As shown in Figure 5.8, the percentage of female students reporting home broadband usage was significantly higher than that reported by male students. In addition, students with a higher socioeconomic status reported

Contact: theo.lynn@dcu.ie

significantly higher levels of home broadband usage compared to those students with a lower socioeconomic status.

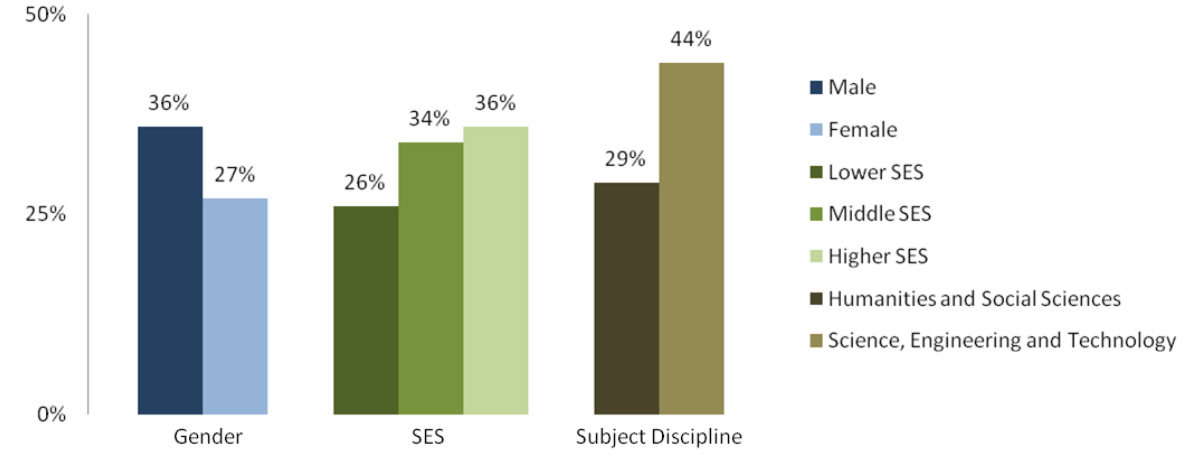
Figure 5.8 **Home Broadband: Gender and SES Differences***



N=378
* All within-group differences are significant at p<.05.

Gender and socioeconomic status along with subject discipline differences were also found in regard to school Internet access. As shown in Figure 5.9, school wired network access was reported by a significantly higher percentage of male students with higher socioeconomic status studying subjects in the Science, Engineering and Technology, compared to female students with a lower socioeconomic status studying subjects in the Humanities and Social Sciences.

Figure 5.9 **School Wired Network Access: Gender, SES and Subject Discipline Differences***



N=378
* All within-group differences are significant at p<.05.

5.1.3 Technology Adoption Profile

Students were asked about their technology adoption practice using a scale developed originally by Everett Rogers and published in his 1962 book *Diffusion of Innovations.* Rogers' theory of diffusion of innovations describes how, why, and at what rate new ideas and technologies spread throughout

cultures. Accordingly, Rogers defines five categories of adopters as a classification of individuals within a social system on the basis of innovativeness and timing of adoption. The five categories of adopters are: innovators, early adopters, mainstream adopters, late adopters, and laggards. Based on Rogers' theory of diffusion of innovations, research on technology adoption has identified several factors associated with adoption and engagement with new technologies, including financial capability, perceived difficulty versus perceived benefits, past experience with technology, and gender (Wood & Li, 2005).

CTYI students' technology adoption profile was mapped into an adapted Rogers' model that has been used in the latest ECAR study of US undergraduate students and ICT (Smith, Salaway, & Caruso, 2009). In particular, as shown in Table 5.1, students were presented with five statements corresponding to the five technology adoption categories, and were asked to choose the one that best described them.

Table 5.1 **Technology Adoption Categories**

Technology Adoption Categories	Which best describes you?
Innovator	I love new technologies and am among the first to experiment with and use them.
Early Adopter	I like new technologies and use them before most people I know.
Mainstream Adopter	I usually use new technologies when most people I know do.
Late Adopter	I am usually one of the last people I know to use new technologies.
Laggard	I am sceptical of new technologies and use them only when I have to.

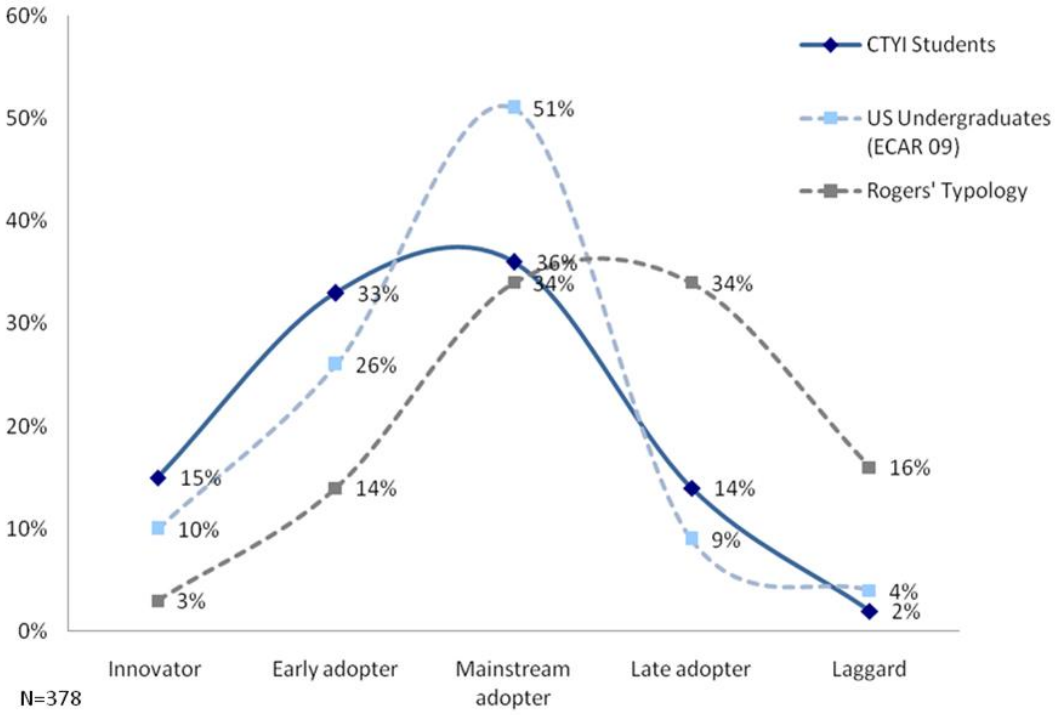
Source: Smith, Salaway, & Caruso (2009: 44)

Figure 5.10 shows CTYI students' answers to the five statements and compares them with those of US undergraduates (Smith, Salaway, & Caruso, 2009) and Rogers' (1962) original typology.

As shown in the above figure, 48 per cent of CTYI students described themselves as either innovators (15%) or early adopters (33%). This is considerably higher than US undergraduates' and Rogers' distribution of technology adoption profiles. On the other hand, the percentage of students describing themselves as mainstream adopters was found to be relatively equal with Rogers but considerably lower than that reported by US undergraduates. Finally, regarding the last two technology adoption profiles, 16 per cent of students described themselves either as late adopters (14%) or laggards (2%), following a distribution similar to that found among US undergraduates.

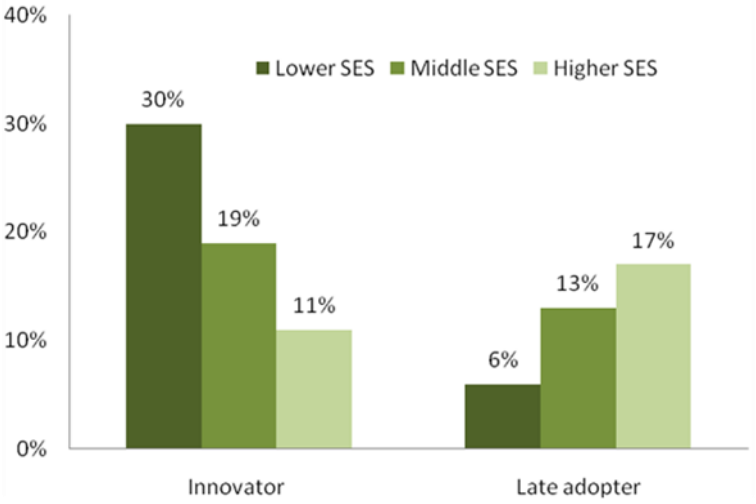
Contact: theo.lynn@dcu.ie

Figure 5.10 **Technology Adoption Profile**



In contrast to the results of the ECAR study (Smith, Salaway, & Caruso, 2009), there were no gender-related differences found among our sample. Interestingly, though, we found that significantly more students with a lower socioeconomic status described themselves as innovators (30%) compared to only 11 per cent of students with a higher socioeconomic status, whereas the reverse was the case in regard to late adopters (see Figure 5.11).

Figure 5.11 **Technology Adoption Style: SES Differences***



N=378

* All within-group differences are significant at p<.05.

Contact: theo.lynn@dcu.ie

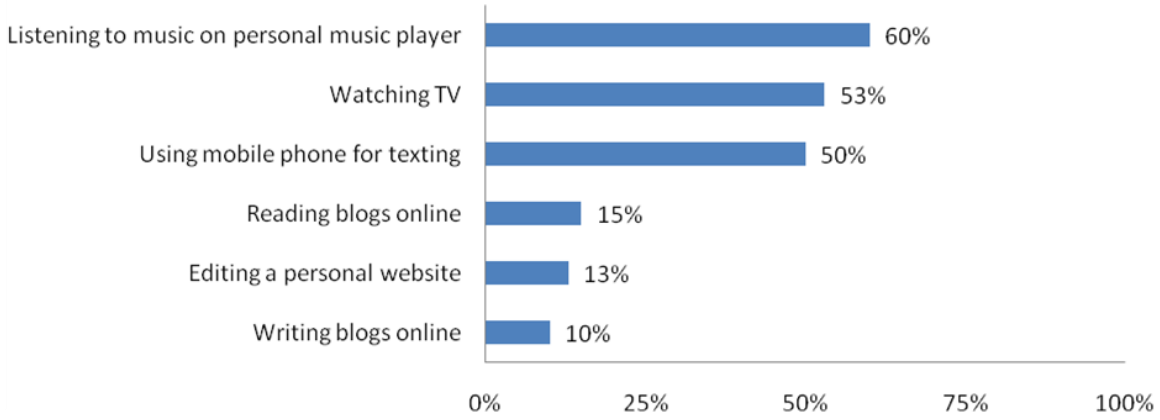
While the influence of gender on new technology adoption has received attention in the literature (e.g. Li, Glass, & Records, 2008), our study reveals that socioeconomic status may also play a significant role in the extent and rate of new technology adoption by young people. Given that technology adoption profiles are associated with individuals' use of and experience with ICT, the somewhat counterintuitive finding that innovators were more likely to be found among students with a lower socioeconomic status holds importance, and certainly deserves further investigation.

5.2 ICT Usage

Recent research on the role of media in the lives of the so-called Net Generation shows that the amount of time spent by young American people, ages 8y-18y, on ICT activities on a weekly basis is the equivalent of a full-time job, with an average of almost 7.5 hours a day using media - three hours watching TV, 1.75 hours listening to music, and just under 50 minutes a day playing video games, and going online (Rideout, Roberts, & Foehr, 2010).

Our results indicate that CTYI students' activities with technology followed a similar trend. As shown in Figure 5.12, the top three activities in which students were spending at least five hours per week were: listening to music on a personal music player (60%), watching TV (53%), and mobile phone texting (50%). To note that, on average, older students (ages 14y-16y) were spending more time on listening to music than younger students (ages 12y-13y). In addition, mobile phone texting was found to be more common among female students than male students.

Figure 5.12 **Top 3 Most and Least Frequent ICT Activities***



N=378
*At least 5 hours per week

Approximately four out of ten respondents (39%) also reported spending at least five hours per week on watching videos online and on digital/video gaming. These activities were also found to be more frequent among male students than female students.

Although research has suggested that teens are increasingly becoming digital content creators and sharers by maintaining their own personal webpage, and creating their own online journal or blog (Lenhart, Madden, Macgill, & Smith, 2007), we found that blog reading, personal website editing, and blog writing were among the top three least frequent ICT activities among CTYI students (see Figure 5.12). However, this is not surprising in view of a recent report by the Pew Internet and American Life Project indicating a striking decline in blogging among teens from 28 per cent in 2006 to 14 per cent in 2009 (Lenhart, Purcell, Smith, & Zickuhr, 2010). The decline of blogging activity among teenagers, according to the same report, may be due to the rise of more integrated social

Contact: theo.lynn@dcu.ie

media platforms, whereby teenagers may be exchanging macro-blogging for micro-blogging with status updates. We take a closer look at CTYI students' social media usage in Section 5.4.2.

5.2.1 Internet Activities at Home

Currently, student use of ICT, including the Internet, is divided among communication, entertainment, and learning purposes (Kvavik & Caruso, 2005). Accordingly, we asked CTYI students to indicate on a three-point Likert type scale (1=never or rarely, 2=sometimes, 3=often or always) the frequency with which they were involved in a typical day in these three types of online activities at home. Figure 5.13 presents the overall results from our sample, while Table 5.2 details the specific activities included in each type of Internet activity and also provides a comparison with the results of a recent survey of US teenagers, ages 12y-17y, conducted by the Pew Internet and American Life Project (Jones & Fox, 2009).

Figure 5.13 **Internet Activities at Home**

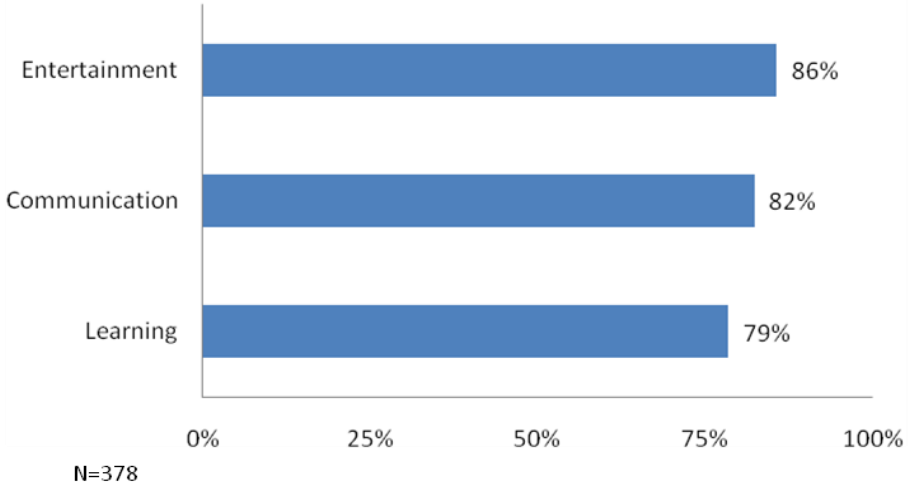


Table 5.2 **Internet Activities at Home**

Internet Activity	CTYI Students %* (N=378)	US Teenagers %** (N=935)
Communication		
Email	93	73
Instant messaging	79	68
Social networking	75	65
Entertainment		
Gaming	80	78
Watching videos	91	57
Listening/Downloading music	86	59
Learning		
School-related learning	75	n/a
Non-school-related learning	82	n/a

*Percentage of students reporting involvement in Internet activities at least "sometimes" in a typical day as rated on a 3-point Likert type scale (1=never or rarely, 2=sometimes, 3=often or always).
**Percentage of students reporting involvement in Internet activities on a daily basis.

Consistent with previous research on the online habits of American teens (Lenhart, Madden, Macgill, & Smith, 2007), our results, as presented in Figure 5.13, indicate that more than eight out of ten CTYI students use the internet for entertainment and communication purposes. In addition, a

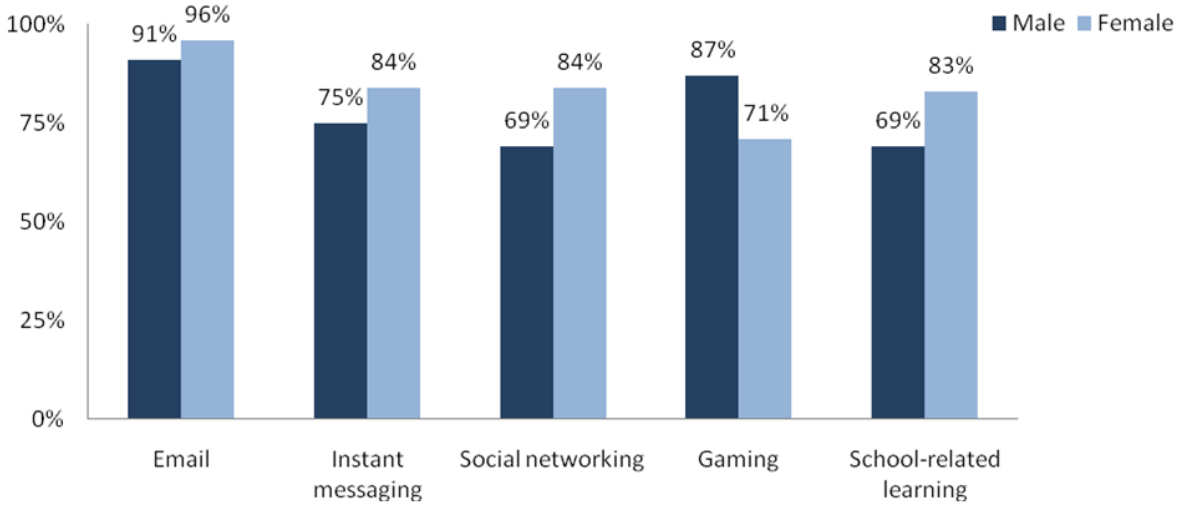
Contact: theo.lynn@dcu.ie

considerable percentage of students, approximately 80 per cent, also use the medium for learning activities. Taking a closer look at the actual online activities under communication and entertainment, Table 5.2 shows that CTYI students score higher than their American counterparts in all activities, such as emailing (93% vs. 73%) and social networking (75% vs. 65%), as well as video watching (91% vs. 57%) and music listening/downloading (86% vs. 59%). In relation to learning activities, the results show that students use the Internet at home more for non-school related than school related learning.

Moreover, we found that a number of CTYI students' online activities were not uniform but rather differed in intensity based on gender and age, as well as socioeconomic status and subject discipline.

First, as shown in Figure 5.14, with the exception of online gaming, female students were found to be involved more frequently than male students in all three communication activities (i.e., emailing, instant messaging, social networking), as well as in learning activities related to school work. Our results suggest that gender probably continues to be a significant determinant of student attitudes to digital gaming (Comber, Colley, Hargreaves & Dorn, 1997; Kerr, 2006). They also corroborate previous research on technology usage among US undergraduates (Salaway, Caruso, & Nelson, 2007) in which female students were found to spend more time than male students communicating and socialising.

Figure 5.14 **Internet Activities at Home: Gender Differences***



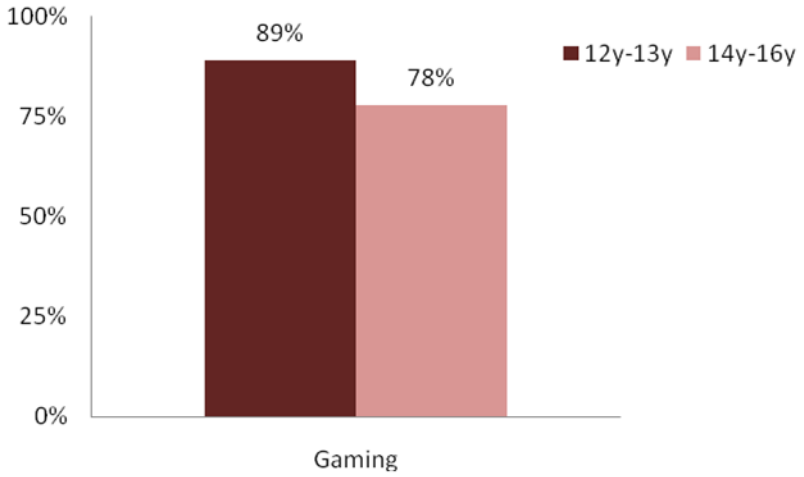
N=378

* All within-group differences are significant at p<.05.

Second, we found that online gaming was more prevalent among younger students than older students (see Figure 5.15). This finding is in line with recent research on digital media use among US teenagers (Rideout, Foehr, & Roberts, 2010), which has shown that, on a typical day, younger teenagers (11y-14y) spend 24 minutes more playing digital games than older teenagers (15y-18y).

Contact: theo.lynn@dcu.ie

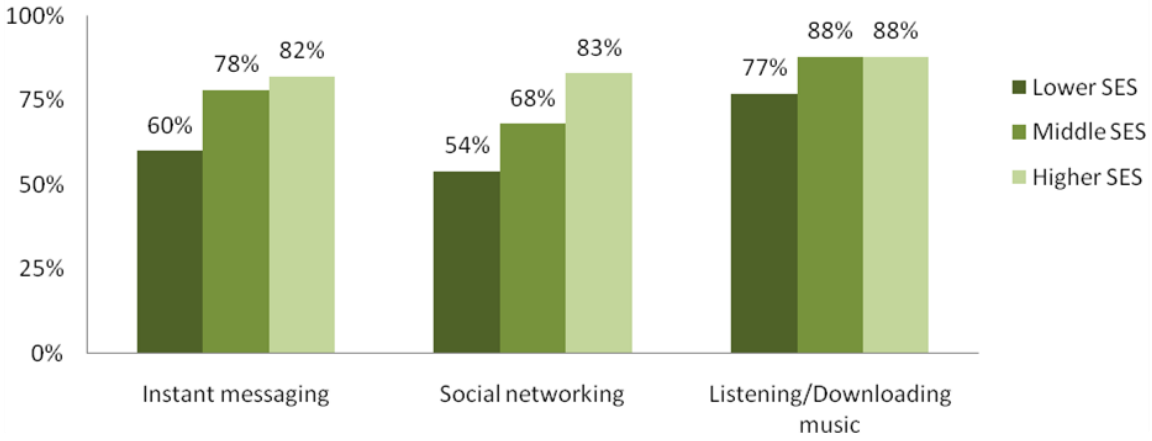
Figure 5.15 **Internet Activities at Home: Age Differences***



N=378
* All within-group differences are significant at p<.05.

Third, our study reveals socioeconomic status to be a significant factor accounting for differences in CTYI students' communication and entertainment activities. Specifically, as shown in Figure 5.16, students with a higher socioeconomic status were found to spend significantly more time in instant messaging and social networking compared to students with either a lower or middle socioeconomic status. Moreover, students with a lower socioeconomic status were listening and/or downloading music online significantly less frequently than students with either higher or middle socioeconomic status.

Figure 5.16 **Internet Activities at Home: SES Differences***

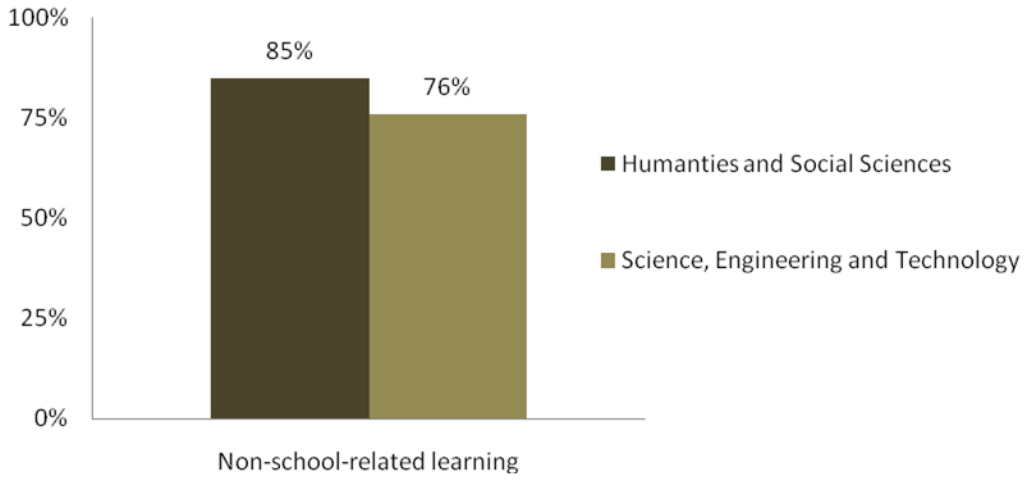


N=378
* All within-group differences are significant at p<.05.

Finally, we found a small yet significant difference in the time CTYI students enrolled in different subjects were spending time online for learning activities not related to school work. As shown in Figure 5.17, students enrolled in subjects within the Humanities and Social Sciences were spending more time than those students enrolled in subjects within Science, Engineering and Technology.

Contact: theo.lynn@dcu.ie

Figure 5.17 **Internet Activities at Home: Subject Discipline Differences***



N=378

* All within-group differences are significant at p<.05.

5.2.2 Internet Attitudes

Internet attitudes are broadly viewed as a component of Internet literacy. The literature suggests that students' attitudes towards the Internet can influence their motivation and interests towards learning to use the medium (Coffin & MacIntyre, 1999). In the same way that computer attitudes have been found to be associated with performance of using and learning computers (Houle, 1996), attitudes towards the Internet are suggested to relate to performance in employing Internet technology. Research has shown that perceptions of the usefulness and ease of use of a new technology are important factors explaining not only the intention but also the competence to use ICT (Tao, Cheng, & Sun, 2009; Verhoeven, Heerwegh, % De Wit, 2010). For example, recent research indicates that perceived usefulness of computers, perceived control of computer use, and computer anxiety are significant predictors of self-perceptions of ICT skills, including competences in maintaining a computer, developing a website, and working with computer programs. In relation to Internet use, previous research (e.g., Tsai et al., 2001) has shown that attitudes towards the Internet are indeed positively related to the actual practice and frequency of using the medium.

In our study, attitudes towards the Internet were assessed with the use of a validated instrument, namely the Internet Attitude Scale (IAS), developed originally by Tsai, Lin, & Tsai (2001). The IAS includes four sub-scales: perceived usefulness, measuring students' perceptions about the positive impact of the Internet on individuals and society; affection, assessing students' feeling and anxiety when using the Internet; perceived control, measuring students' confidence about the independent control of the usage of the Internet; and behaviour, assessing students' actual practice and frequency of using the Internet. All sub-scales were rated on a five-point Likert type scale, ranging from 1=strongly disagree, to 5= strongly agree.

As shown in Table 5.3, CTYI students' attitudes towards the Internet were overall positive, as mean scores for the four sub-scales were found to be above average: 3.2 for behaviour; 4.0 for control; 4.1 for usefulness; and 4.3 for affection. Notably, the average score reported by CTYI students for perceived control was considerably higher than the one reported by a sample of Taiwanese high-school students (Tsai, Lin, & Tsai, 2001).

Contact: theo.lynn@dcu.ie

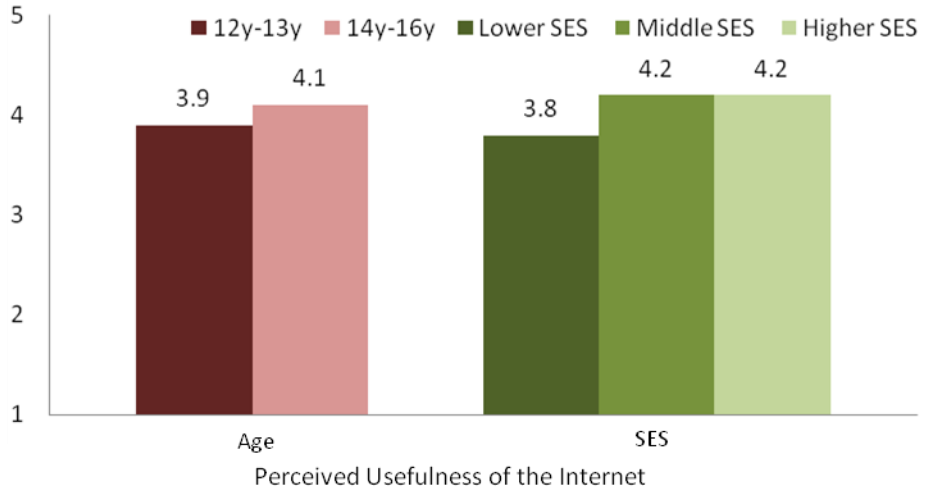
Table 5.3 **Attitudes towards the Internet**

Internet Attitude Subscales	CTYI Students (N=378)	Taiwanese High-School Students (N=753)
Perceived usefulness	4.1	4.2
Affection	4.3	4.0
Perceived Control	4.0	3.3
Behaviour	3.2	3.2

Note: Scores shown are based on responses on a 5-point Likert type scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree).

We also found that perceived usefulness of the Internet differed across age and socioeconomic status. Older students and those with higher or middle socioeconomic status reported more positive perceptions of Internet usefulness compared to younger students and those with a lower socioeconomic status (see Figure 5.18).

Figure 5.18 **Attitudes towards the Internet: Age and SES Differences***



N=378
* All within-group differences are significant at p<.05.
Vertical axis rating: 1=strongly disagree; 2= disagree; 3=neutral; 4= agree; 5=strongly agree

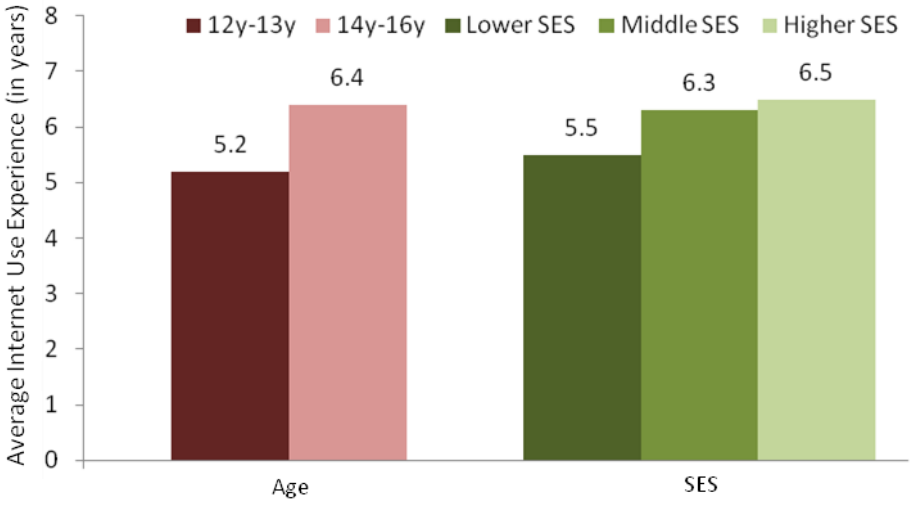
5.2.3 Internet Use Experience

Besides their attitudes towards the Internet, CTYI students were also asked to indicate the number of years for which they were using the medium. The average reported Internet use experience was 6.3 years, with approximately three-quarters of students (74%) reporting Internet use experience more than four years. The median age of first use of the medium was nine years old.

As shown in Figure 5.19, Internet use experience was found to vary along different age and socioeconomic groups. First, older students reported significantly longer Internet use experience than younger students. Second, in terms of socioeconomic status, our results indicate that students of a lower socioeconomic status had 0.8 years less Internet use experience than students of a middle socioeconomic status, while the difference with students of a higher socioeconomic status was one year.

Contact: theo.lynn@dcu.ie

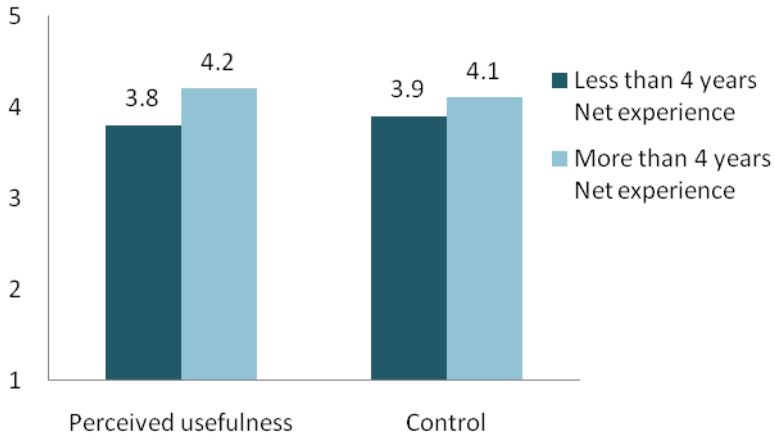
Figue 5.19 **Internet Experience : Age and SES Differences***



N=378
* All within-group differences are significant at p<.05.

Linking students' Internet use experience to their attitudes towards the medium, we also found that perceptions of Internet usefulness and control were significantly more positive among students with Internet experience more than four years compared to those students with Internet use experience less than 4 years (see Figure 5.20).

Figure 5.20 **Linking Internet Use Experience to Attitudes towards the Internet***



N=378
* All within-group differences are significant at p<.05.
Vertical axis rating: 1=strongly disagree; 2= disagree; 3=neutral; 4= agree; 5=strongly agree

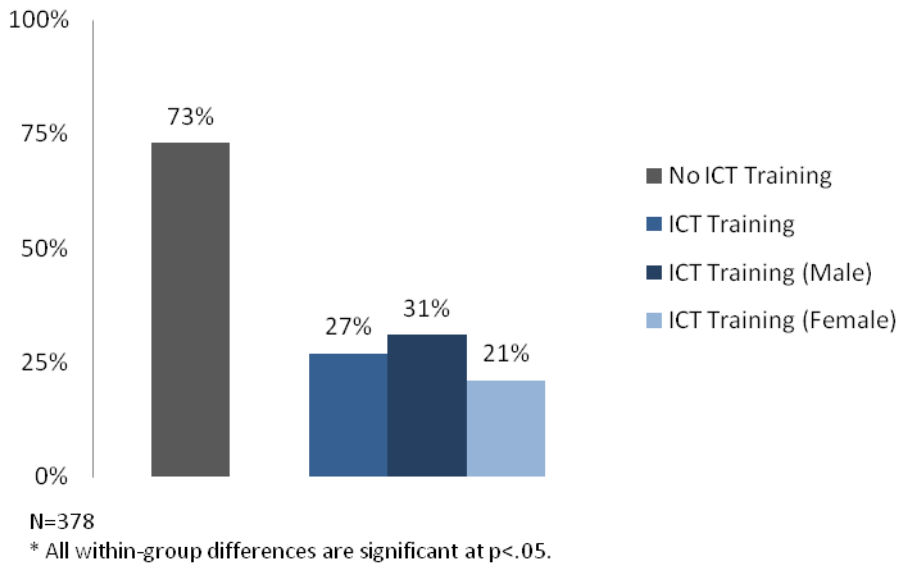
5.3 IT Training

Students' IT skills were assessed by asking them to indicate whether and the types of IT training courses they had completed prior to their enrolment to CTYI's summer school. The results indicate that around three-quarters of respondents had no previous ICT training. The remaining 27 per cent reported completion of the following IT training courses: European Computer Driving Licence (19%), Microsoft Office Specialist Certification (5%), and International Computer Driving Licence (3%).

Contact: theo.lynn@dcu.ie

Completion of IT training was also found to be more common among male students than female students (see Figure 5.21).

Figure **5.21 ICT Training Experience: Gender Differences***



N=378

* All within-group differences are significant at p<.05.

5.4 Emerging Trends in ICT Usage

According to Internet experts and technology stakeholders, there are at least two clear trends in ICT that have begun in the last decade and are likely to accelerate in the near future: the prevalence of mobile devices, and the proliferation of social media (Quitney-Anderson & Rainie, 2010). These two trends are explored below.

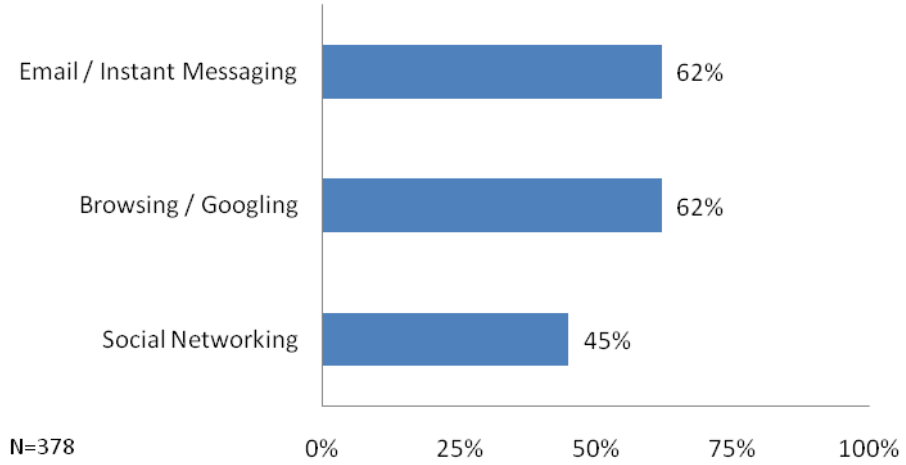
5.4.1 Mobile Internet Activities

Recent research has shown a dramatic increase in mobile media ownership and usage among US teenagers. As Rideout, Foehr, & Roberts (2010, p. 3) state, "the transformation of the cell phone into a media content delivery platform, and the widespread adoption of the iPod and other MP3 devices, have facilitated an explosion in media consumption among American youth". Indeed, as the same authors continue, mobile media afford young people with excellent opportunities for media multitasking – surfing the Internet while chatting to their friends and family or listening to their favourite music – while on the go.

In our study, we were interested in the Internet activities in which CTYI students were involved using a mobile device such as a wireless laptop, mobile phone or PDA. We specifically asked students to indicate their top three online activities using a mobile device at least once a week.

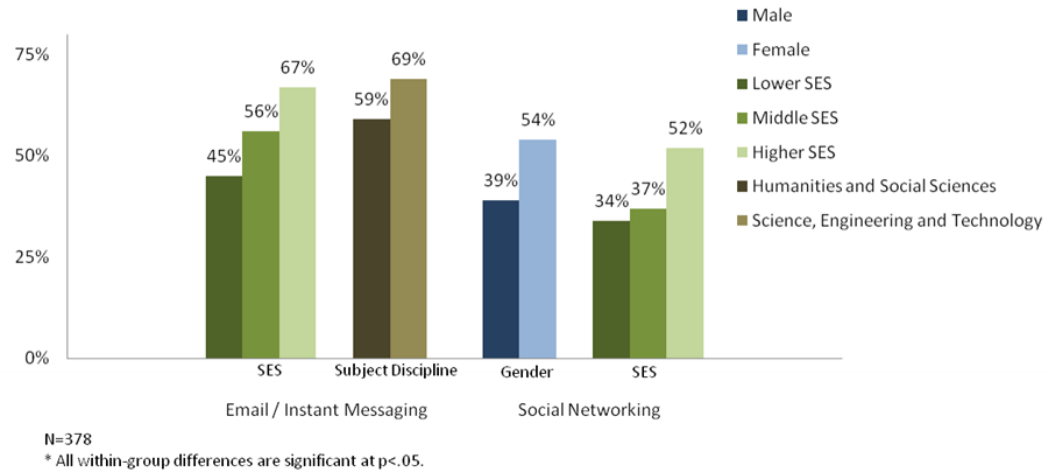
As shown in Figure, 5.22, more than six out of ten respondents reported use of a mobile device for communication (i.e. emailing, instant messaging), and information seeking and gathering purposes (i.e. browsing, googling), followed by 45 per cent of students reporting use of a mobile device for social networking activities.

Figure 5.22 **Top 3 Internet Activities Using a Mobile Device**



We also found that two of the top three mobile Internet activities were patterned along gender, socioeconomic status, and subject discipline lines. More specifically, as shown in Figure 5.23, email and instant messaging was significantly more common among students with higher socioeconomic status and those enrolled in subjects with the Science, Engineering and Technology disciplines. Social networking was also found to be more common among students with higher socioeconomic status, as well as among female students.

Figure 5.23 **Internet Activities Using a Mobile Device: Gender, SES and Subject Discipline Differences***



N=378
* All within-group differences are significant at p<.05.

5.4.2 Social Media Usage

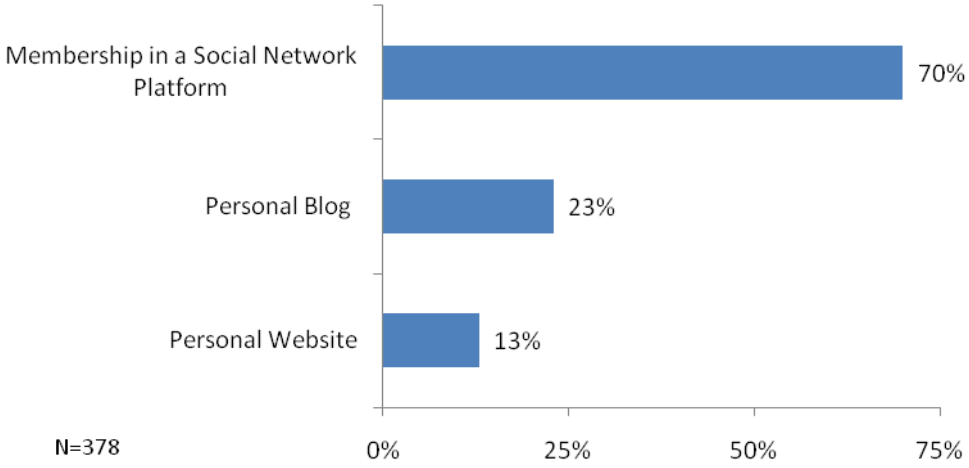
Social media comprise "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content" (Kaplan & Haenlein, 2010, p. 61). According to the Organisation for Economic Cooperation and Development, user generated content needs to fulfil three criteria in order to be considered as such: accessibility through public websites or social networking sites, demonstration of creative effort, and content without a commercial market context in mind (OECD, 2007a). Social media have

historically evolved from personal websites, to blogs, and more recently to social networking platforms and virtual worlds.

The use of social media has become an integral part of many people's everyday lives. Social networking sites, in particular, are increasingly attracting teenagers. The Pew Internet & American Life project has found that, as of September 2009, 73 per cent of online US teens, ages 12y-17y, used a social network platform compared to 55 per cent three years ago (Lenhart, Purcell, Smith, & Zickuhr, 2010).

In our study, social media usage was assessed by requesting respondents to indicate whether they used one or more of the following types of social media: personal website, personal blog, social network platform. As shown in Figure 5.24, and similar to online US teens, 70 per cent of CTYI students reported membership in a social network platform, followed by 23 per cent and 13 per cent of students reporting use of a personal blog and personal website, respectively.

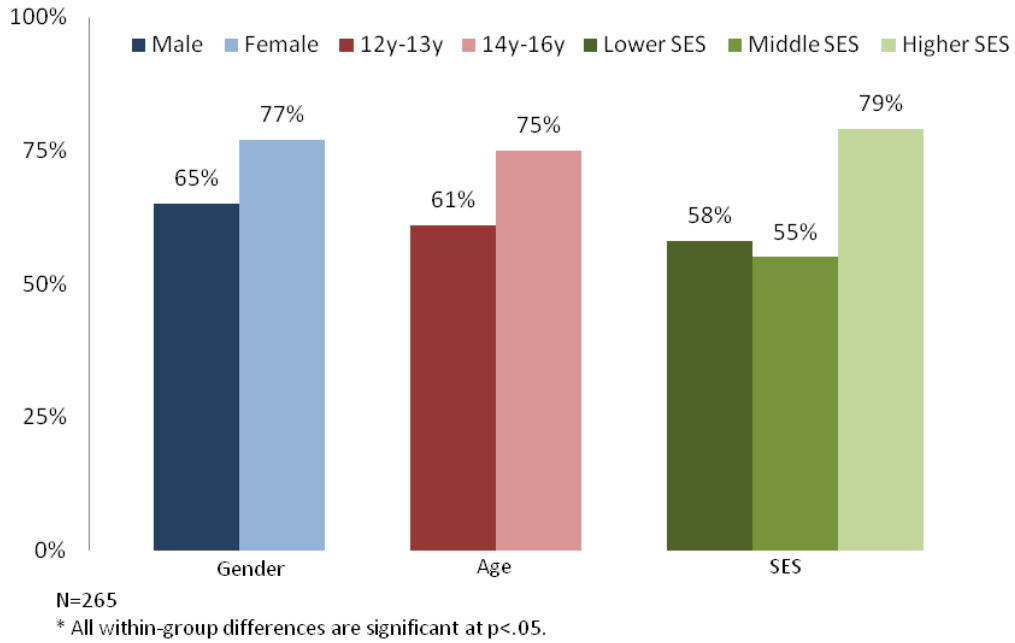
Figure 5.24 **Social Media Usage**



Given the prevalence of social networking sites, we were interested in identifying possible differences in online social networks usage attributed to sociodemographic characteristics of our sample. The results illustrated in Figure 5.25 indicate three differences based on student gender, age, and socioeconomic status. More specifically, usage of online social networks was significantly higher among female students than male students, younger students than older ones, and finally, among students with higher socioeconomic status than students with middle or lower socioeconomic status.

Contact: theo.lynn@dcu.ie

Figure 5.25 **Social Network Platforms Usage: Gender, Age and SES Differences***



N=265

* All within-group differences are significant at p<.05.

Finally, students were asked to indicate their favourite social network platform. As shown in Figure 5.26, Bebo was particularly popular (62%) among CTYI students, followed by Facebook (17%), and Twitter (8%). Notably, Bebo was found to be particularly more popular among students enrolled in subjects within the Humanities and Social Sciences than those within Science, Engineering and Technology, whereas the reverse was found to be the case for Facebook.

Figure 5.26 **Top 3 Social Network Platforms**

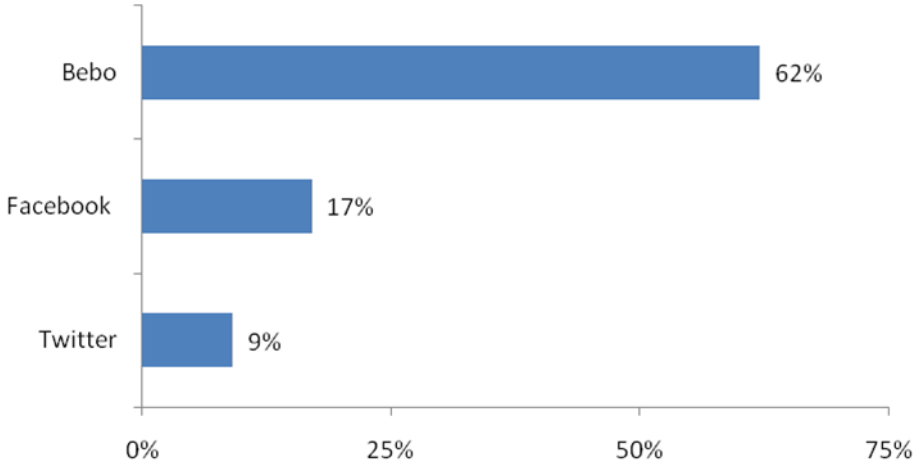


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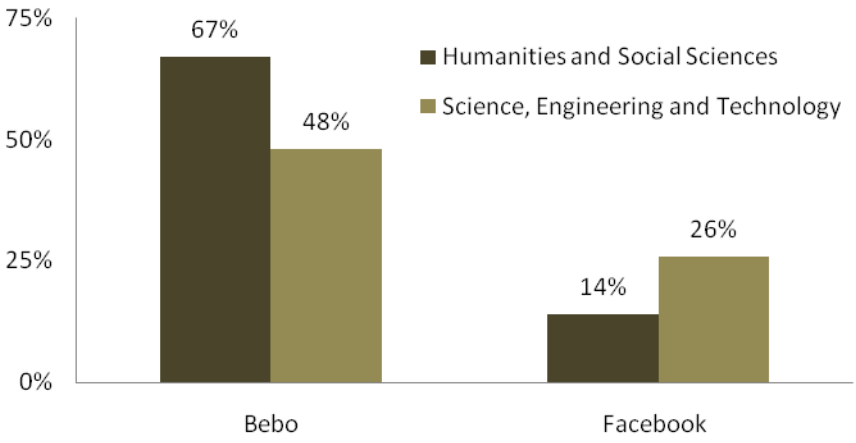
Figure 5.27 **Top 3 Social Network Platforms Usage: Subject Discipline Differences***



N=265

* All within-group differences are significant at p<.05.

6. ICT in the School Learning Experience

This chapter expands upon the previous chapter's exploration of CTYI students' ownership of, home usage of, and skills with ICT to examine their learning experience with ICT in school. The first section presents findings about students' perceptions of the role of ICT in school education. This is followed by examining students' motivation to use ICT and the Internet in school, as well as their perceptions about the ICT competences of their instructors, and the ICT infrastructure of their schools. The third section shifts attention to students' views of the importance of traditional and digital resources for their daily schoolwork. In the fourth section, we take a close look at students' ICT-enabled activities in school by examining: how often they were using computers in school; how often they were bringing and using their laptops in class as well as what their perceived learning benefits of, and barriers to laptop use in class were; and whether they were using Learning Management Systems and One-to-One Computing in school and, if so, whether this was perceived as beneficial for their school learning experience. The final section describes the key features of an ideal online learning environment as perceived by CTYI students themselves.

6.1 The Role of ICT in School Education

Based on previous studies (e.g. Smith, Salaway, & Caruso, 2009), we developed five items to gauge CTYI students' perceptions of the importance of ICT usage for their school education. The items are presented in Table 6.1.

Table 6.1 **Technology in the School Learning Experience**

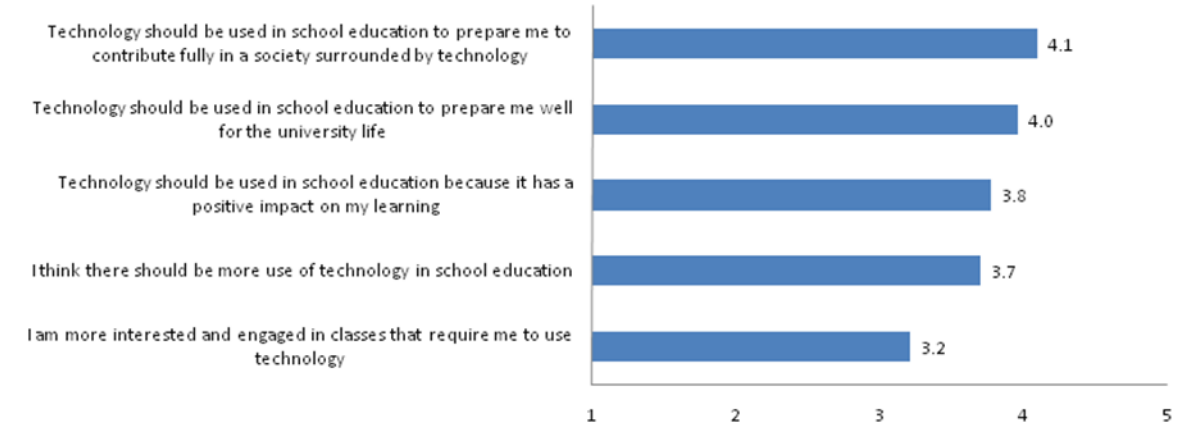
	Items
1	Technology should be used in school education to prepare me to contribute fully in a society surrounded by technology
2	Technology should be used in school education to prepare me well for the university life
3	Technology should be used in school education because it has a positive impact on my learning
4	I think there should be more use of technology in school education
5	I am more interested and engaged in classes that require me to use technology

Note: All items are rated on a 5-point Likert type scale ranging from 1=strongly disagree, to 5=strongly agree.

As shown in Figure 6.1, students, on average, held very positive views regarding the societal role of ICT usage in school. They also agreed that ICT usage in school should serve to prepare them well for the university life. While somewhat lower rated, the learning benefits of ICT usage in school were still acknowledged by the majority of respondents. Interestingly, however, respondents' ratings of the extent to which incorporation of ICT in classes could spark their interest and engagement in those classes were only marginally positive.

Contact: theo.lynn@dcu.ie

Figure 6.1 **Student Perceptions of the Role of ICT in School Education**

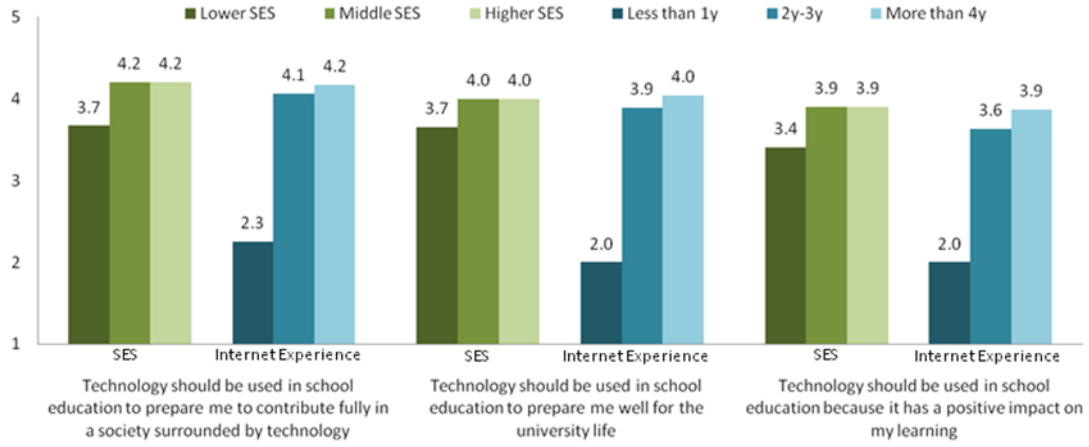


N=378
Horizontal axis rating: 1=strongly disagree; 2=disagree; 3=neutral; 4 agree; 5= strongly agree

Taking a closer look at the above results, we found a number of significant differences in respondents' ratings of the role of ICT usage in school education, which were associated with student sociodemographic characteristics, including gender and socioeconomic status, as well as Internet use experience and subject discipline specialisation.

As shown in Figure 6.2, those students with lower socioeconomic status, and those with Internet use experience of less than one year perceived the societal, educational, and learning role of ICT usage in school to be considerably less important than those students with middle or higher socioeconomic status, and those students with Internet use experience of at least two years. Moreover, as shown in Figure 6.3, we found that males and those students enrolled in subjects within Science, Engineering and Technology differed significantly with females and those students enrolled in subjects within the Humanities and Social Sciences in their perceived interest in, and engagement with classes that require use of technology.

Figure 6.2 **Student Perceptions of the Role of ICT in School Education: SES and Internet Use Experience Differences***



N=378
* All within-group differences are significant at $p<.05$.
Horizontal axis rating: 1=strongly disagree; 2=disagree; 3=neutral; 4 agree; 5= strongly agree

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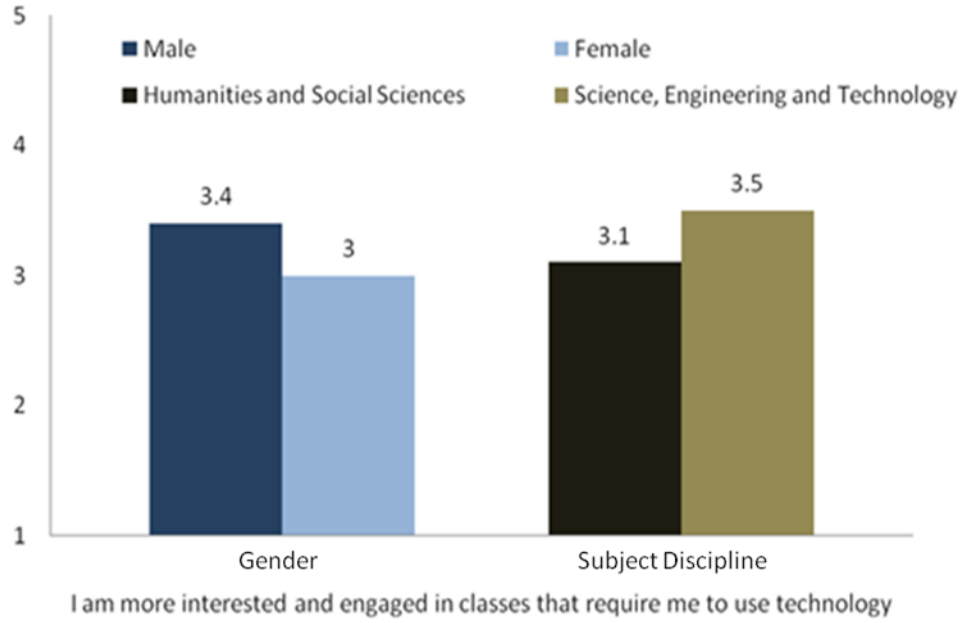
Figure 6.3 **Student Perceptions of the Role of ICT in School Education: Gender and Subject Discipline Differences***



N=378
* All within-group differences are significant at p<.05.
Horizontal axis rating: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5= strongly agree

6.2 Access, Competence and Motivation for Using ICT and the Internet in School

Several benchmarking studies have shown that over the last decade the use of ICT for educational purposes in European secondary schools has almost reached the 100 percent saturation point, with more than 90 percent of secondary schools being now equipped with computers connected to the Internet (Korte & Hüsing, 2006). However, significant variations in the intensity of ICT use in schools across Europe still remain. These variations are reflected in the number of computers connected to the Internet per 100 pupils, with Ireland (9.4 Internet computers per 100 lower and upper secondary school students) lagging behind the European leaders, namely Norway (30.2 per 100 students), Denmark (27 per 100 students), the UK (24.2 per 100 students), and the Netherlands (19.4 per 100 students) (Korte & Hüsing, 2006).

According to a recent benchmarking study on the use of ICT in European schools, 60 percent of European teachers describe the ICT infrastructure in their schools as adequate and the Internet connection as sufficiently rapid, more than 80 percent describe themselves as competent in using computers and the Internet in classroom, and two-thirds dispose of the necessary motivation for doing so (Korte & Hüsing, 2006). In particular, Irish teachers' ratings of access, competence, and motivation are 43.5 percent, 84.3 percent, and 72.8 percent, respectively.

In our study, we were interested in examining how CTYI students would rate their perceived access to, their teachers' competence with, and their own motivation for using ICT and the Internet in school. Accordingly, we adapted the Access, Competence, and Motivation (ACM) model as developed by Viherä and Nurmela (2001) to assess students' propensity to use computers and the Internet in classroom situations.

Based on a 5-point Likert type scale, we therefore asked respondents to state their agreement or disagreement with each of the three dimensions of the ACM model: access to computers and the Internet in school, teachers' competence in using computer software and the Internet and applying it for teaching purposes, and motivation gauged through students' attitudes that using computers in classroom results in significant learning benefits (see Table 6.2).

Table 6.2 **Access, Competence and Motivation for Using Computers and the Internet in School**

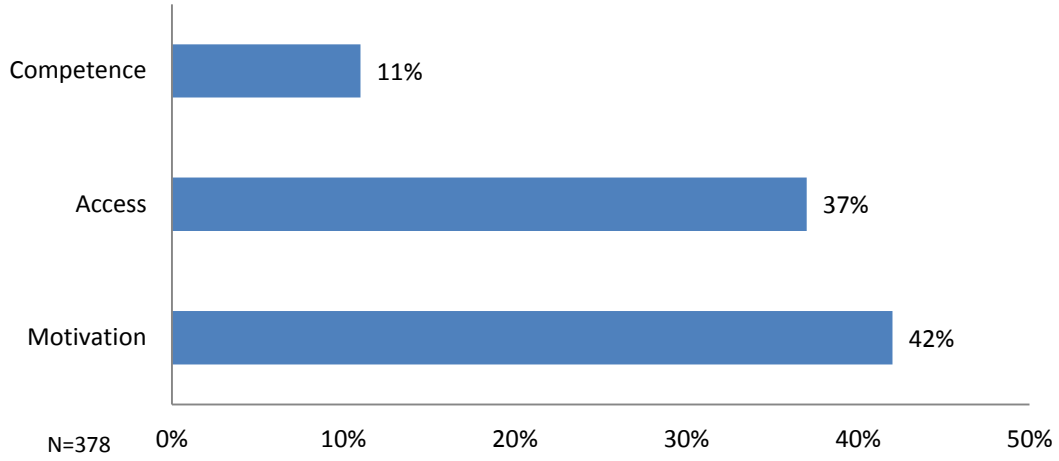
ACM Dimensions	Items
Access	1. Our school is well-equipped with computers 2. The Internet connection we have is sufficiently fast
Competence	1. Teachers in our school do not have the sufficient computer skills* 2. Existing teaching materials on the Internet are of poor quality*
Motivation	1. Using computers in class does not have significant learning benefits for me*

*Reverse-coded item

Note: All items are rated on a 5-point Likert type scale ranging from 1=strongly disagree, to 5=strongly agree.

As illustrated in Figure 6.4, motivation (42%) was ranked at the top among our sample, followed by access (37%), whereas only 11 percent of students agreed that their teachers were competent in using ICT and applying it for teaching purposes.

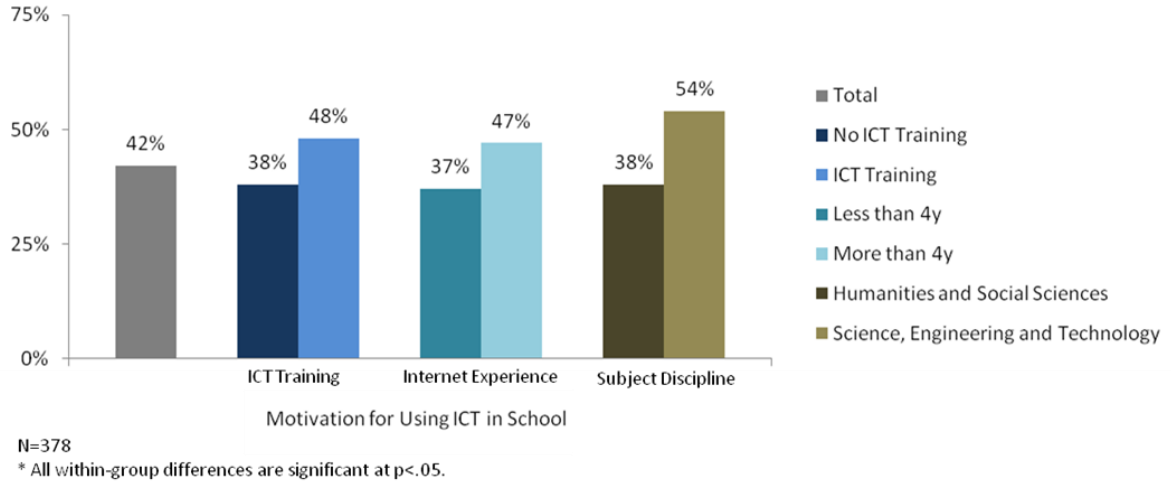
Figure 6.4 **Access, Competence and Motivation for Using ICT in School**



Taking a closer look at students' ratings, we also found a number of significant differences in students' motivation for using ICT in school. These differences, as shown in Figure 6.5, were patterned along students' previous ICT training, Internet use experience, and subject discipline specialisation.

Contact: theo.lynn@dcu.ie

Figure 6.5 **Motivation for Using ICT in School: ICT Training, Internet Use Experience, and Subject Discipline Differences***



N=378
* All within-group differences are significant at p<.05.

Specifically, we found that students who had completed ICT training, students with more than four years Internet use experience, and students enrolled in subjects within the Science, Engineering and Technology disciplines scored significantly higher in motivation for using ICT in school compared to students with no prior ICT training, students with less than 4 years Internet use experience, and those enrolled in subjects within the Humanities and Social Sciences disciplines.

Combining the three dimensions of access, competence, and motivation, we finally classified respondents into four ACM clusters depending on the presence or absence of either concept (see table 6.3).

Table 6.3 **Access, Competence and Motivation Combinations: The Key Role of ICT Training**

ACM Combinations	Total %	ICT Training %	No ICT Training %
Access + Competence	6	10	4
Access + Motivation	15	22	11
Competence + Motivation	7	9	4
Access + Competence + Motivation	3	7	1

Note: All within-group differences shown are significant at least at p<.05.

As shown in Table 6.3, ICT training was found to be a key factor accounting for significant differences in student ratings, with those students having completed some form of ICT training scoring higher in all four ACM combinations compared to those students who reported no prior ICT training.

6.3 Digital Resources for a Successful School Experience

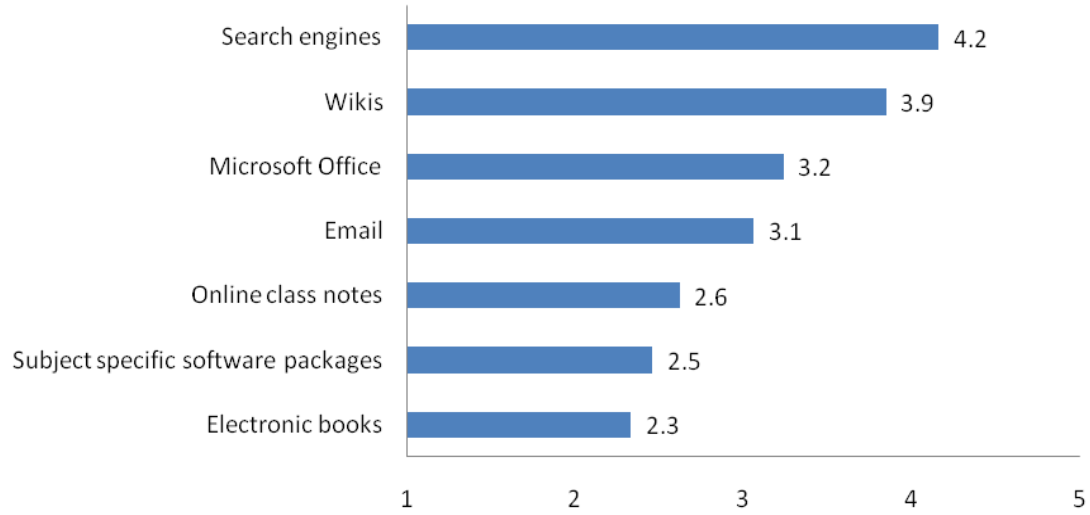
What types of digital resources did CTYI students consider important for their daily schoolwork? How were these resources compared to traditional, off-line resources? In order to answer these questions, we asked respondents to indicate on a 5-point Likert type scale how important they considered a range of digital resources and tools, such as electronic books, online class notes, and subject specific software packages, as well as traditional resources, namely books and handwritten class notes.

Our results show that, while students placed high importance on books and handwritten class notes, they also found important for their daily schoolwork digital resources, especially material they can

Contact: theo.lynn@dcu.ie

find on the Internet. As shown in Figure 6.6, search engines were rated as particularly helpful for their daily schoolwork, followed by Wikis, Microsoft Office, and email. Interestingly, online class notes, subject specific software packages, and electronic books were rated as not that important by the majority of the respondents. This finding is consistent with the findings reported in Korte & Hüsing's (2006) study, which has shown that the average scoring of Irish schools in terms of access to, and teachers' competence with ICT is below the EU average. It therefore seems that students' low ratings of online class notes and electronic books may be due, not to the fact that students do see them as unimportant per se, but to the fact that these resources may have only partially been utilised by their teachers as an educational resource.

Figure 6.6 **Importance of Digital Resources for School Coursework**



N=378
Horizontal axis rating: 1=not important at all; 2=not important; 3=neutral; 4=important; 5=very important

Looking more closely at students' ratings of the importance of digital resources for their daily schoolwork, we found that Internet use experience accounted for significant group differences, with those students with more than four years Internet use experience ascribing significantly more importance to Wikis, Microsoft Office, email, as well as to online class notes and electronic books compared to those students with less than four years Internet use experience (see Figure 6.7).

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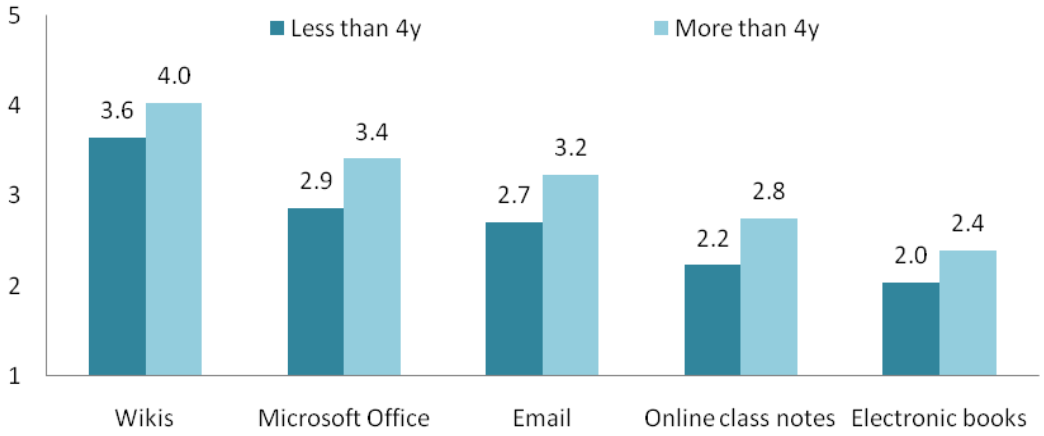
Figure 6.7 **Importance of Digital Resources for School Coursework: Internet Use Experience Differences***



N=378
* All within-group differences are significant at p<.05.
Vertical axis rating: 1=not important at all; 2=not important; 3=neutral; 4=important; 5=very important

6.4 ICT-enabled School Activities

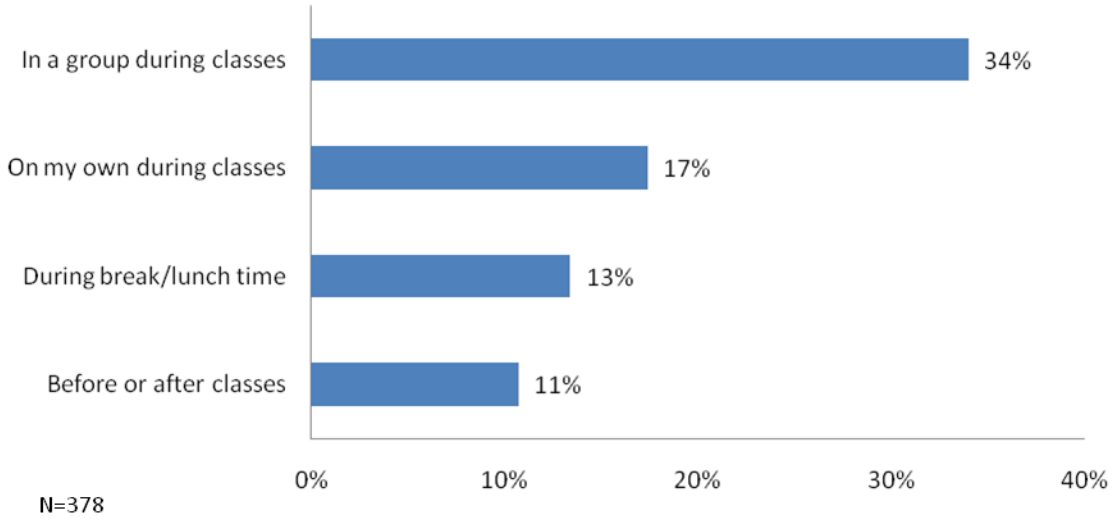
Continuing our exploration of CTYI students' experiences with ICT in the school environment, this section presents findings on PC use in school as well as laptop use in class, including students' views of barriers to, and perceived learning benefits from laptop use. Findings on student usage of learning management systems along with their experiences with one-to-one computing are also presented. Finally, we present findings on the perceived learning benefits of laptop use, learning management system use, and one-to-one computing.

6.4.1 PC Use in School

One of the key challenges European schools are currently faced with concerns the degree of integration of ICT in the teaching process. According to benchmarking data (Korte & Hüsing, 2006), in 2006 the percentage of Irish schools which offered and used PCs in classrooms was 89 percent, followed by 47 percent and 11 percent of schools being equipped with PCs in computer labs and libraries.

In our study, we were interested in examining the degree of PC integration in the school environment by focusing on when, where, and how CTYI students were using PCs in a typical school day. The results, as illustrated in Figure 6.8, indicate that almost one-third of students were using PCs in a group during classes, followed by 17 percent using PCs on their own during classes. A lower percentage of students reported out-of-class PC use, either during breaks/lunch time (13%) or before/after classes (11%).

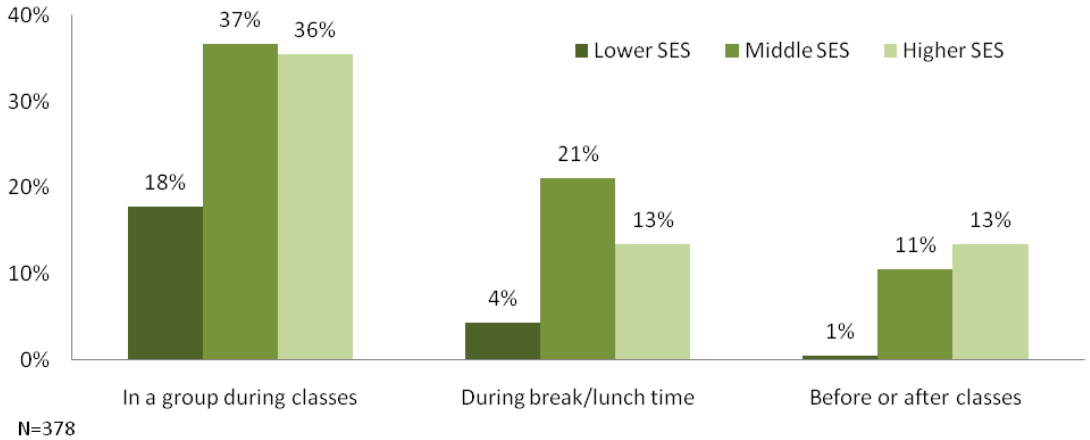
Figure 6.8 **PC Use in School**



Further analysis revealed that PC use in school was not uniformed but rather patterned along students' socioeconomic status, ICT training as well as their perceptions of access to, and motivation for using ICT in school.

In relation to student socioeconomic status, Figure 6.9 shows that those students with lower socioeconomic status reported significantly lower in-class (in a group) and out-of-class PC use compared to students with middle and higher socioeconomic status. Moreover, as shown in Figure 6.10, ICT training was found to be an additional factor accounting for significant differences in both in-class (individual) and out-of-class PC use.

Figure 6.9 **PC Use in School: SES Differences***



N=378

* All within-group differences are significant at p<.05.

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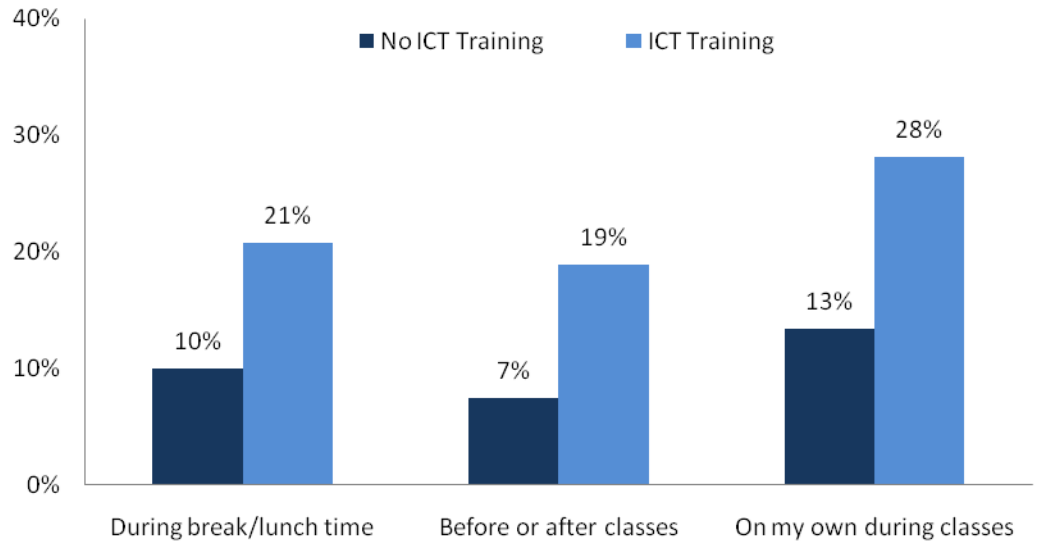
Figure 6.10 **PC Use in School: ICT Training Differences***

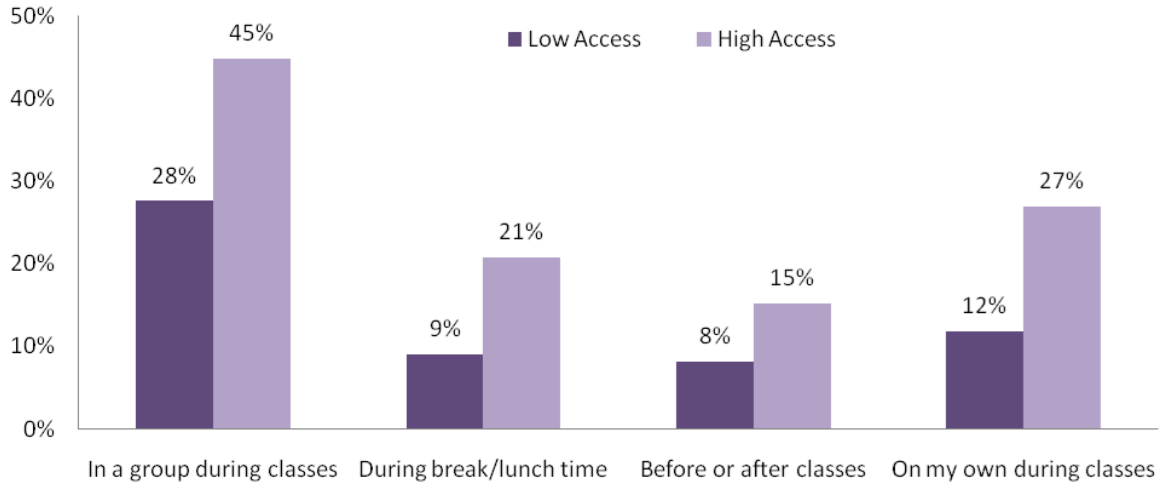


N=378

* All within-group differences are significant at p<.05.

Students' perceptions of access to, and motivation for using ICT in school were also found to account for significant differences in PC use in school. More specifically, and as shown in Figure 6.11, those students with perceived high access to ICT use in their schools reported significantly higher PC usage, both in-class and out-of-class compared to those with low access to ICT use. Finally, those students with perceived high motivation for using ICT in their schools reported significantly higher PC use in class (group) as well as out-of-class (Figure 6.12).

Figure 6.11 **PC Use in School: Access Differences***



N=378

* All within-group differences are significant at p<.05.

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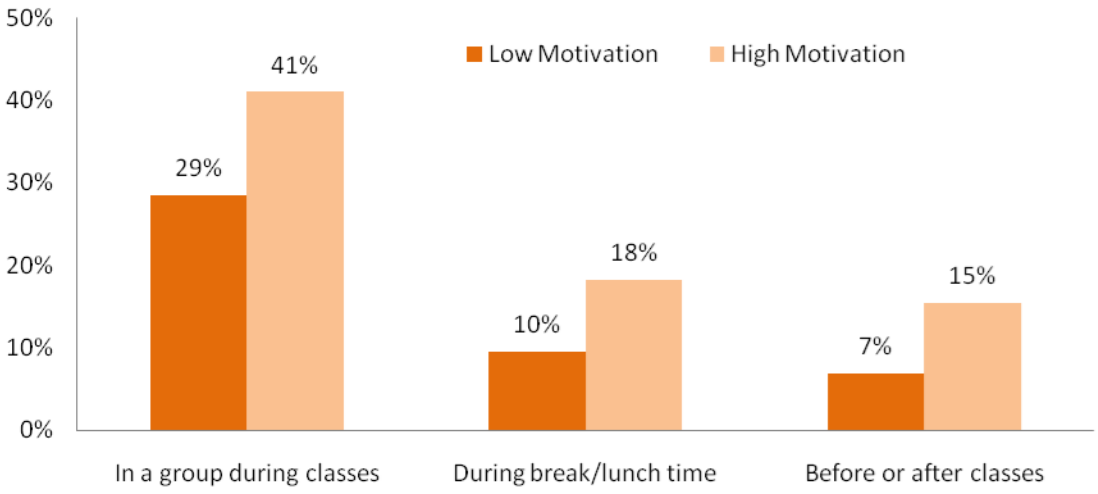
Figure 6.12 **PC Use in School: Motivation Differences***



N=378

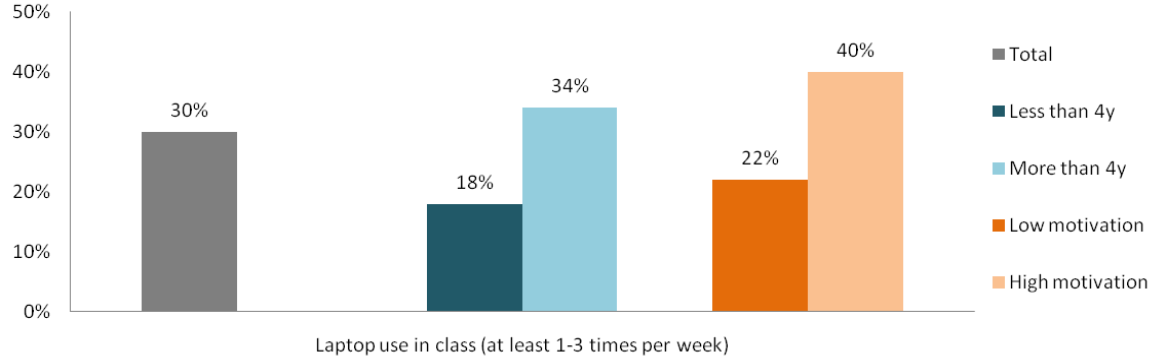
* All within-group differences are significant at p<.05.

6.4.2 Laptop Use in Class

Given the prominence of mobile computing as this is reflected particularly in the widespread ownership and use of laptop computers among the student population (e.g. Smith, Salaway, & Caruso, 2009), we asked CTYI students to indicate whether and the frequency with which they were bringing their laptop computer to class in a typical week. Of the 219 students (58%) who reported ownership of a laptop computer, 70 percent stated that were never bringing their laptop to class. Of the remaining 30 percent of students, 18 percent stated that were bringing their laptop to class every day, followed by 9 percent and 3 percent stating they were bringing their laptop to class 1-3 days per week, and 4-5 days per week, respectively.

As shown in Figure 6.13, significant differences in laptop use in class were found to be associated with students' Internet use experience, and perceived motivation for using ICT in school. Significantly higher laptop use in class was reported among students with more than four years Internet use experience, and those with perceived high motivation, compared to students with less than four years Internet use experience, and those with perceived low motivation, respectively.

Figure 6.13 **Laptop Use in Class: Internet Use Experience and Motivation Differences***

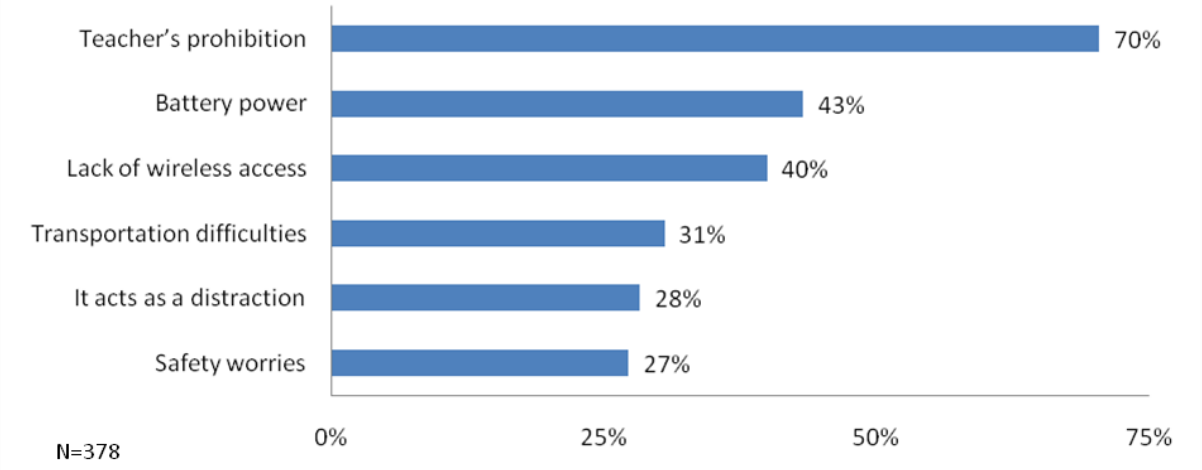


CTYI students who owned laptop computers were also asked to indicate what barriers to laptop use in class they perceived. As shown in Figure 6.14, teachers' prohibition was reported by the majority

Contact: theo.lynn@dcu.ie

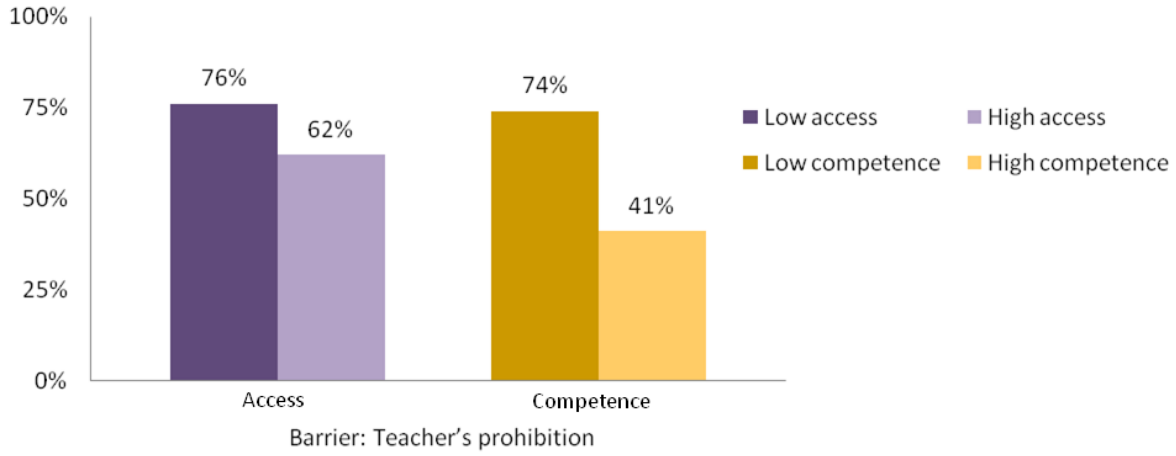
(70%) of our sample as the main barrier to laptop use in class. This was followed by technical, infrastructural, and practical barriers, including battery power (43%), lack of wireless access in school (40%), and transportation difficulties (31%). Around three out of ten students (28%) also indicated that laptop use in class could act as a distraction, while 27 percent expressed safety worries.

Figure 6.14 **Barriers to Laptop Use in Class**



Interestingly, students' ratings of teacher's prohibition to laptop use in class were found to differ significantly based on students' perceptions of access to computers and the Internet in school, and of their teachers' competence in using computer software and the Internet. In particular, as shown in Figure 6.15, teacher's prohibition to laptop use in class was rated by 62 percent of students with high perceived access compared to 76 percent of students with low perceived access. The difference in students' ratings of teacher's prohibition was even larger between students with high perceived competence (41%) and low perceived competence (74%).

Figure 6.15 **Barriers to Laptop Use in Class: Access and Competence Differences***



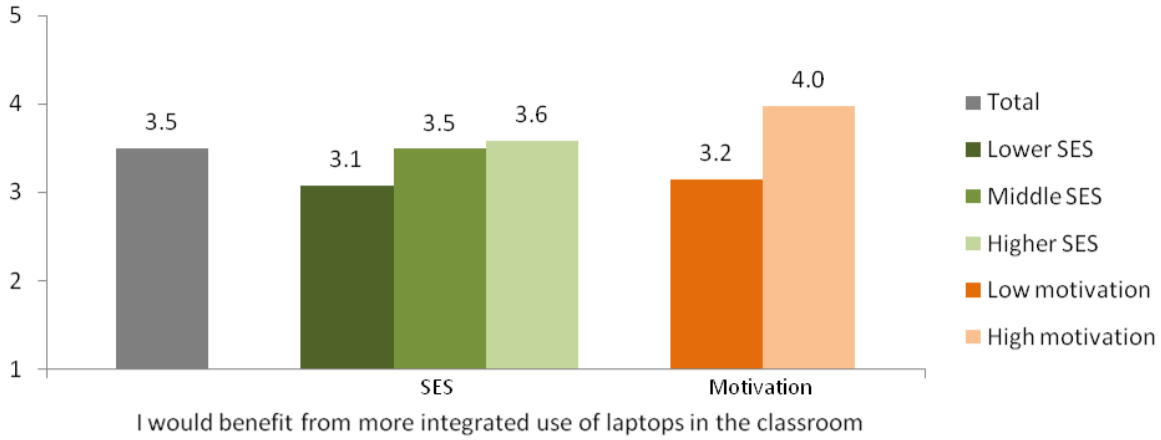
N=378

* All within-group differences are significant at p<.05.

Contact: theo.lynn@dcu.ie

Besides barriers to laptop use in class, we asked our sample to state the extent to which more integrated use of laptops in the classroom would be of benefit to them. Figure 6.16 shows that students, in total, agreed moderately that more integrated use of laptops in the classroom would be beneficial for their learning. However, as shown in the same figure, students' agreement ratings differed significantly in terms of their socioeconomic status and perceived motivation for using ICT and the Internet in school, with those students with lower status and those with low perceived motivation reporting significantly lower levels of agreement with the learning benefits of more integrated laptop use in class compared to those students with middle and higher status, and those with high perceived motivation.

Figure 6.16 **Perceived Learning Benefits of Laptop Use in Class: SES and Motivation Differences***



N=378
* All within-group differences are significant at p<.05.
Vertical axis rating: 1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5= strongly agree

6.4.3 Learning Management System Use

Much of the success of e-learning and online education is associated with the availability and widespread usage of Learning Management Systems (LMS), also known as Virtual Learning Environments or learning platforms. An LMS is essentially software for delivering, tracking and managing educational material and learning resources (Hall, 2003). Besides their administrative benefits, such as automation of training events and course catalogue management, LMS enable educational institutions to develop electronic learning materials for students, to offer these courses electronically to students, to test and evaluate the students electronically, and to generate databases in which student results and progress can be stored and retrieved by teachers, students and parents at their own pace (Paulsen, 2003).

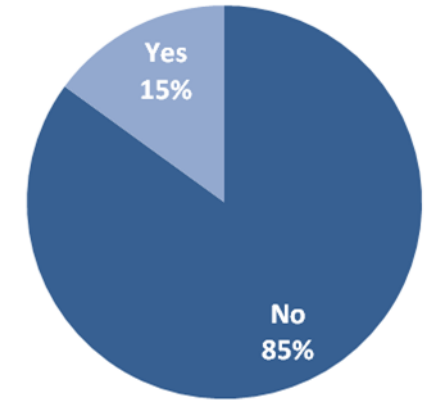
LMS are increasingly utilised by educational institutions, mainly universities but also secondary schools, as tools to improve the learning experience and performance of students by enabling them ready access to, reuse, and sharing of educational resources and learning objects. A recent study examining Irish undergraduate students' perceptions of LMS use indicated that students saw LMS as an expected and integral part of their learning experience, with over 70 percent of the students reporting high levels of satisfaction with the e-learning aspect of their modules (Concannon, Flynn, & Campbell, 2005).

Our results indicate that, on average, only a minority of CTYI students (15%) had ever used an LMS (Figure 6.17). Yet, as shown in Figure 16.18, the use of LMS was found to be significantly higher

Contact: theo.lynn@dcu.ie

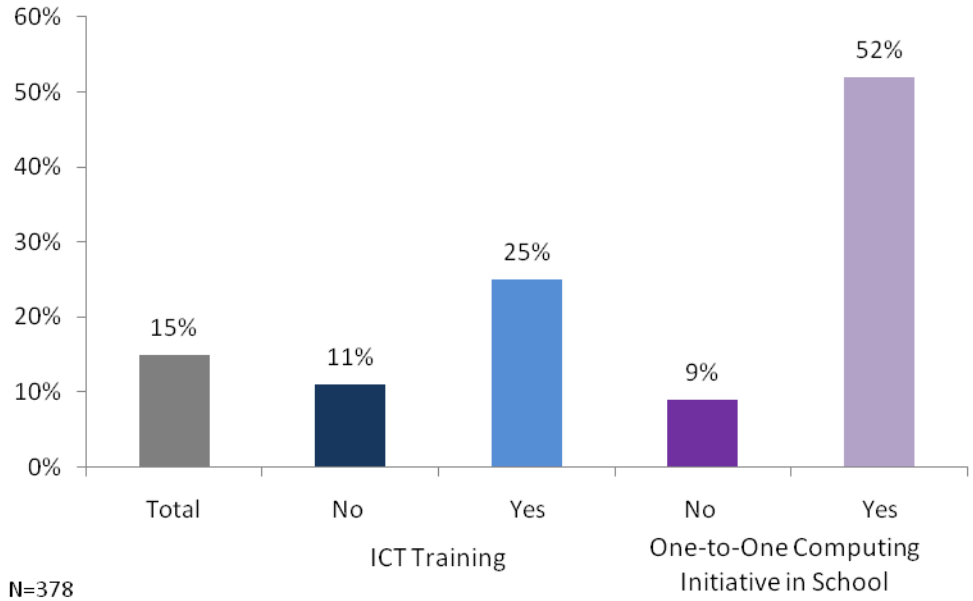
among students who had completed an IT training course (25%) compared to those students with no prior IT training (11%). More importantly, though, there were large differences in student LMS use based on whether or not one-to-one computing initiatives were encouraged by their schools. In particular, in those schools which had in place one-to-one computing initiatives student LMS use was found to be 52 percent, considerably higher than the average use of 15 percent.

Figure 6.17 **Learning Management System Use**



N=378

Figure 6.18 **Learning Management System Use: ICT Training and One-to-One Computing Differences***



N=378

* All within-group differences are significant at p<.05.

6.4.4 One-to-One Computing

Over the past decade there has been increasing interest and investment in one-to-one computing initiatives, early examples of which include Microsoft's Anytime, Anywhere Learning Programme that was introduced in the US in the mid-1990s (Rockman et al., 1998). Common to most one-to-one computing initiatives is the idea that all students are provided with laptop computers loaded with contemporary software, including LMS applications, which enable them to access the Internet

Contact: theo.lynn@dcu.ie

through their school's wireless network, and consequently help them complete academic tasks such as homework assignments, tests and presentations (Penuel, 2006).

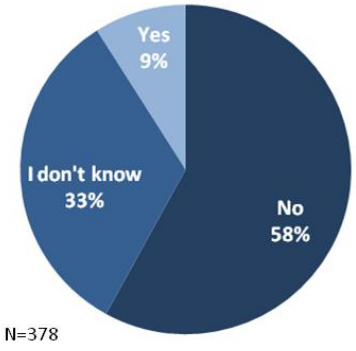
One key feature of one-to-one computing is that it makes possible for students and teachers to transition from occasional and supplemental use of computers, often taking place in computer labs, to more frequent and integral use of technology in a multitude of settings (Roschelle & Pea, 2002). One-to-one computing, in other words, means that students have ubiquitous, 24/7 access to a wide array of digital resources and tools to support their learning, to communicate with other students and their teachers, and effectively to equip them with the digital literacy skills that are necessary in the 21st century workplace (Penuel, 2006). Several studies have documented the benefits of one-to-one computing. These include: greater student engagement, increased student understanding of complex subject matter, increased student interest and enjoyment, heightened discussion and interactivity, increased student awareness of individual levels of comprehension, and increased teacher insight into student difficulties (Roschelle, Penuel, & Abrahamson, 2004). In short, one-to-one computing has the potential for providing students with equitable access to up-to-date resources and learning opportunities, and transforming the school learning experience from a teacher-centred activity to a much more collaborative and participatory process, with improved learning outcomes for students, and more technology-savvy teachers.

In our study, we were interested to gauge CTYI students' experience with one-to-one computing by asking them to indicate whether their schools encouraged one-to-one computing, and how important they considered one-to-one computing to be for their school as well as their university education. Respondents were presented with a brief description of one-to-one computing as follows:

> "In 1:1 computing, each student would be expected to have a laptop computer, and instructional activities would be designed around that expectation. 1:1 computing however involves much more. The learning environment or 'platform' is a critical component of 1:1. What is the 'platform'? It includes the way that courses are delivered online (Moodle, for example) as well as other online and computer based resources".

Our results indicate that less than one out of ten CTYI students (9%) stated that one-to-one computing initiatives were encouraged by their schools, compared to 58 percent of students who stated the opposite, whereas one-third of the respondents stated that they "didn't know" (Figure 6.19).

Figure 6.19 **One-to-One Computing**

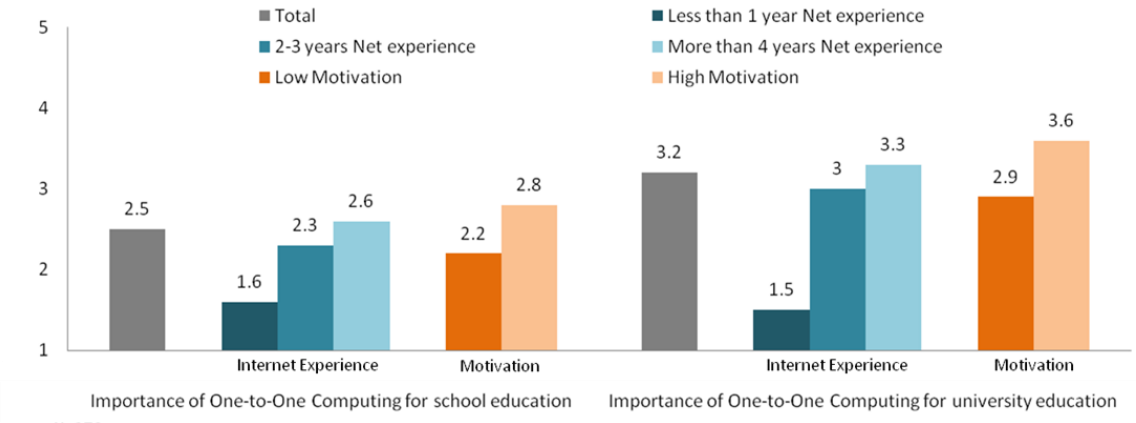


As shown in Figure 6.20, students ascribed little importance to one-to-one computing for their school education. However, they expected that one-one-computing would be more important for

Contact: theo.lynn@dcu.ie

their university education. Moreover, Internet use experience and motivation for using computers and the Internet in school accounted for significant differences in students' perceived importance of one-to-one computing for both school and university education, with students with less one year Internet experience, and those with low perceived motivation ascribing significantly lower importance to one-to-one computing compared to students with at least 2 years Internet use experience, and those with perceived high motivation, respectively.

Figure 6.20 **Importance of One-to-One Computing for School and University Education: Internet Use Experience and Motivation Differences***



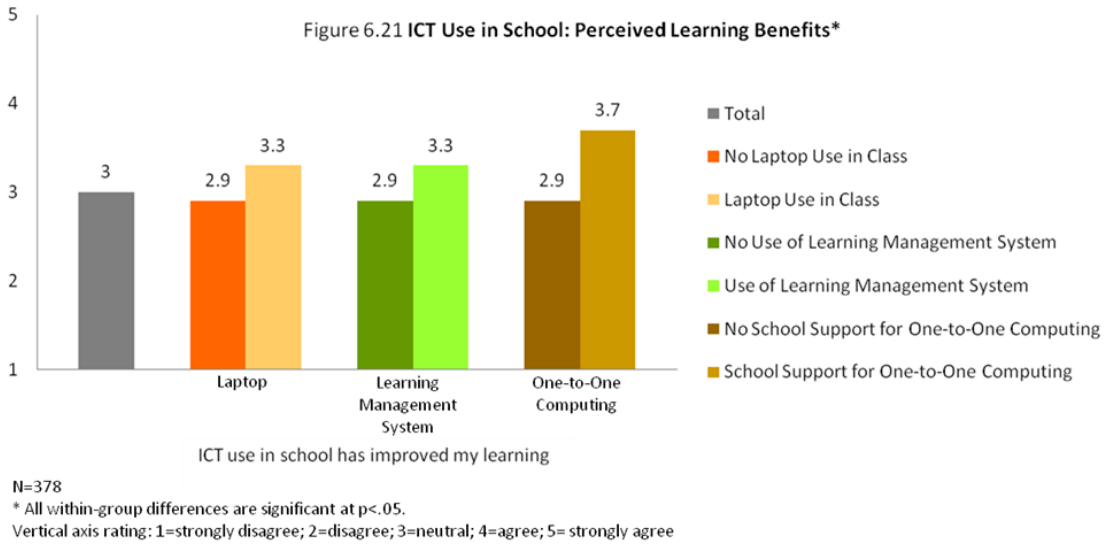
N=378
* All within-group differences are significant at p<.05.
Vertical axis rating: 1=not important at all; 2=not important; 3=neutral; 4=important; 5=very important

6.4.5 The Impact of ICT-enabled School Activities on Student Learning

In order to assess the impact of ICT use in school on student learning, respondents were asked to indicate on a five-point Likert type scale their perceived agreement or disagreement with the statement: "ICT in school has improved my learning".

Our results suggest that, while students only moderately agreed that ICT use in school had a positive impact on their learning, a number of significant differences emerged. In particular, as illustrated in Figure 6.21, students who were using their laptop in class at least once a week reported significantly higher levels of agreement in comparison to those students who were not using their laptop in class. Similarly, the use of learning management system was associated positively with students' perceptions of the positive impact of ICT use in school on their learning. The largest difference was, however, found in regard to school support for one-to-one computing: students whose school encouraged one-to-one computing agreed at a significantly higher level that ICT use school had a positive impact on their learning, compared to those whose school did not encourage one-to-one computing. Our results, therefore, provide support to the claim that integrating ICT in the classroom contributes to student learning and students themselves reinforce this view.

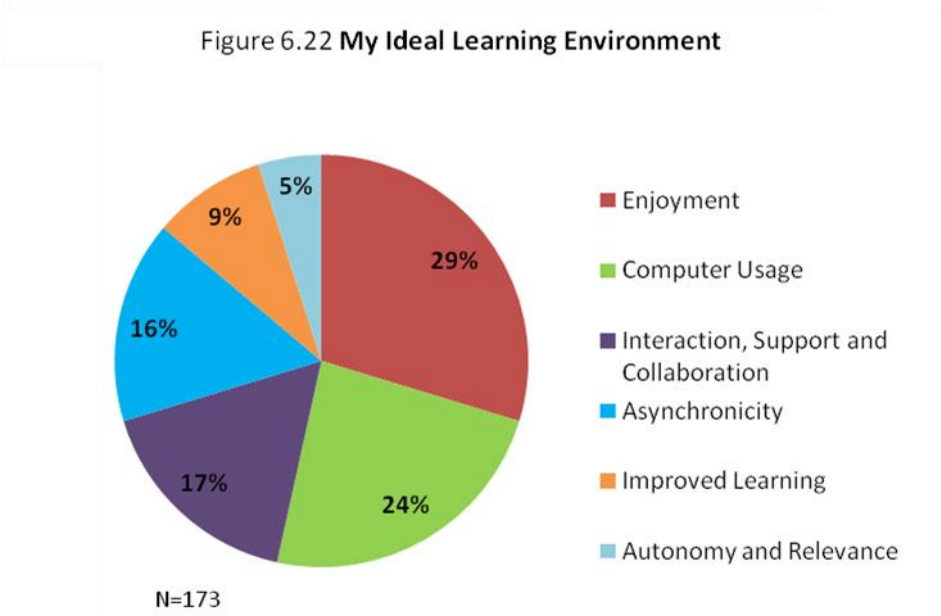
Contact: theo.lynn@dcu.ie



6.5 My Ideal Learning Environment

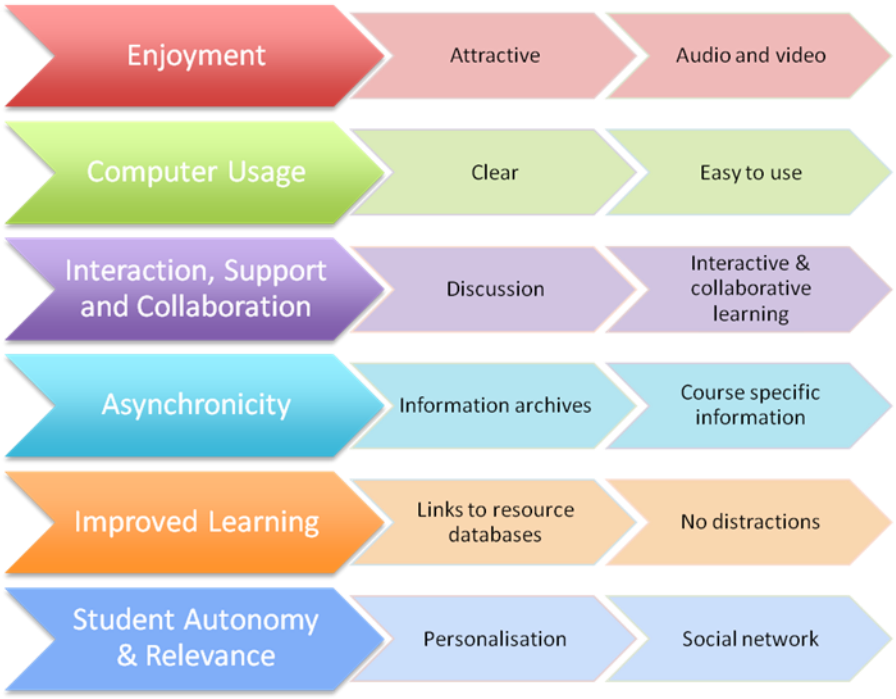
CTYI students were asked to describe the key features of their ideal learning environment, both physical and virtual. In particular, students were asked: "If you had the ability to design your ideal online learning environment, what would you like to see? How would it look and feel? What features would it have?"

According to the descriptions of 46 percent of the respondents who answered this question, as shown in Figure 6.22, enjoyment (29%) and usability (24%) were the top two features of an ideal learning environment, followed by interaction, support and collaboration (17%), asynchronicity (16%), improved learning (9%) and, finally, user autonomy and content relevance (5%).



Based on further analysis of students' descriptions, Figure 6.23 illustrates the sub-features under the six main features that compose the ideal learning environment as described by CTYI students.

Figure 6.23 **Features of Ideal Learning Environment**



Contact: theo.lynn@dcu.ie

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Contact: theo.lynn@dcu.ie