

Paper

A Comparison of ICT Skills and Students Across Europe

J. Haywood, D. Haywood, H. Macleod, University of Edinburgh;
R. Baggetun, University of Bergen; A. P. Baldry, University of Pavia;
E. Harskamp, University of Groningen; J. Teira, University of Salamanca;
P. Tenhonen, Åbo Akademi

Abstract

The key role of ICT in modern education and employment is generally accepted within Europe. At policy level ICT is also seen as an enabling factor for greater mobility of students and workers, both physically and virtually. However, few data are available as to the degree of similarity of European students in terms of their ICT skills and attitudes, an important ingredient in mobility. During 2000-1, we gathered information from 13,000 new and established students at seven European universities about their skills with various ICT applications, their approaches to training and support, and their views about the importance of ICT in their future studies and careers. We wished to gauge the extent to which European students are equipped with the necessary ICT skills and attitudes for current university studies and graduate employment, and the influence on these of gender and subject area.

We concluded that the majority of students at these universities had adequate ICT skills for the needs of their university curricula at any of the universities, and for employment across Europe. Moreover their positive attitudes and confidence towards ICT supported them in these areas, although a minority were less well-equipped and merited continuing attention. Differences between male and female students and those studying different subjects were small.

Keywords:

ICT, skills, graduate, student, gender

Introduction

All European countries currently have an active concern for the state of development of the ICT skills of their populations, which is reflected at the European level through the various pronouncements and actions of the European Union (European Commission, 2002, 2003a). The increasing reliance of these countries on knowledge economies rather than traditional industries is pushing them towards achieving greater participation in higher education and in updating of advanced skills through lifelong learning. The cost of an expanded higher education sector places strains on the economic systems that support it, largely based upon taxation, and hence there is pressure to seek more cost-effective ways to provide university-level education. At present, the adoption of e-learning is considered, at least at the political level, to offer opportunities in this respect whilst still maintaining quality (European Commission, 2001). The ICT skills of learners (and education providers) thus underpin such new-style studying.

Within the EU, there is also a wish to ensure that the population, including students, can take up work and study opportunities in any member country with minimum difficulty, and hence the concepts of mobility, and more recently, virtual mobility have emerged (European Commission, 2002a). Finally, as education, at least at its higher levels, becomes a global business, the EU aims to ensure that its citizens are not presented with only distance education offerings from outside the Union but can also choose high quality ‘home-grown’ programmes, which of course would be available on a world-wide basis to non-EU residents (European Commission, 2000, 2003).

Within this context of the importance of the ICT competences of graduates cannot be underestimated. They will be relied upon by both teachers in universities as they revise their learning and teaching methods to embrace e-learning, by the graduates themselves to enable them to participate in their future continuing professional development (CPD) and by employers as the *sine qua non* of the skilled recruit and employee of the future. The SEUSISS project (“Survey of European Universities Skills in ICT of Students and Staff”) set out to address these questions with a European perspective during the period 2000-2002, with funding from the European Commission. One of our aims was to create a substantial baseline of data about the ICT skills, experiences and attitudes of a large sample of European students, both newly-arrived in universities and well-established on their courses. These data, and the instruments used to gather them, were intended to provide a basis for informal benchmarking between universities and objective data against which to measure change over the years. The full report from the SEUSISS project can be found at SEUSISS, 2003. It is a product of a partnership between Åbo Akademi, Finland; University of Bergen, Norway; University of Edinburgh, UK; University of Groningen, Netherlands; University of Pavia, Italy; University of Poitiers, France; University of Salamanca, Spain; and the Coimbra Group of Universities (an association with independent legal standing), Belgium.

In this paper we present some of our findings about the ICT skills, knowledge and attitudes of new and established students across Europe, focussing on the similarities between them rather than on local differences, and we discuss these in relation to the national and international priorities noted above: mobility, virtual mobility and the increase in use of e-learning in higher education and the relationship between gender and ICT in European students.

1. Methodology – gathering the data

Our aim in the student surveys was to obtain the views of reasonable samples of two target groups, students at or just after the point of first entry (*‘new’*) and students close to or at graduation (*‘established’*), without necessarily being strictly representative of all students in all aspects. We wanted to gain information about those influences on students skills, experiences and attitudes expected to be important to universities, to students, to employers and to the political system. These include gender, age, access to ICT, subject area studied, and the geographical locations of the university within Europe. The universities were of a similar type – ancient or old with a strong commitment to research – and were purposefully chosen to be so. They were not intended to be representative of all European universities, which it is difficult to achieve anyway given the variety that exists. The seven universities are all members of the Coimbra Group of Universities (www.coimbra-group.be/). We argued that it was simpler to test the approach in a sample of universities with more rather than less

similarity, and that other universities could apply the tested methods themselves later if they wished.

The students were surveyed using methods appropriate to each location and stage of studies, for example in Edinburgh and Bergen all new students can be contacted in a single location in the first days after arrival, in Abo and Pavia, students nearing graduation never enter the university in contactable groups and have to be mailed or reached through libraries etc. We aimed to reach a substantial number of new and established students at each university. Ease of access varied but even so the distributions of respondents by gender and subject area of study was reasonably representative of the whole population at each university in most cases. In total, 9221 new students and 3495 established students responded to the survey.

Information was also simultaneously collected from senior managers, and teaching and support staff in these universities, and from a wide range of employers of their graduates, but these are not the main subject of this report. Full data, methodology and the survey instruments in seven languages are presented in the SEUSISS report (SEUSISS, 2003).

2. Major findings

Clearly, in a major survey of this kind carried out across seven different European universities we found many interesting similarities and differences, but space prevents us detailing all of them here. Instead we will present the main issues that emerged from our analysis of the data, concentrating on the commonalities of student ICT skills, knowledge and attitudes across Europe rather than on the differences, which can only be interpreted in the light of local conditions.

2.1 What sorts of students were in the sample?

The respondents were mostly young adults (90% new entrants and 83% of established students were 25 years old or less), entering straight from school or with a short gap in time. This pattern is typical of these types of universities and indicate the limits of direct transferability of the findings to other universities where this pattern does not hold true. Overall, females outnumbered males (64%, 36%) - in some subject areas to an even greater extent. This reflects the broad European trend towards greater participation of young women in higher education.

2.2 How do these students rate their ICT skills?

Despite variations in background (for example social, school, part-time or full-time work), new students entering these seven universities were very similar in self-rated ICT skills. As we had no mechanism to actually check students' competences with different ICT applications, we asked them to self-rate on specific tasks (e.g. use a word processor to create a CV, download music files from the internet) against a 3 point scale of '*I can do this alone*', '*I would need some help to do this*' or '*I have never done this*'. We asked them to self-rate for wordprocessors, spreadsheets, etc, and from their responses we created 'ICT skills indices' of the number of ICT applications they could use *alone* ('restrictive index') or *alone+with help* ('permissive index'). Thus we would be able to compare respondents in different subjects, males versus females or

respondents in the different participating universities. (Although there may be some variation between these measures and the actual skills of students, our experience in teaching and training students in these cohorts lead us to believe that their self-ratings are not seriously adrift from reality.) Figure 1 shows the percentage of all new student respondents who self-rated as able to use the different applications *alone*.

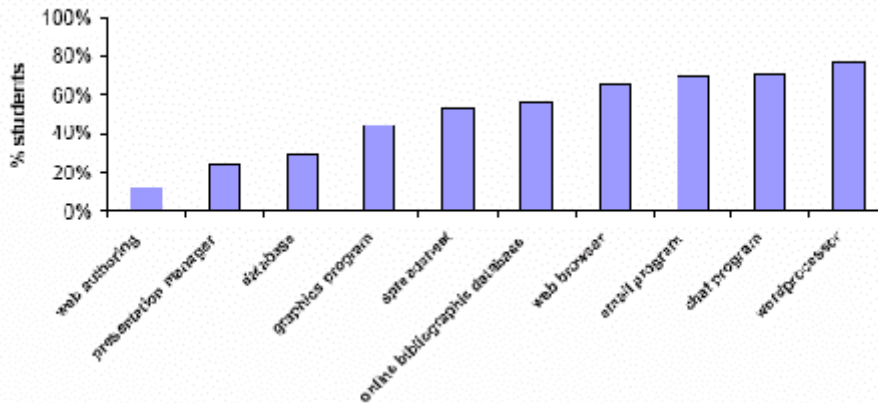


Figure 1. Students' unaided use of ICT applications

Not surprisingly, word-processing was the application that the majority of students reported being able to use unaided, closely followed by chat, email and web browsers. Only 25% could use a presentation manager such as PowerPoint to create a simple slideshow without help. Although there were some individual differences between students arriving at the seven universities in the ranking of some applications, the main trends were similar across Europe.

Figure 2 shows the *restrictive* and *permissive* ICT skills indices for all new student respondents at each university, i.e. the number out of these ten applications that students reported able to use 'alone' or 'alone+with some help'.

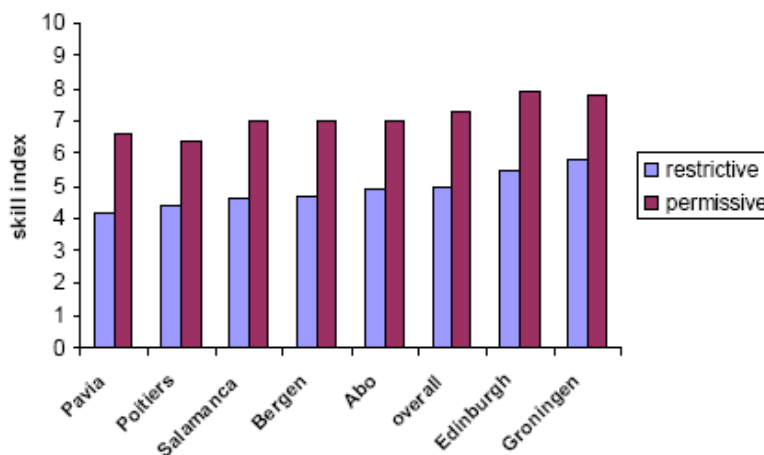


Figure 2. ICT skills indices of students at different universities

The striking overall feature is that despite different local social and educational contexts, there is only a small difference between the new students at the seven universities in their self-rated skills, amounting to about 1 index point difference on both scales (i.e. one more, or one less, application they could use out of the total of ten). The means were 5.0 and 7.3 applications on the restrictive and permissive indices

respectively ('overall' bar). Of the 10 applications presented, students only appear to have no knowledge of, or be unable to use, two or three applications, and these are invariably the newest and or most technical. Established students show similar patterns, but with some interesting differences, which are discussed below.

There was a small but significant variation in skills by age and gender. For students of 35 years old or less, the mean permissive index was 7.7, with very little variation by age, whereas those 36-40 had an index of 6.7 and over 40 years old, an index of 6.2 skills. On average female students had lower restrictive and permissive skills indices than males (4.6, 6.0 restrictive vs. 7.0, 8.0 permissive), and this was due to differences in their patterns of skills with each application.

The self-rated skills of female and male new students with word-processors and with web authoring tools are shown in Figures 3 and 4. These applications are at the opposite ends of the range presented in Figure 1 - word-processing being the most common skill and web authoring the least common skill. They show the extreme of the 'gender effect', with other applications lying intermediate to them. Males and females are very similar in self-rated skills with the common application, the word-processor, but much less similar with web authoring, a less common application. Males outnumber females by 3:1 in ability to use a web authoring tool without help. We interpret this phenomenon as a result of the progressive 'domestication' of ICT applications, with word-processing being a 'fully domesticated software' in wide and frequent use by the majority of students, whereas web authoring is hardly domesticated and still only used by a minority of rather technical enthusiasts. We predict from this that, over the next few years as software applications become more widely used ('domesticated'), current gender differences will diminish steadily. Although we have no direct evidence, we suggest that web browsers and email are nearing the end of this domestication process; graphics packages, presentation managers and perhaps web authoring will go through it in the next few years.

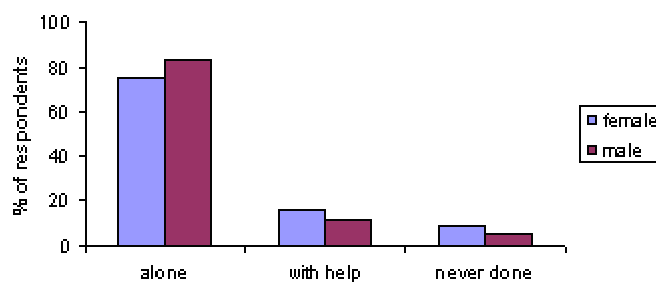


Figure 3. Male and female new student skills with word-processing

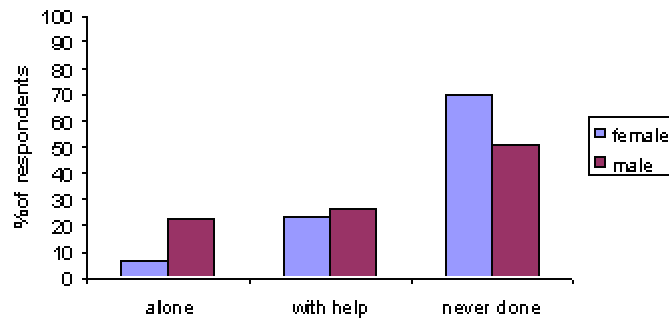


Figure 4. Male and female new student skills with web authoring

2.3 Where do new and established students get their ICT skills from?

It became clear from our other studies (Haywood *et al.*, 2001; Haywood & Haywood, 2002) that students rely more on informal as opposed to formal methods for support and training in use of ICT, and so we addressed this question in our study by asking our respondents to tell us which were their *main* sources of ICT support and training, offering them a choice between: integrated into classes; formal courses inside or outside school or university; self-taught; taught by friends or family; acquired at work. Both new and established students reported that friends and family were by far their major sources (67% and 68% respectively), followed by integrated training in academic courses (42%, 30%) or self-tuition (31%, 38%), these latter varying somewhat between subject areas. Female students were significantly more likely to turn to friends or family than to self-teach through manuals or books (71%, 22% respectively) in comparison to male students (62%, 47% respectively)

2.4 Do student ICT skills change during university?

The ICT skill set needed in today's university curriculum in research-oriented universities is somewhat different to that used generally in society and, probably, to that used in most schools. Two software applications stand out in this respect: presentation managers such as PowerPoint for giving talks about projects and research, and on-line bibliographic search tools, particularly subject-specific types, to research the current and past literature on topics at advanced levels. When we compared the self-rated skills in the 10 software applications between new and established students some interesting differences emerged (Figure 5).

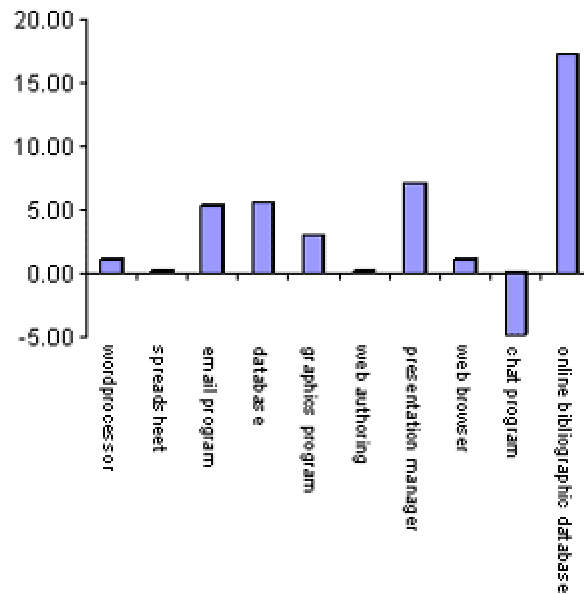


Figure 5. Differences between new and established students with ICT applications

We have to apply caution here, as this was not a longitudinal measure of a single cohort but a study of two discrete groups of students at the beginning and near the end of their studies respectively. We have no data about the established students when they were new entrants 3-4 years previously, although we assume that they were no more, and perhaps somewhat less, ICT skilled than current new entrants. This assumption is supported by information from new students at Edinburgh University that shows a steady rise in both ICT competence and confidence of new students since 1990, when our data collection began (Macleod *et al.*, 2002). There are some small differences between the new and established students but the single large effect is seen in self-rated skill with use of on-line bibliographic databases, searching *without help* for specific references. Established students reported substantially greater skills with this task than did new students, probably reflecting the demands of assignments on courses in these research-oriented universities that are not present in most schools and colleges prior to university. The less well-developed skills of established students with chat programs may be an age-related phenomenon, in that chat has emerged relatively recently as a commonly used application and older students would not have acquired this skill in adolescence. This is one of the age-related phenomena characterised as '*digital natives and digital immigrants*' by Prensky (Prensky, 2001), and that may become a normal feature of society in general and education in particular.

Although the apparent gain in on-line bibliographic database handling skills by students at all of the seven universities was a consistent finding, there were some significant gains in skills at individual universities, reflecting a combination of subjects taught, course requirements and the entry level skills of the students. Significant gains in ability to use applications unassisted were reported in email, spreadsheets, presentation managers and word-processing. As unassisted use is the most demanding we may be recording the effects of a much greater period of practice with familiar tools as well as the acquisition of skills with new ones.

2.6 How do students view the importance of ICT in their futures?

The majority of both new and established students had a positive view of the importance of ICT to their future careers, with 80% of all new and 83% of all established students reporting that they expected ICT to be 'very important' or 'important' to them. There was little variation between universities in these proportions (except in the extent to which students viewed ICT as 'very important' or 'important'), presumably reflecting the students' recognition of the widespread use of ICT in all areas of work across Europe. Students in different subject areas held more different views on average with more scientists and engineers regarding ICT as more important than arts, social sciences and clinical students (45% vs 30-34%). However, in all subjects very few students (range 4.5%-1.3%) thought that ICT would be of 'little or no importance' to their careers.

Unlike ICT skills, where the gender of respondents correlated with differences in self-rated abilities, there was almost no difference between males and females in their views of the importance of ICT in their careers (86%, 82% respectively thought it 'important' or 'very important'), and this too was largely independent of country of origin. Their confidence in using ICT in their careers was also high. In Edinburgh we have observed that the gap between females and males in self-rated competence and confidence has narrowed over the past 10 years (Macleod *et al.*, 2002).

Confidence has a large impact on the number of ICT applications that new students report being able to use alone or with help (Figure 6). Students who are very confident about using ICT in their studies can mostly use applications alone, and appear to need help with very few of them, whereas apprehensive students report being able to use much fewer applications, and of the ones they can use, they require help with around half of them. We cannot determine from these data whether the effect is due, on the one hand, to less confident individuals acquiring fewer skills, or whether they have been unable to gain ICT skills in their prior schooling, family setting etc and, as a consequence, feel apprehensive about using ICT at university. It is likely that different causal relationships hold true for different individuals. The relationship between ICT skills and confidence is, however, almost identical for male and female students.

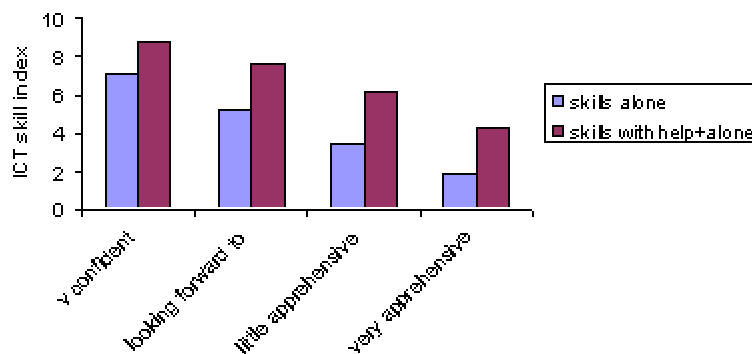


Figure 6. ICT skill index and confidence in new students

Evidence that the majority of students view ICT positively and confidently should not lead us to complacency and ignore the needs of the small minority (~5%) who indicate a

significant degree of concern (*'very apprehensive'*) about using ICT in their studies or careers. A larger proportion have less, but still some, concern. Although this proportion of students expressing some degree of apprehension has been falling in Edinburgh for the past few years, there is evidence that it is levelling out at around 20%, a value that we confirmed in this study in other universities. This may reflect a more general lack of confidence in these students towards new experiences (university or post-graduation employment) or be ICT-specific, but this group also report lower than average skills levels with common applications and so support for them to raise both confidence and competence appears to be an important area for action within the universities. That the mechanisms to do this (self-help documentation, drop-in clinics, short courses etc) would also enable other students to improve their skills in areas of weakness provides a further reason for action.

Conclusions

Our multilingual surveys of student ICT skills and attitudes are the largest to date in Europe, and the consistency of the data that we have collected give us confidence that they are sound instruments for wider use. Two other European projects have successfully used a subset of the questions and obtained comparable results in different universities and with students at different stages of their degrees (PICTURE, 2003; SPOT-PLUS, 2003). In a rapidly-changing environment there is a need for all participants to have access to reliable data that record the extent and direction of change, both to enable them understand the 'bigger picture' and to allow them to assess their position with respect to peers and competitors. Such a survey in the US has proved itself to be a reliable source of data about institutional ICT issues and priorities in a representative sample of universities and colleges, recording key factors as they have changed over time (Green, 2003). We began this article with a discussion of key issues for the European HE community and will conclude by considering our findings with respect to these.

What can we say about students' general ICT 'readiness' for university studies?

We would argue that the levels and range of ICT skills possessed by the majority of new students at the seven European universities are adequate for the general demands that are likely to be placed on them in their studies. Clearly, there will be subject-specific software skills (e.g. CAD, programming languages) that are not addressed by our measures, but the general ICT skills that are reasonable expectations of students in all subjects appear to be sufficiently well-developed in the majority of those who responded to our surveys. The modern university curriculum requires students to be able to carry out, unaided, tasks such as producing documents with word-processors, finding information in physical and digital libraries and on the internet, communicating electronically with staff and perhaps fellow students, and downloading and uploading files. In an increasing number of courses, they also need to be able to present their projects and short talks using software such as PowerPoint or through a personal website. Where e-learning has become commonplace they will also need to be able to navigate the intra- and internet confidently. Our data suggest that most students come to university with adequate ICT skills for these challenges, and with positive attitudes towards ICT in their studies. A minority give cause for concern and reason to continue or to implement support services. As informal methods of acquiring help appear to be

preferred over formal methods such as courses, it would seem that self-help materials, drop-in clinics etc are the most likely to succeed.

What can we say about students' general ICT 'readiness' for graduate level employment?

We propose that the ICT skills possessed by the great majority of established students in the seven universities are sufficient for most demands of their likely future employment. Most graduates will use standard productivity tools, will access intranets or the internet to collect or deliver information, and will need to communicate through email with colleagues or clients. This view is in accord with the information we collected from a sample of graduate employers; with the exception of the use of specialised software applications and systems, they were seeking good basic ICT skills and confidence in its use. Most graduates appeared to come to employment at this level. Some discrepancies will exist for individual students and employers or where self-rated skills overestimate actual competences, but these would appear to be generally modest.

What can we say about ICT and students' potential for mobility (or virtual mobility) within Europe?

The rather small variation in the ICT skills index of new and established students at the seven universities, and absolute level of ICT skills they possess suggests that they should not find difficulty in respect of ICT with studies in other European countries. Of course, this assumes that other European universities do not expect significantly higher ICT skills than the universities we studied, which seems a reasonable assumption based upon what we know of them and their peers from our combined experiences in the HE sector. European higher education, although diverse in many respects, has adopted ICT as a vital component of its core activities of teaching and research, and staff and students generally use the same or similar productivity applications (e.g. word-processors, spreadsheets) at all universities. Thus students moving from one university to another will probably find that the ICT applications in use is one of the most familiar features of the new institution, and that students there are not dissimilar in skills to themselves. Our personal experiences with visiting students support this conclusion. A similar situation appears to hold true for employment. Considering the range of types and their geographical distribution, employers we interviewed in seven countries were remarkably consistent in their views of the ICT skills needed by graduates and the extent to which they find their needs satisfied in new recruits (SEUSISS, 2003). Thus graduates moving to employment in other countries are not likely to encounter serious obstacles in terms of their skills with common software applications.

As we noted above, there is an increasing interest within Europe in virtual mobility, i.e. studying or working remotely through ICT, in addition to or instead of travelling to other locations within or beyond single countries. Although at present there is relatively little use of distance education within European university first degree courses (excluding the various open universities that enrol substantial, and increasing, numbers of students), there are clear signs of change in higher degrees and continuing professional development where many experiments are being conducted in the use of e-learning (cEVU, 2003; UK e-university catalogue, 2003). In employment, the trend towards greater mobility in working practices (Kopomoa, 2000) is increasing alongside use of anytime-anyplace training and staff development through e-learning (Herridge

Group, 2002). Effective engagement with these new features of study and employment requires good basic ICT skills with the standard productivity tools plus high levels of competence and confidence with communication tools such as email and chat.

What can we say about the role of gender in ICT skills and attitudes of European HE students?

In contrast with some prevailing stereotypes, gender effects in the student population we studied were generally small. Due to the large size of our dataset they were, however, statistically highly significant. New and established students at the seven universities showed rather similar gender differences where these existed. For example, females self-rated a smaller number of ICT applications that they could use alone or with help than did males, and reported less confidence in the use of ICT in their forthcoming studies and careers. They were less likely to be skilled with newer applications such as web authoring than well-established ones like word-processing or email. Females may adopt a more pragmatic and less exploratory approach to ICT than males, and value software applications such as communications tools that enable them to perform tasks which are of use to them (Margolis & Fisher, 2002; Bjorkman *et al.*, 1997). However, female students do not regard ICT as less important than males as regards their studies or careers. Like males, female students largely rely on friends and family for support, but they tend to self-teach from manuals and similar sources less and hence may self-restrict more if their support group is not well-versed in newer applications. Given the rather small differences in ICT skills between male and female students, the actual impact of these is likely to be small for both studies and for employment.

Our large scale study of European student ICT skills has shown that there is considerable homogeneity in the student population between the seven universities involved, and that skills levels are generally adequate to allow for mobility and future employment. The extent to which these necessary skills will remain sufficient for future developments in the use of ICT such as mobile working or distance education through e-learning remains unanswered and will be the subject of our further research. The European Union has a population of 370 million people, of which 12 million were in tertiary education in 2000 (Eurydice European Unit, 2003; EUROSTAT, 2003). This figure is almost certainly an underestimate as lifelong learners are not counted as systematically as those undertaking degree and other advanced programmes. In addition the European Union is expanding by including more countries, particularly in the former Soviet bloc. The diversity in this student population is considerable, and our study did not attempt to take this into account as we wished to prove our methodologies and instruments. Further work will be targeted on collection of data from a wider group of respondents, both in terms of types of study, geography, and focus of their universities.

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Address for Correspondence

University of Edinburgh
Media and Learning Technology service
55 George Square
Edinburgh
EH8 9JU

Tel: 0131 650 4097

Fax: 0131 650 4091

E-mail: jeff.haywood@ed.ac.uk