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Learners and learning in the twenty-first century: what do we know about students' attitudes towards and experiences of information and communication technologies that will help us design courses?

Adrian Kirkwood* and Linda Price
The Open University, UK

This article reports on issues relevant for teachers and instructional designers anticipating using information and communication technologies (ICTs) in higher education, particularly those wishing to adopt a flexible learning approach aimed at improving the quality of the student experience. The data that are reported on span more than five years, and have been gathered from a range of large quantitative postal surveys and smaller qualitative surveys, with total respondents numbering around 80,000. The large-scale surveys cover annual course reviews, computer access, students' use of media, access to media technologies and ICT access and use. The smaller qualitative studies include students' use of CD-ROMs and online tuition. This article describes the students' backgrounds and how this can affect their studies. It discusses students' access to media technologies and what their perceptions of media are in the context of independent learning. The conclusion is that, although ICTs can *enable* new forms of teaching and learning to take place, they cannot *ensure* that effective and appropriate learning outcomes are achieved. It is not technologies, but educational purposes and pedagogy, that must provide the lead, with students understanding not only *how* to work with ICTs, but *why* it is of benefit for them to do so. Knowing about students' use of media as well as their attitudes and experiences can help teachers and instructional designers develop better courses.

Introduction

In many countries throughout the world, higher education is undergoing a transformation. The sector has to deal with significantly increased student enrolments with

*Corresponding author: Institute of Educational Technology, Open University, Walton Hall, Milton Keynes MK7 6AA, UK. Email: a.t.kirkwood@open.ac.uk

comparatively reduced resources, while still delivering on quality (Harvey & Knight, 1996). There has also been a focus on the use of technology, particularly following the Dearing Report (National Committee of Inquiry into Higher Education [NCIHE], 1997). As the sector strives to foster active, autonomous, lifelong learners, it must equip students with the necessary skills and strategies that will allow them to reach this potential (Candy, 1998). This requires an understanding of the student body and how they learn in the environments we develop for them (Byrne *et al.*, 2002; Price & Richardson, 2003). This is particularly pertinent if we are to address the issues of improving the quality of student learning, as opposed to *game playing* in order to meet institutional or government targets.

Another driver in the transformation of education has been advances in digitisation. Words, sounds, still and moving pictures can be stored, integrated, conveyed and presented in digital media for easier use and re-use, while communication via computers and telecommunications is becoming widespread. Increasingly, aspects of teaching and learning are being mediated through information and communication technologies (ICTs), both on and off campuses. Partly, this has been driven by changes in student characteristics. No longer can an on-campus student body be assumed to comprise of 'full-time' students. Many are now employed, notionally part-time, in order to pay for fees and living expenses. The distinction between full-time and part-time study is becoming blurred and many of the constraints that face part-time distance education students are now facing those ostensibly engaged in 'full-time' study.

The character of higher education is also changing. Modern communications systems and the 'birth' of the World Wide Web have made it necessary to reconsider 'distance' in relation to higher education, as institutions increasingly enrol students located in a variety of places. Many campus-based universities now provide programmes of study for students who are geographically remote (see Richardson [2000] for a discussion of campus-based and non campus-based education). Arrangements are varied: the Massachusetts Institute of Technology (MIT) has made a large number of courses freely available on the Web (MIT, 2003), while other universities offer some courses in association with international partner organisations. Further, in recent years a number of global university consortia have been established to offer transnational courses via the Web (e.g. Global University Alliance and Universitas 21). Many universities in western countries are adopting a blended learning approach: that is, a merging of face-to-face and technology-mediated learning. Independent learners can now be more flexibly supported: they can locate, retrieve and interact with educational resources and engage with teachers and fellow students in ways not previously possible. Hence the delivery of higher education is changing both in perception and implementation. Research and developments from distance educators, such as the Open University, are now setting the agenda for ICT use in higher education in general.

In response to recommendations made in the Dearing Report (NCIHE, 1997), many institutions are also trying to attract a more diverse range of students, encouraging lifelong learning and extending the participation of 'non-traditional' students.

So how in the twenty-first century can current and new technologies be exploited to flexibly support a more diverse student population? So far, ICT has been introduced into higher education largely as a *supplement* to existing teaching and learning practices. However, there is still much to be done in terms of exploiting ICT for rich pedagogical use (i.e. enhanced forms of teaching and learning), and for serving learners in different target groups (Collis & Van Der Wende, 2002). So the issues do not simply relate to the mode of education or the technology used, but to a range of other factors. In this article we discuss pertinent questions such as: what is the constitution of the student body, what are their experiences, how does this affect their perception of the use of new media in education, and how will this affect the development of new *quality* courses in the future?

The media legacy

Throughout much of the twentieth century, efforts were made to introduce new technologies into teaching and learning in higher education, both in the UK and elsewhere in the developed world. Cuban (1986) reviewed attempts to adopt technology into American classrooms since the 1920s, although many were school based. In the UK, the British Universities Film Council was founded in 1948 to promote the use of film in university teaching and research; the Brynmor Jones report of 1965 sought to promote the greater use of audio-visual materials and resources in scientific higher education (University Grants Committee, 1965); the National Development Programme in Computer Assisted Learning (mid 1970s) was concerned with developing the educational use of computers in schools and higher education; and in 1989 the Computer Board for the Universities and Research Councils established the subject-based 'Computers in Teaching Initiative' (CTI) Centres.

Yet as enthusiasts adopt each new technology format, there seems to be a collective amnesia about lessons learned. More likely, there seems to be an assumption that the novelty of each new technology renders previous media knowledge and experiences as obsolete, in which case it is not worth reviewing and considering previous research and evaluation. But is there any credence to the assumption that 'It's new, so it must be different and better'?

A quarter of a century ago, Schramm (1977) looked back over several decades of educational media research and concluded that there was little evidence to suggest that any particular medium or technology could, in or of itself, account for enhancing learning outcomes. Rather, he pointed out, 'a common report among experimenters is that they find more variance *within* than *between* media—meaning that learning seems to be affected more by what is delivered than by the delivery system' (p. 273).

In the 1990s the UK government launched the Teaching and Learning Technologies Programme (TLTP) to promote the development and use of computer-based materials and resources. A number of discipline-based consortia were funded to develop software that could be used throughout the higher education sector. An 'evaluation of evaluations' was commissioned to provide an overall review of the projects, identifying good practice and 'lessons to be learned'. One of the conclusions was that

existing knowledge of teaching and learning with technologies had largely been ignored and that the projects could have been improved if they had heeded previous research:

> In only a small minority of cases can we say that projects had taken account of pedagogic issues in any systematic way; often existing research concerning the use of technology in higher education, even in the relevant discipline, was not used. (Coopers & Lybrand *et al.*, 1996, p. 60)

The Australian government funded a similar programme. The aim was to share software and lessons learned from the development process throughout the higher education community. An important finding from the overall evaluation of the programme was that:

> The use of a particular information technology did not, in itself, result in improved quality of learning or productivity of learning … Rather, a range of factors were identified which are necessary for a successful project outcome, the most critical being the design of the students' learning experiences. (Alexander & McKenzie, 1998, p. 3)

With a growth in the development of distance education programmes in the United States (largely as a result of the Web), the Institute for Higher Education Policy commissioned a review of existing research. Although this was rather partial, the conclusion was that 'many of the results seem to indicate that technology is not nearly as important as other factors, such as learning tasks, learner characteristics, student motivation, and the instructor' (Phipps & Merisotis, 1999, p. 8).

Teaching and learning in higher education are unlikely to be improved *simply* by the application of a new technology. However, learning can be enhanced when innovations take into account not only the characteristics of the technology, but also the pedagogic design, the context within which learning takes place, student characteristics and their prior experience, and familiarity with the technologies involved. So, although ICTs can *enable* new forms of teaching and learning to take place, they cannot *ensure* that effective and appropriate learning outcomes are achieved. It is not technologies, but educational purposes, that must provide the lead. Students need to understand not only *how* to work with ICTs, but *why* it can be of benefit to do so.

In the following sections we present some outcomes from research undertaken with large numbers of UK Open University (OU) students across a range of discipline areas, with the number of respondents totalling 80,000 over the period 1996-2002. These findings are significant for the whole higher education community given the increasing use of ICT for teaching and learning. This article draws upon findings from three types of research studies undertaken with OU students.

1. Monitoring of students' home access to ICT and the extent of usage in their studies. Specifically, how do factors such as gender, age and geographical location impact on ICT access and usage? (Surveys 1 to 5 in Table 1).
2. Examining *how* students use ICT, both in connection with their OU studies and more generally. Specifically, what applications are they using and how are they using them? Who are they communicating with and to what effect? What sources

of information are they using and how? What ICT skills do they possess and which do they need to develop further? (Surveys 1 to 5 in Table 1 and Studies 1 to 10 in Table 2).

3. Monitoring learners' attitudes to and preferences for using ICT for studying. Specifically, *why* do learners choose to devote more time and attention to certain materials and resources than others? How do students develop their own priorities within the curriculum? How do these priorities change over their study career with the university? (Surveys 3 and 5 in Table 1 and Studies 8 to 10 in Table 2).

The findings reported and discussed in the following sections draw upon the cumulative data collected in these various studies.

The studies

Context

For more than 30 years the UK Open University has been offering degree-level courses to dispersed independent adult learners, the majority of whom are home based. Students vary in factors such as prior educational experience, socio-economic background and age. About two-thirds of students are between 25 and 45 years of age: most of these report that distance education enables them to study while maintaining family and work commitments. Overall there are slightly more female than male students, although the proportions vary from course to course. Approximately 80% of students remain in full-time employment throughout their studies. About one-third of those entering undergraduate studies with the OU do so without the minimum qualifications normally expected for entry to UK higher education. Learners undertake their studies independently, although each is allocated a tutor (Associate Lecturer), who grades and comments upon their assignments and also provides study support. Some courses include a limited amount of contact time, when groups can meet face to face with their tutor. At the end of every course students sit an examination or they submit an examinable component (i.e. a substantial piece of assessed work not completed under examination conditions).

While courses have always provided learners with a range of multiple media resources, ICT has increased over recent years. The National Committee of Inquiry into Higher Education (NCIHE, 1997) identified the 'scope for the innovative use of new Communications and Information Technologies … to improve the quality and flexibility of higher education and its management' (paragraph 65), and recommended that higher education institutions should expect that 'by 2005/06 all students will be required to have access to their own … computer' (Recommendation 46). In response to this, the OU has adopted as policy that from 2005 all courses are required to include an ICT component. However, this raises important issues for an 'open' university. On the one hand, the educational potential of new media needs to be realised; on the other, there are access issues for independent learners (Kirkwood & Kirkup, 1991; Jones *et al.*, 1992). Further, in exploiting multiple media for teaching and learning we need to *maximise* the educational benefits of each in order to contribute to the overall

Table 1. Main surveys relating to Open University students' access to and use of ICT in recent years

	Survey	When undertaken	Size and nature of student sample	Focus of study
1.	Annual Courses Survey	At the end of each study year (October)	A course-based survey that covers all courses in first year of presentation plus a selection of others. If course population is 400 or less—all students are surveyed. If course population is greater than 400—a random sample of 400 is selected. 1999: 124 courses; 18,413 respondents; response rate = 68%. 2000: 113 courses; 16,571 respondents; response rate = 64%. 2001: 115 courses; 15,483 respondents; response rate = 65%. 2002: 123 courses; 16,389 respondents; response rate = 63%.	One of the major instruments for monitoring and evaluating the courses and services offered to OU students. Students who complete a course provide feedback about their use of, and their level of satisfaction with course components and services associated with their studies in the current year. Includes questions about access to and use of ICT in connection with their studies.
2.	Computing Access Survey	At the middle of study year	A stratified student-based sample from all courses. 1996: 2,253 respondents; response rate = 56%. 1997: 2,355 respondents; response rate = 57%.	Monitoring students' access to and use of computers (hardware and software).
3.	Students' Use of Media Survey	At end of 1999 study year	A stratified student-based sample from all courses—all had completed at least one year of study with the university. 1,564 respondents; response rate = 58%	Survey of students' attitudes to and preferences for various media technologies. Contained questions about students' access to and use of ICT and audio-visual media.
4.	Access to Media Technologies Survey	At the middle of study year	A stratified student-based sample from all courses. 2000: 2,075 respondents; Response rate = 52%. 2001: 2,552 respondents; Response rate = 51%.	Monitoring students' access to and use of ICT (hardware and software) and audio-visual equipment.
5.	ICT Access and Use Survey	At end of 2001 study year	A random sample of new students taking Level 1 courses in Arts, Social Sciences and Languages 1,017 respondents; Response rate = 43%.	Students' overall experience of using ICT—types of use, range and extent of expertise, desire for further ICT skills development, etc.

Table 2.   Selected course-based studies relating to students' use of ICT in recent years

	Study	Year	Focus of study
1.	'Cadences' CD-ROM (French language)	1996	Formative evaluation of interactive materials—observation of individual users and set of self-completion forms (Testers = 6).
2.	'Students Project Reports' CD-ROM (Family and Community History)	1997	Formative evaluation of interactive materials—observation of individual users and self-completion forms (Testers = 8).
3.	'The Human Brain' CD-ROM (Biology)	1997	Developmental testing of interactive materials for individual use—postal survey of all students using the CD-ROM in that year (Respondents = 83).
4.	'The Human Brain' CD-ROM (Biology)	1998	Developmental testing of interactive materials for individual use—postal survey of all students using the revised and extended CD-ROM in that year (Respondents = 60).
5.	'En France en Francais' CD-ROM (French language)	1999	Developmental testing of interactive materials for individual use—postal survey of students volunteering to use the CD-ROM (Respondents = 24).
6.	'Begegnung in Leipzig' CD-ROM (German language)	1999	Formative evaluation of interactive materials—observation of individual users and set of self-completion forms (Testers = 8).
7.	'Cladistics' CD-ROM (Evolution)	2000	Developmental testing of interactive materials for individual use—postal survey of all students using the CD-ROM in that year (Respondents = 126).
8.	Online tuition for 'Governing Europe'	2001 /02	Postal survey of all students participating in online tuition in those years (Respondents = 66).
9.	Arts Faculty Online Tuition—Undergraduate courses	2002	Postal surveys (at two points in the study year) of all students on three courses participating in online tuition (Respondents = 47).
10	Arts Faculty Online Tuition—Postgraduate course	2002	Postal surveys (at two points in the study year) of all students on a Master's level course participating in online tuition (Respondents = 29).

learning process (Laurillard, 1993). The OU has not sought to *replicate* or *copy* traditional classroom-based education. Instead it has aimed to create a different—but equivalent—educational experience. Our research into learner use of *any* media has similarly used this view as its baseline for measuring successful employment.

The nature of the studies

Data have been derived from a range of large-scale postal surveys. Most have been primarily concerned with evaluating courses and services provided by the university to inform decision-making. All survey instruments have been developed by experienced survey researchers and have been subject to scrutiny and approval by the university's Student Research Projects Panel and senior staff with responsibility for quality assurance. The Survey Office and the Student Statistics Office in the Institute of Educational Technology have undertaken all sampling and data processing. Information about the nature and scale of the main quantitative studies appears in Table 1.

Sampled students are sent a questionnaire together with a reply-paid envelope. After two to three weeks they are sent a reminder card; all returns are checked to ensure that only one completed form per student is processed. When students are surveyed immediately after they have taken an end-of-year examination, the response rate tends to be high, typically above 60%. The response rate for surveys undertaken within a study year is usually slightly lower, but very often above 50%.

There are a variety of smaller, course-based studies aimed at evaluating the development of specific software or the use of particular tools. Some examples are listed in Table 2. These studies often combine quantitative and qualitative data collection. The large-scale surveys listed in Table 1 have primarily been used for quality assurance and policy development. The studies in Table 2 have primarily been used for quality enhancement. Data from all these sources have enabled us to develop generalisable and relatively consistent conclusions about adult learners and their use of media.

Findings and discussion

Access to and use of ICT

A fundamental shift in students' access to ICT occurred in 1988, when the university started to phase out its *provision* of local terminal access to mainframe computers. From that year, all students registered for specified courses were *required* to make their own arrangements for access to a suitable personal computer. This coincided with increased infiltration of personal computers into the home, followed later by the penetration of the Internet. Computer access in UK households grew from 13% in 1985 to 19% in 1988; it subsequently rose to 50% by 2001 (Office for National Statistics, 2002). Home access to a computer has always tended to be higher in families with children aged under 18, and where the head of household was employed in professional, managerial or other non-manual occupations.

Changes in access to computers reflected not only attitudinal changes but also the changing needs of society: interactions in all walks of life were being transformed. Education was not to be exempt from this change and, as already mentioned, the OU seized the opportunity early. It changed its policy to require students to have their own computing facilities for courses from a wide range of subject areas in which computer use formed an essential component (i.e. courses that could not be completed successfully without the use of a computer). This enabled early studies of innovative use of new media to be undertaken before its use became popular and expected. ICT has been transforming the nature of distance education for independent learners in a number of ways:

● Computer-based materials and resources introduced a level of *interaction* that had formerly been difficult to achieve. Course-related software engages students with learning activities across a range of disciplines in ways not previously possible. Internet developments offer the potential for students to access information from local, national and international sources.
● More importantly, the Internet enables two-way communication to be enhanced. Potentially, this reduces the isolation of independent learners, making dialogue possible not only with tutors, but with fellow students as well.

Access to equipment has been monitored for courses with and without *required* 'personal computing'. This has risen from 37% overall in 1988 (Kirkwood, 1990) to more than 89% in 2002 (Programme on Learner Use of Media, 2003). Home access among OU students has consistently exceeded the corresponding national figures. Within the student body, there have been differences in terms of gender, age, geographical location (these reflect the UK population as a whole) and subject area.

Many key policy makers in the university are concerned about the potential conflict between widening access to education and expanding the use of ICT. Institutions concerned with widening participation in higher education will need to consider how the 'digital divide' may disadvantage those students that it seeks to attract. Actual levels of ICT access and familiarity will need to be monitored rather than assumed in order to minimise such tensions. Gender differences have been a particular concern, not only in terms of computer access per se, but also in the quality and level of access. For example, male students are likely to report using 'their own equipment', while females often report using 'a family resource'. Although such differences have reduced over time, they are still evident.

As modes of higher education become increasingly diverse and the student body more heterogeneous, the use of ICT presents a complex set of issues, particularly when many of the key variables are outside the control of those designing courses. The differences highlighted here are important because they reflect possible trends throughout the sector. Course developers need to take account of the characteristics of their potential learners, particularly factors such as gender, age, geographical location, occupation and social class. They must assess whether their course is likely to attract people who already have access to ICT, or would be disadvantaged if it were made obligatory. If courses are seeking to widen participation by enrolling adults who

would not normally consider higher education, they need to be particularly cautious about making unwarranted assumptions about potential students' access to ICT and familiarity with its use.

Practical difficulties associated with personal computing

OU students welcome the flexibility that supported open learning offers: they can determine *where* and *when* their studying takes place. Home study requires a calm and undisturbed setting, but ICT equipment is often located in a communal family space and competition among family members for the computer and telephone line is routine (Kirkwood, 2000). Further, the Internet bandwidth available for most home computers is considerably smaller than is common in higher education institutions, so downloading files can be slow. Similarly, computer access in the workplace is often restricted and/or requires the sharing of resources with other users. Many students using shared equipment are subject to limitations on the times available for 'personal' use. Even where this is not the case, work-based computer access can present other difficulties. Often the loading of 'external' software—including course resources—onto an employer's computer is prohibited. Concerns about computer security have meant that the installation of 'firewalls' can cause problems for students using communications software.

Hence the *quality* of learners' access to ICT needs to be taken into account in the design of courses. Course developers should make realistic expectations about how, when and for how long a computer can be used by part-time independent learners. The design of most courses should not be over-dependent upon use of ICT, expecting regular and frequent access for extended study periods. Ample opportunities are needed for learners to work off-line with materials and resources when connection to a network is not necessary.

Differences between subject areas

Historically, OU students' access to computing equipment was far from uniform across faculties and disciplines. Students taking computing and information technology courses are required to have access to a computer, but access was also high among those studying courses in technology and business. Students who made use of ICT in their jobs were more likely to do so in their studies, even if their course did not *require* computer use. In contrast, access tended to be lower among students taking arts, languages, and health and social welfare courses. Further, the equipment used tended to be of a lower specification with less likelihood of regular upgrading. Often there were more female students taking these courses, so gender differences could be a factor here. This reflects not only varying levels of access to ICT, but also variations in experience of use. Students who have gained ICT experience through their occupation or other contexts are likely to exhibit greater fluency with ICT in their studies. In contrast, those without such experience are more likely to depend

upon course designers to demonstrate the potential of ICT, and to support and guide their use of it.

Students' access to the Internet has always been lower than their access to ICT hardware. Internet access among OU students in 2002 was about 86% overall. Within the UK population as a whole, however, Internet access has been rising quite rapidly (National Statistics, 2003). UK household access increased from 9% at the end of 1998 to 43% at the end of 2002, with an estimated 62% of adults having accessed the Internet by that time. Access is inversely related to age: while 95% of those in the 16-24 age group had used the Internet, only 15% of those aged 65 or over had. The annual survey undertaken for the Independent Television Commission (ITC) (Towler, 2003) presents similar findings: in 2002 the proportion of UK homes with a computer (46%) was only slightly greater than those with a computer *and* the Internet (43%). The ITC survey also reported that almost half of all homes with children had an Internet connection in 2002, and that there had been a rapid rise in home access (to 46%) among those aged 45-64 years.

Although students' access to computers and to the Internet is no longer considered an obstacle in some subject areas, there are still concerns in others (e.g. health and social welfare). Further, the effects of the 'digital divide' remain a crucial issue in respect of strategies aimed at widening participation to learners in social groups that have previously been underrepresented.

How students are using ICT in their studies

The most frequent use of 'general' software has been for the preparation of assignments (word processing, spreadsheets and graphics). This enables students to frequently redraft and revise their work and allows them to keep a final version after submission for marking. In addition, most students have some experience of using email and browsing the Web (Kirkwood, 2002; Programme on Learner Use of Media, 2003). This reflects the growth of Internet use by the UK population as a whole. For example, among those accessing the Internet for private use, 79% had used to it for information about goods and services, and 72% had used email (National Statistics, 2003). Increasingly, employees are expected to use ICT in the workplace, including communicating with other people and obtaining information via the Internet. Younger students have gained experience of ICT at school (and also at home), and expect to use these skills in higher education. Research commissioned by the Department for Education and Skills in 2002 (British Educational Communications and Technology Agency, 2003) indicated that 98% of young people used computers either at home, at school or elsewhere.

These changes in access and attitudes to ICT use are advantageous for higher education. Many people now have some experience of ICT, making its use more acceptable in education. Hence transformations in the wider society are making increased ICT use not just possible, but expected.

Engaging learners with educational resources

One of the most important functions of any educational use of ICT is to actively engage learners. Students can work with interactive exercises in a variety of forms—exploring, manipulating and interrogating resources. However, to achieve meaningful and appropriate educational outcomes, software development must follow from the design of activities that help learners achieve desired educational goals (Kirkwood, 1998, Jones *et al.*, 1998, Lawless & Freake, 2001). More often than not these are carefully linked with assessment (Scouller, 1998).

So, students need to know not only *what* they are supposed to do, but also *why* they are expected to do it and *how* it will contribute to their learning. Otherwise 'learner control' will prove to be counterproductive, as it can promote the adoption of 'unfocussed and inconclusive' approaches (Laurillard, 1998).

Locating and using web resources

Many students search for resources for their studies on the Web, even when not required to do so, using search engines such as *Google*™ (Programme on Learner Use of Media, 2003). This can produce a large number of undifferentiated 'hits', but then require students to undertake considerable selection and evaluation activities (e.g. are they up to date, at appropriate level, authoritative, etc.) Further, vast amounts of information on the Internet are simply not accessible by means of a common search engine. It has been estimated (Bergman, 2001) that most common search engines access less than 20% of the 'Surface Web' and that information in specialist databases and archives forms a 'Deep Web' that is 400 to 550 times larger than the 'Surface Web'. Students in higher education need to operate at a sophisticated level when using the Web. They need to develop and refine *information literacy* skills that go beyond basic searches, and to understand that managed 'gateways' or 'portals' can provide access to appropriate and quality-assessed websites, possibly not accessible by other means.

When course or external websites resemble 'books on screen', there is a tendency for students to print long documents—increasing the costs incurred and often with diminished print quality. Presenting course resources on the Web must involve more than simply delivering existing materials in a different medium: it requires a *transformation* process for both the form and the pedagogical approach (Petre, *et al.*, 1998). In higher education, course developers need to understand and be clear about *what* they want students to use the Web for and *how* they expect learners to make use of digital resources if they are to be useful aids to learning.

Electronic communication

Email and computer conferencing have enabled asynchronous dialogue between tutors and fellow students not previously possible in distance education. It is a valuable communication channel for students who live in remote locations, or for those who are housebound due to health, disability or domestic responsibilities. The textual

format of the contributions and its *asynchronous* nature provide participants with the opportunity to reflect upon each message, providing a considered response. Since participants do not have visual or auditory contact with each other, contributions are not overtly influenced by preconceived notions or prejudices based upon accent or physical attributes, although any written communication can present cues about the social and gender characteristics of the writer (see, for example, Mann & Stewart, 2000). Reserved individuals need not be intimidated by the speed of response or tone of voice of other contributors. Hence learners are able to participate in a manner that is more considered and reflective than is normally possible in face-to-face sessions. However, it is a different form of discourse from face-to-face communication, and most new students have limited experience of its use and need guidance.

Some students still like the ability to 'talk' to other students in real time and the OU has recently been experimenting with this. *Lyceum* is an audio and text synchronous groupware communication tool developed by the OU to support multiway interactions between tutors and students. It is used in a variety of capacities, such as tutoring, group work, negotiation, collaborative writing and peer-to-peer communication. Its use is being pioneered in language courses where the primary interest is in supporting students to practise their verbal skills.

However, use of this medium by participants is not transparent (Price, 2002; McAndrew, 2003). While this form of communication has much potential for education, there are issues that need to be addressed in order to make it effective. Activities for beginners need to be highly structured, with explicit instructions, as the loss of visual cues has to be supplemented with additional verbal or written ones. The learning goals for sessions need to be explicit so that students know what the potential gains are. It cannot be assumed that participants know how to operate in this environment: they need to be taught what the protocols of use are, such as turn taking when speaking and how to work collaboratively on documents. Both staff and students need to be trained in the use of new media such as Lyceum; not just the technical aspects of operating the system, but also focusing on planning activities that are integrated with the course pedagogy to maximise the group learning outcomes.

Both synchronous and asynchronous computer conferencing enable course participants to discuss and explore information, ideas, problems, strategies, etc. Some would argue that interpersonal communication, cooperation and collaboration are essential elements of higher education in the early twenty-first century (see, for example, Beaty *et al.*, 2002). However, the facilitation of two-way communication needs to be linked to purposeful activities if worthwhile outcomes are to be achieved (Kear & Heap, 1999). New skills for working online are necessary for both teachers and learners (see Salmon, 2000).

Independent learners' use of media

Multiple media can provide learners with a richer perspective and greater flexibility than could be achieved with just one medium. Students' *perceptions* of the value of various media resources are related to whether or not that component is linked to the

assessed course outcomes. On most OU courses students spend more time working with printed texts than with any other form of materials, so it is hardly surprising that printed texts almost always receive very high ratings from students (see Programme on Learner Use of Media, 2003). When other materials and resources are embedded in the pedagogy—including those involving ICT use—they are perceived by students as being integral to the course rather than as optional extras. As such, they are much more likely to be used and valued than those that are not. Hence, students' perceptions of the educational benefits of a medium are more significant than its intrinsic characteristics.

For most students studying does not have first call on their time and attention—their work or domestic responsibilities have higher priority. Very often, the time available is insufficient for all of the course materials to be studied to the depth anticipated by the course designers. Students have to be selective to survive in the system, and the assessment plays a significant part in guiding learners' choices. While a small proportion of learners seem to study *only* what is essential for assessment purposes (*assignment focused*), a much larger proportion confess that assignments do influence their study behaviour (*assignment conscious*) (Kirkwood, 2003; see also Scouller, 1998). This relates closely to the notion of *surface and deep approaches to learning* (see Richardson, 2000, for a review). Courses need to be designed and developed to take account of the situation and circumstances of independent learners. Further, in order for materials in any medium to be valued they need to be integrated into the pedagogy and *constructively aligned* (Biggs, 1999) with the assessment strategy to engage students fully with the learning opportunities offered.

In conclusion

We contend that it is essential for teachers and decision-makers in higher education to develop a better understanding of the issues surrounding the use of ICT, so that innovations are not driven by technology. The new circumstances for learners and learning require consideration to be given not only to the characteristics of technologies, but also to (a) the pedagogic models and processes they have to serve; and (b) the contexts within which learners engage with ICT. We conclude that the following issues need to be addressed by those involved in designing and implementing the use of ICT for teaching and learning in the early twenty-first century.

Access to and use of ICT

- Consider the increasingly diverse backgrounds and circumstances of students and potential students: pay particular attention to the 'digital divide' and use ICT where most appropriate.
- If learners are expected to use their own equipment (or an employer's), anticipate a high degree of variability in hardware specification and software availability.
- Be realistic about the amount of time learners can spend working online and allow space and time for them to work off-line.

Practical difficulties

- Access to ICT is rarely ideal and unrestricted: learners often need to share computing and communication facilities with others. Course design should reflect this and not be over-dependent upon ICT.
- Getting access to and downloading remote resources can be very time-consuming when working via a dial-up network: in certain circumstances such activities will not be sanctioned.

Subject or discipline differences

- Those with ICT experience from other contexts are likely to exhibit fluency in ICT use in their studies; those without such experience will be dependent upon course designers to demonstrate the potential and guide their use of ICT.

How students are using ICT

- Changes in the wider society are making increased ICT use not just possible, but expected: so many people now want to use ICT in educational contexts.
- Few students have high levels of competence across a wide range of applications. Familiarity with the use of email does not imply expertise in rigorous online debate and discussion.

Engaging learners with resources

- Students need to know not only what they are supposed to do, but also why they are expected to do it—how engaging with activities and resources will help develop their learning.

Web-based materials and resources

- Developing and refining information literacy skills is an important element of courses using ICT.
- Course materials must be transformed for the Web to enable effective pedagogical use with ICT.

Electronic communication

- Asynchronous communication offers students the opportunity not only to reflect upon a posted question or statement, but also upon their own response to it. This is a desirable aspect of any educational programme, particularly when it contributes to valued learning outcomes being achieved.
- Synchronous communication needs to be more highly structured for novice users as there is limited experience of use in society in general. Tutors also need training in how to tutor in this medium if its use is to be purposeful.

Independent learners' use of media

- Regardless of the medium being used, it is very unlikely that students will make use of materials and activities unless they are embedded in the course pedagogy. If materials are not linked to the assessment strategy then the medium is likely to be unused and its potential will remain fallow.

The most important point to conclude from the studies presented in this article is that the medium itself is not the most important factor in any educational programme— what really matters is how it is creatively exploited and constructively aligned. The educational benefits that students perceive as gains from using ICT are more significant than the intrinsic characteristics of any particular medium.

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