British Journal of Educational Technology Vol 31 No 1 2000 29–46

Distance education via the Internet: the student experience

Linda Carswell, Pete Thomas, Marian Petre, Blaine Price and Mike Richards

All of the authors are members of the Centre for Informatics Education Research (CIER), in the Department of Computing, Open University, Milton Keynes, UK. Email: L.Carswell@open.ac.uk

Abstract

This is the second in a series of papers that describes the use of the Internet on a distance-taught undergraduate Computer Science course (Thomas *et al.*, 1998). This paper examines students' experience of a large-scale trial in which students were taught using electronic communication exclusively. The paper compares the constitution and experiences of a group of Internet students to those of conventional distance learning students on the same course. Learning styles, background questionnaires, and learning outcomes were used in the comparison of the two groups. The study reveals comparable learning outcomes with no discrimination in grade as the result of using different communication media. The student experience is reported, highlighting the main gains and issues of using the Internet as a communication medium in distance education. This paper also shows that using the Internet in this context can provide students with a worthwhile experience.

Introduction

There is a danger assuming that replacing traditional teaching techniques with new technologies can cause a significant improvement (Dede, 1996; Moore, 1996). There are many examples where attempts have been made to use electronic communication to cope with increasing student numbers (Daniel, 1998) (and proportionately diminishing resources) or to improve learning outcomes (Bischoff *et al.*, 1996; Scardamalia and Bereiter, 1992; Moskal *et al.*, 1997). However, it is vital to discover whether the pressure to increase student numbers overshadows the need to provide students with a meaningful educational experience, and whether course appraisal techniques disguise the quality of the courses that are presented.

The Open University (OU) in the UK has an eye on both the future and the past: the future to embrace new technologies with which to enrich its distance teaching programmes, the past to ensure maintenance of standards and quality. Our aims focus

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF, UK and 350 Main Street, Malden, MA 02148, USA.

on *providing valuable and repeatable learning experiences*. In our view, improvements in student performance should not come at the expense of the student experience.

As a distance education university we are interested in the effects of new technology on the student who is remote from both teacher and fellow students. The Internet could be a life-line for students in remote areas: it is a means for combating their isolation, extending their knowledge, and gaining proficiency in its use (Franks, 1996). It gives students a communications technology that cheaply and quickly connects them to the rest of the world, giving them ready access to information. The issue for educators is how to harness *effectively* the benefits of the Internet in order to provide students with a fulfilling educational experience (Bates, 1991).

The work reported here focuses on the effect of the Internet on student experiences to determine what real gains there might be, if any, in replacing traditional teaching processes with new methods that exploit the Internet.

Background

The distance approach to education requires an understanding of the issues facing part-time students, including:

- dealing with distance: ie, overcoming isolation;
- dealing with asynchronous learning: ie, handling delays when help or feedback is not available as soon as required;
- managing part-time study: ie, coping with job, family or other commitments as well as studying.

Helping students deal with these issues by providing an appropriate support network is reflected in the student's experiences. The reputation of the OU stands firmly on a high quality "supported" distance learning process (Baker *et al.*, 1996) which has nurtured the "*good experience"* reported by many of its students over the lifetime of the university. The OU is keen to ensure this experience is not undermined by the use of new technologies.

When we first began investigating the use of the Internet in one of our popular undergraduate Computing courses, experienced teaching staff expressed concern about the effect it would have on students. Not surprisingly, they were unconvinced by the argument that the Internet might improve student performance as they had seen technology fads come and go. Their perspective focused on the student experience, ie, the intellectual self-development and self-awareness *en route,* which they regard as the most valuable aspect of an OU student's life.

Therefore, our investigation of the effects of introducing Internet-based teaching had two main aims:

- to examine the experiences of the Internet students and compare them to those of the students on the conventional course;
- to identify means of improving the service to students by use of appropriate technology.

Thus, both the Internet and conventional students studied the same course with the same materials; they attempted the same assignments and they sat the same examination. The difference in treatment between the groups was solely the communications medium.

The Internet trial

The Internet trial was conducted with the introductory course, *Fundamentals of Computing* (M205). This course used Pascal as its exemplar programming language and taught data structures, file processing and programming. It attracted students with a range of abilities and backgrounds, from complete novices taking the course as their first taste of university education, to those with considerable experience both of Computing and of distance education.

The course was typical of Open University courses; study materials including printed texts, audio and video tapes, CD-ROMs and floppy discs, were mailed to students. Students were required to submit assignments for grading and feedback, and to take a final examination. During the term, students could attend a small number of local tutorials, telephone or write to their personal tutor for advice, and form self-help groups with other students. Thus, students had opportunities to communicate with their tutor, either on a one-to-one basis or in a group situation, and with other students.

In our trial, the Internet was used for communication in every aspect of the course's presentation. Internet students communicated with their tutors and fellow students via electronic mail and HyperNews (a simple electronic news system used for conferencing). In practice, the students used email for one-to-one asynchronous communication, and conferencing for communication with either their tutorial group or their peer group.

Tutor-marked written assignments (known as "TMAs") are the core of the Open University's teaching system, providing a mechanism for individual feedback and instruction, as well as assessment. Traditionally, TMAs are paper documents exchanged by post: passing from student to tutor, then to the central Assignment Handling Office (AHO), and then back to the student. Despite the excellent postal service in the UK, this can be a cumbersome and slow procedure. In the Internet trial, assignments were processed electronically: students submitted word-processed documents, either by email attachment or secure Web form, to a central database. Tutors down-loaded assignments from the database and, with the aid of a specially designed marking tool, graded and commented on student scripts on-screen. Marked scripts were returned to the central database via an automated handler where the results were recorded. The script was then routed electronically back to the student. Details of the electronic submission and marking system can be found in Thomas *et al.* (1998).

The study groups

The students elected to enrol for either the conventional course or the Internet version. In a typical year, the conventional course attracts about 3,500 students; of this, we were restricted to about 300 students for the Internet version. The target groups were as follows:

- Internet: all students who enrolled on the Internet presentation (300);
- Conventional: students enrolled on the conventional course, including students whose tutors also had Internet students (150) and students of selected tutors with only conventional students (50).

The composition of the conventional target group allowed us to consider tutor differences as well as to make conventional–Internet comparisons for given tutors.

The study

Given that the Internet students were self-selected (a "fact of life", since the OU philosophy prevents researchers from imposing special conditions on students), we were keen to establish how divergent they were from conventional students in terms of the factors we would have been likely to have used to make selections in a controlled study. The data sources for this analysis included:

- *background questionnaires*: used to establish students' previous computing experience and prior knowledge, helping to assess group constitution;
- *learning style questionnaires*: used to assess whether any student who displayed a preferred learning style fared better in one medium or the other, and to compare the learning style profiles of the groups overall;
- *final grades* including both continuous assessment and final examination; used to compare the two groups' learning outcomes.

The background and learning style questionnaires were sent to students in the target populations at the beginning of the course. Conventional students received these materials by post and Internet students by electronic mail.

Background questionnaire

The background questionnaire was designed to reveal individual characteristics and, in compilation, to indicate group constitution. It was assumed that it would be possible to assess through analysis whether groups were comparable and, if necessary, to compensate for group differences. It is a self-assessment questionnaire which asks students for their opinions, rather than a psychological index of their attitudes or personalities. It has six sections, as shown in Table 1.

Learning Style Questionnaire

Honey and Mumford's Learning Style Questionnaire (LSQ) (Honey and Mumford, 1992) indicates strength of preference for each of four learning styles: *Activists, Reflectors, Theorists,* and *Pragmatists*.

- *Activists* like new experiences and immediate tasks, thrive on challenge, and are bored by implementation. They learn by *doing*.
- *Reflectors* review experiences, analyse thoroughly before concluding, and can postpone decision making. They learn through *reflection*.

Table 1: Profile of background questionnaire

Section	*Category*	*Type of Information*
1	Computer Use	Length and nature of experience, and student's self-assessment of ability, competence and confidence
2	Email and Network Use	Experience of, familiarity with, and current usage of electronic mail, networks, and the Internet
3	Programming	Length and depth of experience; self-assessment of ability and confidence; familiar languages and applications; preferences
4	Education and Employment	Educational and employment history, un-paid occupations and hobbies
5	Style of Studying	Study habits, patterns, and preferences
6	Attitudes	Expectations, personality traits, attitudes toward computing and technology

- *Theorists* are assimilators, tidy and rational, adapting observations into theories. They learn from *systems, models,* and *concepts*.
- *Pragmatists* are "ideas people", who put theories into practice, like decision making, and problem solving. They learn by *practical application of theory*.

The LSQ has 80 statements, 20 for each of the 4 learning styles. The statements are not weighted; each is ticked for agreement or crossed for disagreement. Within-style scores indicate the strength for each preference. Each student's profile is a *composite* of the four ratings; the questionnaire indicates an overall profile, not a rigid type designation. The test is easy to use and quick to complete (it takes approximately 10–15 min to complete and about 5 min to score), making it ideal for use electronically or by post.

Final course grade

The student's final grade was used as an indicator of learning outcomes; the final grade is the average of the overall continuous assessment score and the final exam grade. Eight continuous assessment assignments were spread over the course. Each assignment typically had four parts which related to the previous units of study. For example, students might have been required to write and test a program from a design, modify a program, or design a program—typical assessment techniques where general concepts are tested through particular examples. These tried-and-tested assignments are recognised by peer institutions and the university as providing effective discrimination among students and are therefore used in this study as a reflection of a student's progress on the course.

The procedure

The background questionnaire and the learning style questionnaire were sent to students in the target populations at the beginning of the course. Conventional students received these materials by post and Internet students received them by electronic mail.

How did the Internet and Conventional populations compare?

We began by comparing the Internet and conventional populations overall. The data shows that, for a variety of attributes, the Internet and conventional student populations are very similar, both in terms of personal attributes and in terms of learning outcomes. Table 2 illustrates gender, age, and learning outcomes for both populations, showing their relative comparability.

Gender

One small difference is the number in women in the Internet population, which is slightly higher than in the conventional population. This difference is not statistically significant. It does indicate that women were not discouraged from studying this course in the Internet version, despite our advance concern that women might have been deterred because of the course's high technology dependence. Based on previous research (Gerver, 1986; Jones *et al.*, 1992; Shashaani, 1994; Durndell *et al.*, 1995; Durndell and Thomson, 1997), it was thought that women were likely to have less ready access to computers than their male counterparts. The enrolment figures suggest that Internet presentation *per se* was not a deterrent to women.

Age

Another early concern was that the Internet presentation would favour a younger audience, which we expected to see reflected in a lower average age. Contrary to expectations, the average age of both groups was the same. The Internet students' ages are more tightly clustered around the mean, however, the minimum and maximum ages in both groups are similar. This result is encouraging from an equal opportunities perspective; there is no evidence here to support an age bias in Internet presentation.

Performance

Table 3 shows that the populations have a broadly comparable pattern of performance, with a similar distribution of grades. There were, however, some differences. Proportionately more Internet students reached the exam phase, but proportionately fewer

Table 2: Comparison of attributes for Internet and Conventional populations

Attribute	*Internet (n = 223)*	*Conventional (n = 2458)*
Gender:		
Female	50 (23%)	482 (20%)
Male	173 (77%)	1976 (80%)
Age:		
mean	37	37
standard deviation	7.88	8.61
minimum	20	17
maximum	80	87
Mean continuous assessment score	83.2	83.4
Mean exam score	68.7	67.89
Mean final score	76.0	75.6

Table 3: Breakdown of course results

Grades	*Internet (n = 223)*	*Conventional (n = 2458)*
1	28 (13%)	403 (16%)
2	60 (27%)	517 (21%)
3	37 (17%)	440 (18%)
4	49 (22%)	498 (20%)
5 (fail)	43 (19%)	538 (22%)
Fail (resit permitted)	4 (2%)	55 (2%)
Pending	2 (1%)	7 (.3%)

Internet students achieved grade 1. At the time of writing we have no explanation for this, but we conjecture that the extra burden and time required to deal with the Internet was enough to distract the more able students from attaining a grade 1. Nevertheless we believe that this has little, if any, impact on our conclusions. The Internet student results are broadly similar to the conventional student results with similar profiles in the range of grades.

Broad comparability
The comparisons in Tables 2, 3, and 4 show that the Internet students can be considered typical of students on this course in general, even though they differ in one important particular: they elected to study the Internet version of the course. No other major differences were detected between populations.

How representative are the target groups of the population?
Students volunteered to participate in the trials, and so the selection of the study groups was not controlled—the OU's "equal access" commitment obviates selection. However, a comparison of attributes (the same data on which we would have had to base selection for controlled groups) demonstrated their broad comparability. Table 5 shows the grades for the study groups and the overall populations. In both cases the Internet students scored slightly higher in all categories.

All available comparison data indicates broad comparability between the study group and the population from which it was drawn; no significant divergences were detected. Further, the study groups can be considered to be representative of typical OU students on this course.

Low response is not unusual for studies at the OU; the course alone puts heavy demands on students, most of whom already have substantial commitments elsewhere. Although the response was proportionately low, the study groups (59 and 73) were still of respectable size, and we have taken care to look for indications of bias in their constitution. Therefore, although the study groups were smaller than we would prefer, we conclude that the study groups can be considered to be sufficiently representative of the populations to draw conclusions from the data they provided.

Table 4: Attrition rate for both populations

	Internet	*Conventional*
Registered	280	2918
Examined	223	2458
Attrition rate	57 (20%)	460 (16%)

Table 5: Comparison of study groups and populations

Attribute	*Internet population (n = 223)*	*Conventional population (n = 2458)*	*Internet study group (n = 59)*	*Conventional study group (n = 73)*
Gender				
Female	50 (23%)	482 (20%)	16 (27%)	13 (18%)
Male	173 (77%)	1976 (80%)	43 (73%)	60 (82%)
Age:				
mean	37	37	38	38
SD	7.88	8.61	7.24	8.0
Minimum	20	17	22	26
Maximum	80	87	55	63
Mean continuous assessment score	83.2	83.4	84.1	82.4
Mean exam score	68.7	67.89	69.9	64.4
Mean final score	76.0	75.6	77.0	73.39

Attrition

Table 4 illustrates the attrition rates (ie, the number of students who fail to complete the course at any time between registration and examination) for both populations; these are comparable to those for other Open University undergraduate courses. The Internet population has a slightly higher attrition rate. It is typical for there to be a higher attrition rate for new courses or new presentations. A longitudinal study comparison with other presentations is underway to establish if this higher attrition rate is indeed a new-presentation phenomenon, or a trend associated with Internet presentation in particular, or just peculiar to this presentation, and if it is in any way due to an inferior experience.

How do the study groups compare?

A varied corpus of data was collected from the study groups to provide a more in-depth view of the student experience. In general, the background questionnaire revealed no significant differences in any of the major areas probed. However, these data did reveal some more slight and subtle differences between the study groups that merit noting.

Gender

As in the populations overall, the proportion of women in the Internet study group is higher than in the conventional study group.

Table 6: Comparison of attributes of Internet and conventional questionnaire data.

Attribute	*Internet (n = 59)*	*Conventional (n = 73)*
Average years computing experience	9.6	8.18
Number who use computers in their job	54 (91%)	52 (71%)
Pascal experience	12 (23%)	19 (26%)
Personal Characteristics:		
Extrovert (Introvert)	19 (32%)	24 (32%)
Pragmatist (Theorist)	45 (76%)	51 (69%)
Doer (Thinker)	32 (54%)	41 (56%)
Methodical (Intuitive)	25 (42%)	46 (63%)
Educational Level:		
1 "O" level standard or equivalent	17 (29%)	16 (22%)
2 "A" level standard or equivalent	14 (24%)	22 (30%)
3 Degree, HND, HNC, or equivalent	19 (32%)	24 (33%)
4 MSc, Professional Qual., or equivalent	1 (2%)	1 (1%)
5 PhD, or equivalent	0	0
Missing values	8 (13%)	10 (14%)

Age

Table 6 shows that in both study groups the average age was 38 (37 in the overall populations).

Personal attributes

Other differences, illustrated in Table 6, are the number of students who *use computers in their job* (91% Internet, 71% conventional) and the number of students who *perceived themselves to be methodical* (42% Internet, 63% conventional). The *methodical* attribute, although self-indexed, may indicate students who are more likely to prefer to take a tried-and-tested course than be subjected to the innovative but unfamiliar.

Learning styles

Comparison of LSQ data for both groups, shown in Table 7, illustrates similar patterns in the profile of each group.

The attribute with the largest variation between groups is *Theorist*. *Theorists* are characterised as perfectionists who favour tidiness and order. They are analytical, preferring to maximise certainty, disliking irrelevance. Given these characteristics, this attribute bears a relation to the self-perception of *methodicalness* (as reported above), and so it is unsurprising that the conventional students recorded their preference for this style as slightly higher than did Internet students.

Performance

As shown in Table 5, no population or study group scored significantly higher than any other. Using the Internet as a communication medium in the trial caused no significant

Table 7: Comparison of Honey and Mumford LSQ of Internet and conventional students

	Internet (n = 59)	Conventional (n = 73)
Activists		
Very strong preference	7 (12%)	7 (10%)
Strong preference	7 (12%)	7 (10%)
Moderate preference	29 (49%)	31 (42%)
Low preference	14 (24%)	21 (29%)
Very low preference	2 (3%)	7 (10%)
Reflectors		
Very strong preference	13 (22%)	13 (18%)
Strong preference	14 (24%)	19 (26%)
Moderate preference	13 (22%)	24 (33%)
Low preference	11 (19%)	9 (13%)
Very low preference	8 (14%)	8 (11%)
Theorists		
Very strong preference	6 (10%)	15 (20%)
Strong preference	13 (22%)	13 (18%)
Moderate preference	17 (29%)	29 (40%)
Low preference	21 (36%)	11 (15%)
Very low preference	2 (3%)	5 (7%)
Pragmatists		
Very strong preference	5 (8%)	6 (8%)
Strong preference	10 (17%)	15 (20%)
Moderate preference	28 (47%)	24 (33%)
Low preference	13 (22%)	17 (23%)
Very low preference	3 (5%)	11 (15%)

difference in learning outcomes—Internet students performed about as well as their conventional counterparts.

How does the Internet affect student experience?

To compare the student experiences, we analysed not only the data sources listed above, but also:

- additional "course experience" questionnaires administered at the beginning and at the end of the course (These covered attitudes and expectations, assignments, conferencing, tutorials, queries, learning, technical problems, social aspects. They used both ratings and short open questions, and they included repeated queries using different forms of words.),
- all of the electronic communication between students and tutors (both tutorial interactions and queries), and
- marked assignments.

The analysis was largely data driven, seeking to identify factors affecting the students' experience, to identify factors associated particularly with a presentation medium, and to identify patterns in their experience of the course. Although we used whatever metrics and statistical measures we thought might provide insight, the analysis was largely qualitative, since we have no reliable metrics for the student experience. We report on the experiences of each group in the following specific areas: assignments, conferencing, tutorials, queries, learning outcomes, and technical problems.

Assignments

Turnaround time

Improving the turnaround time for assignments was an objective of these trials. Distance learning students rely on feedback from their tutors for motivation, instruction, and remedial action, and so the speed of return of marked assignments is crucial. While the postal service in the UK is robust and efficient, there are nevertheless delays, and there are clear disadvantages for international students.

The return of TMAs was faster for Internet students: on average the conventional students received their marked assignments in two weeks, and the Internet students received theirs in one week. Electronic assignment handling provided the Internet students with greater flexibility and convenience, among other gains:

- *geography*—location is no longer a disadvantage: international students do not have to make allowances for their remote communities or inefficiencies in their postal services;
- *flexibility*—can work up to the deadline (no need to allow time for posting, no need to get a stamp, no need to go to a post box);
- *legibility*—hand writing and margin notes are not a problem;
- *assurance*—acknowledgement of receipt is automatic;
- *efficiency*—automatic handling includes checking programs that virtually eliminated delays due to clerical and arithmetic errors.

Students liked this "*no fuss, no bother*" approach to sending assignments; as one student reported: "*I just love being able to email my TMAs*". In particular, students liked the "desktop" assurance that their TMA had been received: "*it beats queuing at the post office for a proof of posting certificate*".

Reading marked assignments

Students used different practices in reading their tutors' comments: some students read the comments on screen and then filed the assignment, some read on screen and then printed the marked assignment for future reference, and others printed the marked assignment for reading and later reference. Reading method was a matter of taste, and none seemed more popular than the others. The general response was positive, because students were able to read their tutors' comments with ease, a factor appreciated by those who had had previous experience of attempting to read tutors' handwriting.

The tutors' handwriting is only part of legibility. Comments on paper-based assignments must be made around fixed text; some scripts become a tangle of dense comments between lines and in margins. Electronic assignments allow unlimited room for comment; it is possible to insert comments of whatever length *into* a student's script and to highlight portions of the student's script precisely. When the tutor does not want to disrupt the original layout by inserting comments (for example, in sections with special structure such as computer programs or diagrams), the on-screen marking tool allows comments to be attached as annotations to be displayed in a separate window. Students appreciated this feature of the marked script. It took some students a little time to adjust to the new system; several claimed initially that they could not find their tutor's comments.

Using conferences

Email postings

The HyperNews conference included the facility to email conference postings to students, as well as being readable on the Web with all the threading (ie, the discussion structure) visible. Email forwarding meant that latest postings were brought to students' attention, but they were delivered out of context. Prompt receipt assisted prompt response and hence helped students stay in the flow of the discussion. Web access provided a visual representation of the structure of the discussions, but required students to access the conference explicitly to look for new postings and to be connected to the Web for longer periods. The majority of Internet students elected to have conference postings automatically emailed to them (and many treated the material on the Web as archival). Promptness and convenience were more important to them than a pretty interface.

Inexperience and perceived cost

Conventional students who were asked if they would enrol in an Internet course, offered the cost of telephone calls as one reason for not doing so—they expected to incur large telephone bills. Some Internet students, too, expected that this would be a likely expense. This impression arises from inexperience; in fact, students did not incur large bills. The course was designed so that the majority of the work could either be *read or prepared off-line*. Nevertheless, the perceived cost of Internet access is clearly a barrier to new students.

Internet culture

Not all students found it easy to communicate using the Internet. One student reported that he was "*afraid*" to send email, and another reported "*my lack of (conference) 'chat' participation was due to a total lack of confidence*". Some students had little experience of the Internet culture and hence little knowledge of the "unwritten rules". Some problems seemed to arise from the lack of understanding of "Netiquette", and a student remarked that: "*text should be written sympathetically to the medium*". One student offered advice to new students starting the course: "*don't be an Internet virgin*".

Students sought leadership from their tutors: "*group tutors should try to keep the group communicating*". One student requested a formal face-to-face ice breaking session at the beginning of the course in order to become more familiar with the medium (all tutors have the discretion of offering additional "special sessions" when they feel it would be educationally desirable). As the use of the Internet spreads and the protocols of Internet culture become more familiar, this problem will lessen, however there is a current need for engendering students' confidence in this very different environment (Sumner and Taylor, 1998).

Lurkers

Both tutor and student conferences attracted a high number of "lurkers", those who followed the conference but did not participate actively. Students liked the ability to observe without revealing their presence, and they found it useful to keep track of events. All students reported lurking. Reasons given for lack of participation included: *confusion as to their roles* and *unclear expectations*. Other simply didn't want to participate.

Tutorial experience

Conventional students are offered a small number of face-to-face tutorials at regional study centres, on this course typically a series of 2-hour tutorials (amounting to a maximum of 18 hours in total, including tutors' preparation time). Attendance at tutorials is not mandatory, and (as is typical of OU students) less than half the students attend any tutorials. Students on the whole are keen to attend tutorials, but they report that distance, work and personal commitments prevent their attendance. The OU encourages students to form self-help study groups to encourage discussion and participation in the learning process, but again the major disincentives are time and distance.

Electronic students were offered the ability to contact their tutor and fellow students via email and computer conferencing. Tutors were asked to provide a service similar to that which they would provide for conventional students (equivalent to 18 hours). Geographic and temporal constraints were no longer barriers; electronic students contacted their tutors more often (see Table 8) and had more contact with their peers. All students participated in electronic discussions, if only as observers—although not all wanted to participate actively.

What are tutorials for?

There are three main reasons why the OU provides tutorials (Baker *et al.*, 1996):

- to overcome the isolation of the long distance learner,
- to encourage the exchange of ideas and learning experiences,
- to enhance the delivery and presentation of distance learning materials in a structured and supportive environment.

We also looked at what students wanted from a tutorial. Both Internet and conventional students responded similarly. They did not cite extra teaching or content, as might have been expected. Instead, their requirements centred around group

Table 8: Student contact with peers and tutors

Group	*Average number of times a student contacted tutor*
Internet	20
Conventional	5

activities: working in a learning community, seeking clarity, confidence building, gaining alternative concept representations, sharing problems, and appraising themselves against their peers. Students reported that tutorials benefited them by:

- reassuring
- making ideas clear
- providing a wide scope of discussion (often said to be the most useful part of a tutorial)
- showing what's important
- providing good communal practice for beginners
- reinforcing concepts, highlight pitfalls, and provide alternative explanations
- providing different perspectives
- raising interesting and unexpected issues
- enabling the sharing of problems
- providing alternative explanations
- providing a basis for gauging own performance against others' (this comment was repeatedly cited)
- helping understanding by encouraging students to try to explain a point themselves.

By scrutinising the OU tutorial aims and the student's perceptions we considered how we might provide tutorials electronically to meet these aims and objectives. It seems that a mechanism for focused discussion that engages the student to contribute actively could provide much of what the students feel is important.

The reported benefits of electronic tutorial sessions were various, from affect to information, eg:

- *"you could see other people's ideas"*
- *"I made useful social contacts with other students"*
- *"electronic tutorials act as summer school to revive interest".*

The majority of Internet students said that tutorials (whether synchronous or asynchronous) were "*useful for maintaining motivation and enthusiasm*".

Problem sharing

Some aspects of conventional tutorials became separated from the tutorial in the Internet presentation. Tutors reported that "diagnosis" of students' understanding and problems moved away from tutorials into individual communications. Similarly, the "problem sharing" that conventional students value in tutorials, was undertaken by the Internet students not just through tutorials but also through student-to-tutor and student-to-student email. One student reinforced this, saying: "*email makes it easier to get in touch with other students: a problem shared is a problem halved*". One student remarked that being in wider contact with other students caused him to explain concepts to others more often, which helped his own understanding of the subject.

Not a replacement, but a different facility

Interestingly, electronic tutorials did not simply stand in place of face-to-face tutorials; Internet students saw electronic tutorials as providing something otherwise unavailable or unattractive to them. Electronic tutorials were "attended" by students who could not—or would not—have attended face-to-face tutorials, eg:

- *"Time and place are the biggest barriers to tutorials—electronic tutorials offer an opportunity to participate."*
- *"…attending face-to-face tutorials would have been impossible…"*
- *"I hate tutorials anyway and prefer to work in an isolated environment."*
- *"I wouldn't have attended tutorials anyway so electronic ones provided me with an opportunity I wouldn't normally have had."*

However, some students found that electronic tutorials were no more stimulating than face-to-face tutorials, and others simply did not want to participate anyway. As one student said: "*this was the reason I choose distance education in the first place*". However, students who did not attend tutorials reported "lurking", so electronic tutorials reached all Internet students.

There was an unexpected demand from *conventional* students for electronic tutorials. They reported that they would have liked to have had more contact with their tutor and peer group if an alternative meeting mechanism (say, electronic) had been offered. Students did not see the requirement for communications equipment and software as a barrier; many already had the required "kit", and others were prepared to acquire it.

Queries

For these one-to-one interactions, conventional students typically contact their tutors by telephone or post. Electronic students used email.

Perceived reliability

Some conventional students reported that at times they were unable to contact their "*elusive tutor*"—tutors are not always able to answer the phone. In contrast, the Internet students reported that "*email queries were responded to very quickly*". Students referred to the reliability of email response: sending a message gave students the feeling that it was at least in the process of being dealt with, and they always got a reply.

Increased interaction

Electronic communication encouraged an increased interaction between student and tutor, with on average four times as many interactions (see Table 7). Electronic queries were typically answered in a single exchange; invitations to follow up with additional messages or telephone calls were rarely taken up. Logs of the tutorials and other electronic interactions demonstrated that tutors used humour and exchanged general conversation alongside course-specific teaching interactions. Students enjoyed using electronic communication, and they reported a greater ability to "*get to know*" their tutors. The development of relationships between students and tutors via the Internet is not only possible—but is arguably better than conventional experiences (Bischoff *et al.*, 1996).

Learning outcomes

As indicated by the previous tables (4, 5, and 6), there is no significant difference in learning outcomes in any of the groups. Internet students performed as well as their conventional counterparts. No Internet student felt that using the Internet contributed to learning about the course content. However, Internet students felt that they had gained valuable experience in using the Internet and its associated tools—"*I have learned more about email and I have greater confidence using the web*". While such learning was not an objective of the course, it was a welcome by-product.

Technical support and technical problems

Internet students were asked to report on the technical aspects of this environment. It was clear that telephone support was crucial, particularly in the initial stages in order to help get students "up and running". In addition, students requested "out-of-hours" support, which was not offered in the trials, although the OU does offer some "out-of-hours" support in its regular service. The trial confirmed the importance of this service.

Students are surprisingly tolerant of technical problems—as long as they are resolved. Students do experience problems with modems, lost lines, and servers, but they accept this as a fact of life. The few who did experience problems were typically unable to recall later precisely what the problem was. One student summarised: "*problems cease to be problems when they are solved*". The student also reported how "*understanding the staff had been regarding his problem and how quickly it was dealt with*". Fast and empathic problem solving is crucial to preserving the student experience, both in terms of promoting tolerance and confidence, and minimising frustration. A delay in rectifying technical problems can interfere with normal study.

Summary

Our trials show that the Internet offers students a rapid and convenient communication medium that can enable increased interaction with fellow students (both within and beyond their tutor groups) and tutors. Possibly the biggest gain for Internet students was the improved turnaround time of assignments, so that students received timely feedback. A summary of gains includes:

- Faster assignment return; more immediate feedback;
- Robust model for queries, with greater perceived reliability;
- Increased interaction with tutor and other students;
- Extending learning experiences (eg, problem-sharing with other students) beyond the tutorial; and
- Internet experience.

Learning outcomes (as indicated by continuous assessment and final examination) were comparable, and the Internet students' experience was favourable and was one they would wish to repeat—a major factor in maintaining the enthusiasm and motivation of distance education students throughout a complete degree programme. We have no reason to believe that our results are ephemeral—a Hawthorne effect—since experience with conferencing and electronic communication elsewhere in the university has been that students' experience improves after the first year of exposure, as their use becomes more sophisticated (Mason and Bacsich, 1998).

Distance education models for elements like tutorials had to be adapted—indeed, transformed—to serve teaching and learning functions within the strengths and limitations of the medium. Electronic tutorials offered a different facility from conventional tutorials, not a replacement for them.

The biggest obstacle to Internet presentation was inexperience—and cultural inexperience presented tougher obstacles than technical inexperience. Internet presentation requires a culture shift by students and tutors. Both must learn how to cultivate communication in a largely asynchronous environment, and both must develop a sensitivity to the emerging etiquette and conventions of Internet culture. Using the Internet does come with higher expectations: students (both Internet and conventional) expect electronic communication to be faster. One of the keys to successful Internet presentation is to instil appropriate expectations among all participants.

Internet presentation requires considerable technical support, a cost which is dangerous to under-estimate. Student tolerance and confidence rely on prompt and effective assistance with the inevitable technical problems. In enabling students to escape time and place constraints, we incur expectations for round-the-clock support.

Electronic communication can support distance learning students by providing them with flexible, convenient interaction that is neither *time nor place dependent*. Using the Internet, as described in this paper, is one way of providing an effective and motivating community of learning.

References

Baker C, Tomlinson N, Cole S, Stevens V, George J, Howwells A and Thorpe M (1996) *Support for Open Learners: Reader* (Vol. SUP 34725 2) The Open University, Milton Keynes.

Bates A W (1991) Third Generation Distance Education: the challenge of new technology *Research in Distance Education* **3** (April) 10–15.

Bischoff W R, Bisconer S W, Kooker B M and Woods L C (1996) Transactional distance and interactive television in the distance education of health professionals *The American Journal of Distance Education* **10** (3) 4–19.

Daniel D (1998) Can you get my hard nose in focus? Universities, mass education and appropriate technology *in* Eisenstadt M and Vincent T (eds) *The Knowledge Web* Kogan Page, London, 21–29.

Dede C (1996) The evolution of distance education: emerging technologies and distributed learning *The American Journal of Distance Education* **10** (2) 4–36.

Durndell A, Glissov P and Siann G (1995) Gender and computing: persisting differences *Educational Research* **37** (3) 219–227.

Durndell A and Thomson K (1997) Gender and computing: a decade of change *Computers in Education* **28** (1) 1–9.

Franks K (1996) Attitudes of Alaskan distance education students toward media and instruction *The American Journal of Distance Education* **10** (1) 60–71.

Gerver E (1986) The under-representation of women in computing *Open Learning* **1** (2) 22–31.

Honey P and Mumford A (1992) *The Manual of Learning Styles* (2nd edn) Honey, Maidenhead.

Jones A, Kirkup G and Kirkwood A (1992) *Personal Computers for Distance Education: the Study of an Educational Innovation* Paul Chapman, London.

Mason R and Bacsich P (1998) Embedding computer conferencing into university teaching *Computers and Education* **30** (3–4) 249–258.

Moore M G (1996) Tips for the manager setting up a distance education program *The American Journal of Distance Education* **10** (1) 1–5.

Moskal P, Martin B and Foshee N (1997) Educational technology and distance education in Central Florida: an assessment of capabilities *The American Journal of Distance Education* **11** (1) 6–22.

Scardamalia M and Bereiter C (1992) An architecture for collaborative knowledge building *in* De Corte E, Linn M C, Mandl H and Verschaffeel L (eds*) Computer-Based Learning Environments and Problem Solving* **84** Springer-Verlag. Berlin, Germany, 41–66.

Shashaani L (1994) Gender differences in computer experience and its influence on computer attitudes *Journal of Educational Computing Research* **11**(4) 347–367.

Sumner T and Taylor J (1998) Media integration through meta-learning environments *in* Eisenstadt M and Vincent T (eds) *The Knowledge Web* Kogan Page, London**,** 63–78.

Thomas P G, Carswell L, Price B A and Petre M (1998) A holistic approach to supporting distance learning using the Internet: transformation, not translation *British Journal of Educational Technology,* **29** (2) 149–161.