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Practical Experiences of, and Lessons Learnt from, Internet Technologies in Higher Education

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ABSTRACT

The paper addresses how the Internet as computer-mediated communication is affecting teaching and learning in higher education institutions, particularly as these institutions face increasing competition due to the emergence of Web-based collaboration and assessment technologies. London's South Bank University (SBU), a typical modern-day higher education institution is thereby in the process of integrating Internet technologies into its conventional and distance learning programmes. From its practical experiences so far SBU has learnt a variety of valuable lessons. In particular the technical and social aspects that determine the choice and use of the most appropriate software tools were identified, as well as a new approach towards online (Internet / Web) subject reference sources was outlined. From SBU's anecdotal experiences, useful recommendations are made for the effective use of Internet technologies that applies to many higher educational institutions.

Keywords

computer-mediated communication; distance education/learning; online education; Web-based instruction/training

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Introduction

As confirmed by Burnett and Beede (1997) and Beller (1998), universities are becoming increasingly subjected to financial pressure to justify their role as a service in the future of education. Developments in Internet technologies continue to improve the means of sharing information globally and universities can no longer rely solely on their earlier advantage of exclusive access to the resources for assisting students to gain a higher education qualification. Recent years have seen tremendous growth in the number of Web based courses globally, and a significant proportion of these is provided not by traditional academic institutions but by online profit-making organisations.

While the threat can not be judged as immediate, early action to seek a competitive stance in the market is imperative if the role of the traditional university is to be justified. This paper looks at developments in the field and examines some of the moves by South Bank University (SBU), London, United Kingdom, being a typical higher education institution, to embrace Internet based course delivery. The case studies illustrate varying degrees of integration from online provision of campus-based course notes to full distance learning, in order to show how the Internet can be put to the best use in differing situations.

Increased recognition

The range of possibilities for the use of the Internet in education is becoming more widely recognised. Web based courses are proliferating and, for universities, offer cost savings in infrastructure and a far wider potential customer base. Among those recognising the benefits is Queensland University, Brisbane, which is preparing for the future by introducing a professional development programme online for educators called TOPS - Teaching Online Professionals - in an effort to create a high level of computer and Internet literacy among teachers (Marshall, 1998). The need for institutions to accept the high probability of online tuition taking over from conventional tuition is emphasised in their approach. Amongst other objectives, the course will focus on transferring all current course subject matter to electronic media. The reason for this approach is that the nature of printed material dictates that references to other material can not be followed up instantly; there has to be an

effort on the part of the reader to seek and retrieve the other resources. By providing seamless links to the material online, however, the reader is able to maintain attention on the subject content itself rather than the task of retrieving it, leading to vastly improved learning. UK organisations are also beginning to appreciate the need for action: for example, the South Yorkshire Networks for Enterprise has similarly developed a course to give teachers, lecturers and trainers the skills for delivering tuition via the Internet: (http://www.sheffcol.ac.uk/lettol/enquire.htm).

General evidence

Recent years have seen an exponential increase in examples of distance learning via the Web. Many have been established in an attempt to overcome practical problems regarding the logistics of providing courses for students who are unable to attend an institution due to geographical dispersion, or who have little time to attend because of other commitments. Indeed SBU has arranged a course for students of the Mid-Sweden University to address both these problems and that of the lack of available tutors in Sweden.

It is only comparatively recently that studies have been conducted on the quantifiable results of distance learning compared with conventional learning. A controlled study by Schutt (1997) at California State University, Northridge, compared the performances of two similar sets of students studying identical course material, one in the classroom and the other via the Web. It emerged that the students studying remotely had a greater level of interaction with their peers and, as a result of effective teamwork via email, newsgroups and online chat, these students had increased their grades by 20%.

Gilliver, Randall & Pok (1998) researched the comparative merits of virtual and classroom learning with a cohort of first-year Financial Accounting students at Ngee Ann Polytechnic in Singapore. They concluded that a strategy of minimal rote tuition and a focus on raising students' motivation to explore topics at their own pace resulted in demonstrably improved success in grades. Students in the study were freely encouraged to share their own ideas and opinions on the subject material, thereby engaging into discussion at all times and consequently fuelling their self-motivation to explore and learn more.

It may be however that those students who have little experience of the Internet might initially be concerned about having to learn a whole new communications skillset that this media presents in addition to their subject of study. Cuskelly, Danaher and Parnell (1997) observe that although students may have the enthusiasm to learn new techniques, they are reluctant to give up the telephone and audio tapes as preferred means of communication, primarily because they can use the old, familiar technology more quickly and easily. There is a hint that a combined approach may be the best option at the outset so that students may adjust gradually as they become aware of the advantages offered by Internet communication.

Online education at SBU

South Bank University (http://www.sbu.ac.uk/) is representative of many institutions entering the realm of online delivery of courses in the UK. Founded in the late 19th Century, South Bank University (SBU) is a modern-day university. A Polytechnic institution until 1992, it offers an eclectic range of courses covering arts and sciences, and its 20,000 or so student population spans a wide range of cultures, backgrounds and ages. The institution has ranked well in higher education quality ratings (http://www.sbu.ac.uk/sbucomm/news/rank.html). SBU's tutors, like the vast majority of all higher education institutions, have primarily taught students using traditional 'face-

SBU, like all UK higher education institutions, has a permanent high capacity Internet link under the JANET scheme (http://www.ja.net/). Given its wide ranging background and these common online facilities, the experiences of SBU would undoubtedly apply to similar institutions considering, developing and implementing online courses.

First Class

A working example of the use of the Internet for learning at SBU involves students who are resident abroad. An MSc course in Mathematics Education is provided for home-based students in Sweden using Softarc's First Class software (http://www.softarc.com) over the network between SBU and Mid-Sweden universities. The system provides for both synchronous and asynchronous text-based conferencing, and every week the tutor

begins an asynchronous conference by quoting an academic paper and indicating points arising from it to be discussed by the students, who post their views as appropriate.

The shallow learning curve of First Class ensured that both tutors and students could use it after a relatively short period. However, recently there have been problems with the downtime caused by server failure. The problems revealed the importance to the University of ensuring the availability of an adequate level of technical expertise specifically related to both the proprietary application and the infrastructure in order to troubleshoot the situations which may arise. The difficulty in finding the required expertise resulted in loss of contact via First Class for weeks at a time. These difficulties necessitated efforts to increase the level of course information available on a supporting Web site, leading to thoughts that such a situation may be a catalyst for conversion to total Web delivery of the course.

Online text chat sessions were also provided, with mixed results. Although the students were keen to participate in communication over specific issues, the asynchronicity inherent in the sessions resulted in stilted and often confusing conversations; replies to earlier questions frequently appeared after the debate had moved on. The short silences which punctuate face-to-face conversation when one pauses to consider a solution to a problem did not transfer well to this medium; delays were often perceived as distractions from the task under consideration or as temporary failures in the system. Video-conferencing was considered but deemed inappropriate because of bandwidth and hardware problems.

Despite the problems, a comparison between SBU's remote-learning and traditional-attendance Mathematics Education courses showed that there had been an overall rise in the number of students retained throughout the duration of the course compared to when it was studied conventionally. However, this apparent success did not seem to have been gained easily. The construction and maintenance of the course placed heavy demands on the tutor's time. For instance, in addition to the time required for research and formulating discussion questions from academic papers, there was also the time spent drafting replies to email messages and developing threads in conferences. Despite all good intentions, in SBU's conventional education programmes email was not often used for real academic benefit; if a student had a question he would often prefer to speak to a tutor in person. There are two possible reasons for this:

- an answer to one question frequently creates more questions, and no amount of email exchange can compare to the immediacy of face to face dialogue in such cases;

- despite the claim that it should be the primary method of contact, email appears to be considered by most as a means of communicating items of lower importance, and so replies to messages are often either too late to be of any use or even non-existent.

However, in online learning, email becomes the most important link between student and tutor. A suggested alternative would be to create a forum for real-time discussion. It is thus anticipated that a trial of a virtual community using the facilities provided by the Diversity University (http://www.du.org) may soon be arranged for this course to test whether it would be a useful medium for communication in this context.

Newsgroups versus mailing lists

The growth of the Internet in recent years has given rise to two Internet-related units offered at SBU. They are currently available only for conventional study but the lessons learned also provide pointers for the development of distance learning courses. One unit, Global Communications Techniques, is divided into two halves, equal amounts of time being spent on the tuition of JavaScript (http://developer.netscape.com/) and on the discussion of the future of Telematics (http://www2.echo.lu/telematics/). The other unit, Computing for Business Telematics, focuses primarily on teaching Java (http://www.java.sun.com/). A newsgroup exists for each of the units to give students a platform for sharing their views. There were two reasons for the decision to use newsgroups. The first was to assist the students in generating ideas for an assessed written commentary of their learning experiences. The second was to enable the tutors to gather regular weekly feedback on the progress of the students so that it could be clearly seen how students' understanding developed over time. Then, if necessary, action could be taken during the unit to address any misunderstandings. In theory, this method for gathering feedback compares favourably to the more usual tactic of asking students to complete a simple evaluation questionnaire at the end of the unit.

Unfortunately, the same problem occurred as was found in an Open University study (Petre et al, 1997), the SBU-MidSweden project and another Web-based unit at SBU teaching the Ada programming language: The

number of participants in the discussion groups was far less than originally expected, reducing the effectiveness of the groups as conferencing tools and channels for feedback. Given that students were, in the main, keen to collaborate and compare coursework answers, it was initially difficult to discern why the discussion forums were under-utilised. At first it was thought that it may be due to the medium used and that perhaps GroupWare such as First Class or Lotus Notes (http://www.lotus.com) should be tried. On investigation, however, it emerged that the medium itself was only partially responsible for poor acceptance. Reasons given by SBU students included the following:

- those who used newsgroups properly quickly became disillusioned with the process by those who used them carelessly, for example by posting test messages, posting the same message numerous times, ignoring previous posts or by starting new threads instead of developing existing ones; such misuses often generated conflict, as addressed by Pollard & Vile (1998) and Chester & Gwynne (1998);

- those students experiencing the greatest difficulty in the subject were often either too embarrassed to state so in a public forum or were unable to formulate meaningful requests for assistance (particularly when phrasing questions about aspects of programming languages);

- students saw little benefit in going to the trouble of typing a message to the newsgroup and hoping for a response which may never have arrived, when they could instead discuss matters with their colleagues face to face and gain instant feedback, the asynchronicity of online discussion groups being a major drawback in this respect;

- there was little incentive in the marking criteria directly relating to the extent to which a student made use of newsgroups. However, the end of unit reflective commentary carried a specific allocation of marks, therefore many students preferred to keep their ideas to themselves to gain full credit for them in the commentary.

If the newsgroup was actually being read, it was by 'lurkers'. McKendree & Mayes (1997) argue that dialogue between learners can benefit the observer even if the latter does not participate. It is appreciated that there was an element of such learning in this particular case but the level of participation itself was insufficient to provide sustained benefit to onlookers.

Newsgroups have a self-perpetuating problem: a low level of participation discourages others from participating. Students ventured, however, that had they been able to send an email to a mailing list it would almost certainly have been read by all list subscribers very quickly. The guarantee of a widespread audience and a possible quick response would have encouraged participation. When initially considering which medium to use for conferencing, electronic mailing lists were discounted because their 'push' nature was regarded as potentially too intrusive and may have resulted in information overload. However, judging from the above student opinion, mailing lists may offer a better solution. The first action of most students on sitting down at a computer is to check their email. If a mailing list was put in place the students would frequently have the opportunity to reply to the latest comments without having to start a new application to do so. This contrasts with the past situation using newsgroups where the student could not tell whether there were new messages until he launched the news reader, and if he found that there were none the incentive to check again later was diminished. Contrary to being obtrusive, it seems that the push nature of email would probably be welcomed when it comes to a platform for discussion. This could be a major reason why email is checked daily and newsgroups are checked perhaps once per week. If the reader decides not to respond to an email message at the time, he only has to move the message to another folder and read it later. It is anticipated that a later trial using mailing lists will test the theory.

Distance learning courses especially have an obvious need for the effective use of a conferencing area and must seek to avoid the problems outlined above. It would be helpful if an institution offering any type of online study course additionally offered a short course in using Internet utilities effectively, perhaps even making it a prerequisite for the main course. The short course would include the proper use of email, newsgroup and Web search techniques. If students were thus better prepared for distance learning and the use of the medium itself becomes second nature, maximum attention could be focused on the core subject material.

If newsgroups are to be used, the issue of difficulties with the subject matter leading to non-participation in on-line discussion might be resolved by a combination of two changes. The first is carrying out frequent assessments of each student's understanding of the subject. The second is allocating a proportion of unit marks directly to the student's ability to maintain regular newsgroup contributions. An obligation to post weekly would push students to set out clearly from the outset where the problems lie, it would bring encouragement to

others with the same problem, and it would invite rapid assistance from other students keen to make a weekly contribution while demonstrating their proficiency. In this way the less proficient students would be assisted well before the course progresses too far for them to catch up. With a little persuasion, the collective intelligence facet of newsgroups might be fully realised.

Additionally, it is suspected that the level of participation in a newsgroup is related to the number of students studying the unit. The Global Communications unit had around two hundred students and the Telematics unit had around fifteen; there was a corresponding ratio of posts to the respective newsgroups. It is thought that there exists a 'critical mass' which justifies newsgroup use as opposed to traditional human networking. The former is seen to be more effective in large groups since students have less of an opportunity to discuss points in-class with the tutor and their colleagues.

Online assessment

An optional remedial English class has been running for the past few years in order to ensure that students' command of English is at the level suitable for higher education. In the current academic year a Web based version of this course, created with Netscape Composer, was introduced for a number of reasons. The benefit for students is that they can follow the course at their own pace and have an alternative means of studying which may avoid the need to attend fixed sessions in addition to their usual timetable. The incentive for the tutor is the time saved on preparing handouts for the students now that they can be delivered via the Web. The course is developed on a weekly basis and assessment exercises for grammar sessions typically include a set of sentences which require correction. These exercises are presented in plain HTML, leaving the student to write his responses on paper before comparing them with the answers on another Web page. The tutor's hopes for the site are that it will in the future be configured to accept students' responses and will parse them in order to offer informative error diagnosis. Also, multimedia could be included in an attempt to make the site more attractive through the use of images and sound, including animated arrows pointing to those concepts deserving particular attention. Finally, layout is considered important: the site is divided into two frames which display each week's test and hints, the hints being replaced by answers after completion of the test. This is intended to resemble the more familiar textbook layout with just two pages of text per session, so as not to overwhelm the student, and answers at the back of the book. At present there is no facility for monitoring accesses to the site and, as this is the first year of the Web version, there are as yet no statistics for the comparative level of success of this to face-to-face tuition. Since the tutor is a part-time employee, there is a need for any proposed solution to be easily-configurable and capable of being quickly updated. Also, as noted by Pownall, Mobbs & Cann (1998), academic staff are unhappy about using a mark-up language and Webmasters are becoming more concerned about running CGI programs on their servers, so discounting several commercial options available today. In addition to the options described in texts by Hall (1997) and McCormack & Jones (1998), and taking into account analysis by Nichol (1998), several online alternatives have been examined:
i) The TRIADS system (http://www.derby.ac.uk/assess/newdemo/mainmenu.html) designed by Derby University was considered because of its attractive multimedia interface created with Macromedia's Shockwave for Authorware (http://www.macromedia.com), and because of its customisation options. However, this option would have required training in the Authorware package and maintenance would have been a problem in the future;

ii) The CASTLE system (http://www.le.ac.uk/castle), though very easy to use, was initially discounted because it offered only multiple-choice tests. However, Phase 2 of its development promises a more appropriate type of test for this situation. While the ubiquitous multiple-choice style is suitable for many types of assessment, it is felt that the English tests should retain their existing style, requiring students to re-write a full sentence. This method avoids giving the student prompts and a good chance of making a lucky guess; it instead depends on a proper understanding of the subject matter. This is thought preferable since in the real world the student has few prompts for each situation. Using the knowledge gained by the tutor from previous tests, common incorrect answers in the new system would each have to generate a different explanatory message and point students to the areas which should be revised;

iii) WebCT (http://homebrew1.cs.ubc.ca/webct/webct.html), although offering free hosting of assessment sites, was difficult to configure and did not allow a response tailored to each answer; there was only a generic response which did not take account of the specific input;

iv) Clyde Virtual University's Assessment Engine (http://cvu.strath.ac.uk/ae) offered a test which could be configured via a Web browser, making maintenance relatively simple. However, there was still no facility for

full-sentence input. The utility still only offered either multiple choice questions or long text answers with no feedback tailored to each response;

v) Question Mark's Perception (http://www.questionmark.co.uk) offered a good interface and suite of maintenance tools for assessment exercises. The problem here, though, was that implementation of tests required a Microsoft Web server and technical knowledge of server installation. This was not appropriate in this case since there was a need for a user-friendly solution.

In the absence of a suitable ready-made alternative, it was eventually decided to test a solution using JavaScript. The solution had the advantage of easily being updated (the tutor has only to change the relevant questions in each script) and also allows free text entry using HTML forms. Validation of the answers is provided by means of parsing the answers for punctuation and capitalisation where appropriate, and then comparing the answers against the most common mistakes and providing a suitable diagnostic error message for each different type of error found. Figure 1 shows the system in action. Feedback from students will be monitored to assess the suitability of this solution.

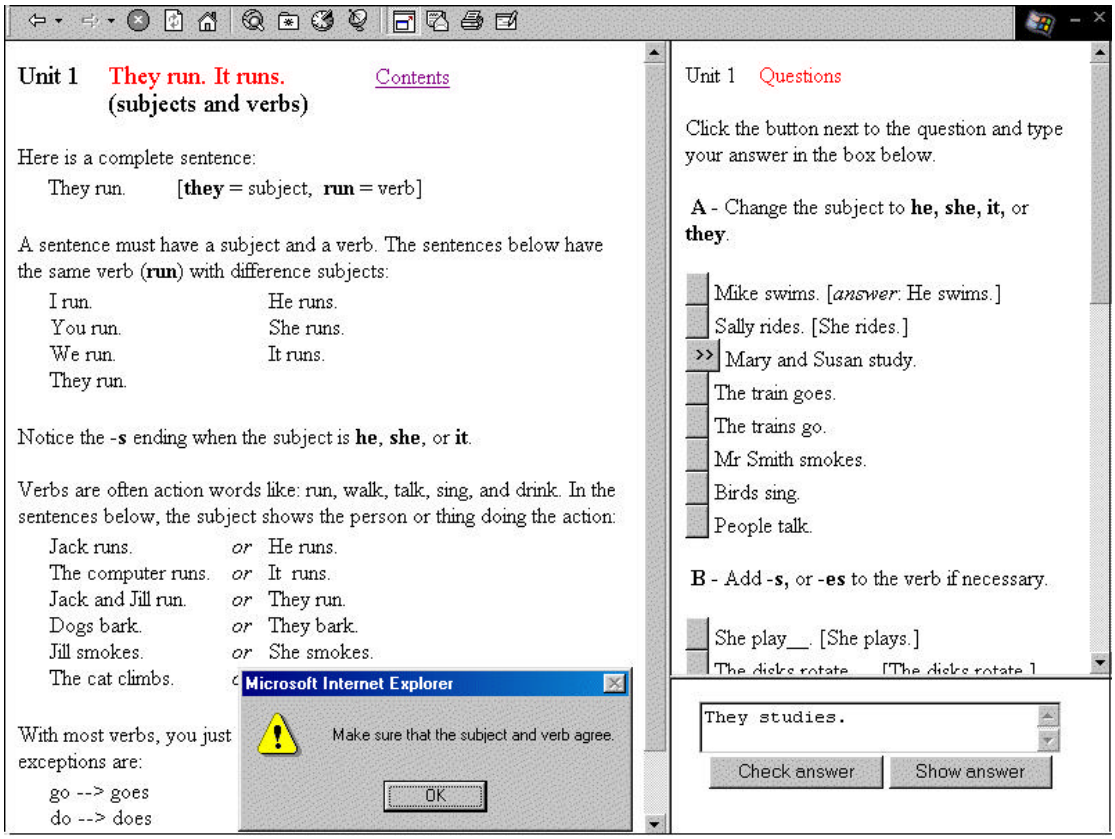

Figure 1. The English assessment system using Javascript

Distance Learning Centre

SBU's Distance Learning Centre, which had successfully been delivering traditional correspondence courses in nursing for some years, was originally keen to embrace Web based courses. However, the results of their survey asking prospective applicants whether they would like to study via the Internet showed that only 3% stated that they had access to sufficient IT facilities. The Distance Learning Centre had 1000 students each year and had to have a minimum of 300 applicants per course; the thirty or so who were in favour of Web based learning would have been a small minority and insufficient for such a course to go ahead. In addition, the costs of setting up the infrastructure for such a move, including hardware and ongoing technical support, were deemed prohibitive by the management. The centre presently continues to offer correspondence courses, but clearly the increasing availability of easier-to-use tools and knowledge gained from cases such as those illustrated looks set to turn the situation around to the benefit of a wider student population in the very near future.

Issues to consider in online courses

Social aspects

The social isolation arising from online study is widely documented and the practical experiences of SBU reinforce the need for further attention in this area. This is perhaps one of the reasons that, historically, physical attendance at an institution has been a more popular mode of study than correspondence courses or individual self-tuition. In the Web learning environment, virtual communities may be able to help in this regard. While not substituting fully for close personal contact, they do provide a platform where students can express themselves and seek views and support from their colleagues.

In a study of the Open University's trials of Internet based learning (Petre et al., op. cit.), it was found that patterns of interaction were quite different to those of conventional courses. In contrast to the study by Cuskelly et al. (op. cit.), many online students communicated with tutors more frequently by email than they would have normally done face-to-face or by telephone. The advantage of asynchronous contact methods such as email is that students have time to gather and arrange their thoughts and can present them clearly and in their entirety without fear of interruption or embarrassment. However, the problem mentioned earlier was reiterated in the Open University study: it was found that those students who posted frequently to the open discussion groups were dissatisfied with the number of responses from colleagues. This may be explained by the fact that individuals were happy to discuss topics with the tutor but would not always have wanted their thoughts to be broadcasted to their colleagues.

Having stated the above, different groups display different personalities according to their proximity. The need for a physical social interaction element was manifested quite visibly among the SBU students in Sweden. It was common for those who found that they were geographically close, often in the same town, to meet for group discussion and social occasions. These students generally fared well on the course. However, those who were dispersed more widely and not able to meet with their peers sometimes voiced feelings of inadequacy and despair when having problems with their studies, and were more likely to produce poorer results because of low morale. They voiced their feelings in posts to their personal logs, a component of the course.

Ease of Web navigation

Many courses on the Web consist of multiple linked pages through which the student navigates back and forth in what can sometimes appear to be a random manner. If the student needs to gain access to material on a specific topic, the nature of the Web at present is such that he may have to click through hundreds of pages, gathering some information from each, to collate all that he requires. The student then has to combine all the relevant information and be able to store it in a format which allows him to revise it conveniently. Since the portable Internet access device is not yet widespread, the most convenient form of output is usually hard copy. However, the problem is of course that paper printouts of Web pages do not allow the simple cross-referencing which the Web facilitates! There is clearly a need for intensive planning of a course Web site in order to minimise the time and effort required to access primary sources relevant to the area under study. This should perhaps include key references, each of which has been made available in one file for maximum ease of local saving and printing. Armed with the knowledge gained from these key references, the student may then go on to conduct a well-informed search for related material.

McGinty (1997) describes how Marist College makes course materials available online. The college's digital library system offers a wide range of reference material and can be accessed 24 hours a day from any node on the college's network. The resources are available in a variety of formats so that students can select the most appropriate for their particular needs; photographs, newsreels and taped speeches offer a wider range of study material than has been associated with the Web to date, where plain HTML still forms the majority of content. Higher education institutions could learn from this example in their plans for Web based courses. For example, SBU offers a collection of many sources, including texts, videos and journals on CD-ROM, which has been developed over several years in line with the demands of the courses offered. At present, though, the majority of this material can only be accessed while at the university and only before it closes at 9pm. By offering this wealth of information to remote students via the Web/Internet a university such as SBU could capitalise on its advantages of educational experience. It can also offer access to academic networks and quality materials to students, and simultaneously further enhance its role as a major force in the future of online education.

Wider recognition of sources

Student centred learning using the Internet allows for a far wider range of sources than before. The many-to-many nature of publishing facilitated by the Web may well have implications for the future of academic assessment. Before the advent of the Web, a major component of assessing a student's research was to determine the extent to which he had consulted specifically recommended research papers, texts and journals and related his research to them. Indeed, prior to the Internet, peer-reviewed research was perhaps the only source of material which students could access, since most submissions had to be approved as conforming to a wide range of criteria before they could be allowed for publication in journals. However, the Web allows anyone with a view on any topic and a little knowledge of HTML and FTP to be able to publish their thoughts and make them available to the world. Of course, this means that the range of standards is necessarily broadened. However, if it also means that students are able to draw from a wider range of views and thus formulate their opinions more objectively, this collective intelligence facet could offer great benefits to education. Many times a visionary idea has been initiated by an unknown individual with the capacity to "think outside the box", i.e. make a suggestion unbound by the preconceptions held by the majority (Wysocki & DeMichiell, 1997). Therefore, in assessing a student's secondary research, there might be a future trend towards the recognition of a greater range of sources than has been allowed thus far. If concerns remain over the use of unrecognised sources, students ought to be shown how to develop their critical ability in the selection of those sources. For this purpose, an online resource, the Internet Detective (http://sosig.ac.uk/desire/internet-detective.html), has been developed by staff at The Institute for Learning and Research Technology at the University of Bristol. SBU appreciates the value of this resource and will be using it in its education programme.

Conclusion

The growth of the Internet has created a real need for higher education institutions to assess their role in the future of education. Results gained from controlled studies elsewhere have demonstrated that Internet technology can be effective in raising educational standards. Traditional universities will have to be at the forefront of research into the provision of the technology in order to be able to keep pace with commercial competition which is rising steadily. Resources will have to be provided for training tutors in Internet techniques and allocating the time for development of online course content.

The experiences of SBU indicate the benefits to be gained from breaking free from previous ways of thinking and instead tailoring online course delivery to individual and group needs, thus encouraging interaction both between student and tutor and between students themselves. Care has to be taken to choose appropriate methods for group collaboration and individual assessment, taking into account the effects of combinations of Internet facilities and the comparable strengths and weaknesses of the Web, email, newsgroups, mailing lists, online chat and virtual communities. Equally important to pedagogical expertise is the need for a university to have related technical support knowledge so that new problems arising from Internet use can be tackled effectively.

In devising a plan for provision of online content, attention should be directed at minimising the potential for isolation among students. Successful courses will contain facilities for social as well as academic interaction, since if basic human needs are overlooked the quest for educational excellence will ultimately be undermined. Careful thought must be given to planning the layout of resources made available via the Web to minimise confusion and effort. No matter which resources are provided, there has to be sufficient access made available to them for students to gain the full benefit. In providing these facilities it must also be appreciated that students will be able to draw on a much wider range of sources and so consideration will have to be given to the acceptance of sources which may have been denied in previous years.

Attention to these matters may prove to be of great assistance in maintaining a role for traditional universities in the future of higher education.

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