DOES E-LEARNING WORK?

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ABSTRACT

This paper discusses how we can assess the effectiveness of e-learning. It is surprising how little evaluation of e-learning has taken place given the current enthusiasm for the term: whether from the point of view of educators, those being educated, or those who decide how to fund e-learning. For example, Higher Education institutions are embarking on a range of ambitious managed learning environment projects without reference to previous experiences of computer-based learning. As Computer Science educators we are in a unique position to assess various aspects of e-learning, especially those that arise from technological choice and deployment in education. Can we use this knowledge to inform the design of e-learning?

Keywords

e-learning in IT and CS; evaluation; critical issues

1. DEFINING E-LEARNING

"For all the hype and expenditure, advances in eLearning have been limited." - the UKeU website[1].

The current trend is 'e' with everything: e-science, e-commerce, e-universities and e-learning. Since this term has been used only with the advent of wide-scale use of the Internet it makes sense to define e-learning as being networked learning or any form of education which uses the Internet. There are those who regard e-learning as being all forms of computer-based learning, including CDROM materials [2]. However, in general, e-learning implies use of computer communications.

Typical web-based tools for e-learning include computer-based assessments, chat rooms, e-mail, whiteboards, library catalogues and simulations.

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Enhanced telepresence through desktop video conferencing is also popular, though more difficult to achieve.

Various frameworks which integrate some of these tools have been developed, such as virtual or distributed learning environments (VLE, DLE). More recently, Higher and Further Education (HE and FE) institutions have started looking at the large-scale integration of learning environments and management information services (including student databases and time-tabling software) to produce managed learning environments (MLE). The deployment of an MLE is often seen as enabling an institution to provide campus-based education and distance learning at one and the same time [3]. In addition, other competing technologies, such as Portals and emergent GRID systems, are being considered as appropriate ways to promote e-learning [4].

As educators, how are we to assess the effectiveness of such technologies for our students? I suggest that as information and computer scientists we are in a unique position to make such an assessment given the need to understand education, computing technologies and large-scale information systems projects when dealing with e-learning.

2. TECHNOLOGIES AND UK INITIATIVES

2.1 Technologies

The history of Internet applications is well known and covered by Tanenbaum in all editions of his text [5]. Many of these applications have been used for educational purposes: email (1971), newsgroups (1979), chat servers (1985), Internet Relay Chat (1988), Gopher (1991) and Mosaic (1993). What are also of interest are ideas and tools that were used in education such as Hypertext (1965), Hypercard (1987), Guide (1990) and the Web (1992). Multimedia became available in commercial forms in the early 90s and the results of the TLTP projects described below were mainly aimed at the production of CDs.

The history of collaborative computer-based systems which originate from Computer Science research such as CSCW and Groupware are shown in figure 1. Some of these are discussed more fully below.

VLE/Groupware	Date
BSCW	1993
LotusNotes/Learning Space	1994
WebCT	1995
TAGS	1995
Blackboard	1997

Fig 1: Collaborative Tools

2.2 UK Funding Initiatives

Developments in communications and IT (C&IT) for HE have been supported by UK-wide funding initiatives such as the Teaching and Learning Technology Project (TLTP) which gave money to 72 subject-specific projects (see figure 2). Similar initiatives include the CTI (Computers for Teaching Initiative), which originally provided funding to produce computer-based teaching products. The CTI evolved into the current LTSN two years ago. The HE sector in Scotland was provided with high-bandwidth Metropolitan Area Networks (MANs) in the mid-90s under funding from the Scottish HE Funding Council (SHEFC). SHEFC also provided funding for projects which explored the Use of the MANs (UMI 1, UMI 2) and further staff development and C&IT work under the ScotCIT programme.

Funding Initiatives	Start	Finish
CTI/1	1983	1989
CTI/2	1989	1999
LTSN	2000	Onwards
TLTP/1	1992	1996
TLTP/2	1994	1998
TLTP/3	1998	2001
UMI/1	1995	1996
UMI/2	1997	1999
ScotCIT	1999	2001

Fig 2: C&IT Funding Initiatives

The TAGS framework for researching, developing and deploying learning environments was developed at St. Andrews [7] [8] [9] with UMI and ScotCIT support. Several HE and FE instititons have adopted products such as WebCT or Blackboard to provide e-learning across an institution. The Joint Information Systems Committee (JISC) has been instrumental in supporting the use of VLE and MLE across HE and FE. These included in-house development of systems such as Merlin at Hull, COSE at Staffordshire and MMS at St Andrews. Figure 3 shows the JISC funding initiatives.

JISC	Start	Finish
JTAP & VLE	1996	2000
FE & MLE Interoperability	2001	2001
Building MLE in HE	1999	2002
Lifelong Learning: Building MLE across FE & HE	2001	2003

Fig 3: JISC and LE

2.3 TLTP and LE Results

The results of the TLTP give pause for thought: only 3 products are still in use. Though most projects focused on the production of self-instructional material on CDROM, funding was provided in later stages for web-pages and associated services such as evaluation and dissemination. Findings from the reports of the £90M initiatives suggest that there was little understanding of project management and very few projects employed specialist IT staff to do any development work. Those involved were surprised by the lack of take-up by others in their subject area, even though they had done little or no consultation within their discipline. Funding for evaluation was not factored in to the proposals and hence little was done [6].

An analysis of the TLTP and LE initiatives has identified the following issues as problematic [10]:

- Cost
- Evaluation
- Sustainability
- Focus
- Standards
- Social Learning
- De-skilling
- Acceptance and take-up

Many of the above have implications for the design and adoption of e-learning. In particular, whether or not some form of evaluation takes place, and for whom; and what replaces or supports the social aspects of learning when e-learning is deployed, especially when distance learning models are assumed to apply. Another issue which arises from the current use of the web, are the differences between global e-learning, and locally developed e-learning. The following section looks at various Computer Science e-learning projects as examples of subject-specific local projects.

3. COMPUTER SCIENCE EXAMPLES

3.1 Ceilidh

Ceilidh software was developed at Nottingham University in the early 90s by a team from a computer science department. It has been used to teach students good programming practice, and

was tailored for a variety of computing languages, including C, C++, Formal Specifications and Z, and Prolog. Ceilidh was replaced in 1998 by the commercial package CourseMarker. Ceilidh and CourseMarker are regarded as systems for the automatic assessment of student work. CourseMarker is web-enabled [11][12]. Since the software has been in use for over ten years, adapted for use in a large number of departments and migrated to a commercial system, this can be regarded as a very successful computer-based, and now web-based learning tool.

3.2 BSCW at Durham

The department of computer science at Durham University used docuement-sharing software for group projects in a Software Engineering course from 1996 onwards. BSCW (Basic Support for Co-operative Work) was developed by GDR FIT, the German National Research Center for Information Technology. BSCW extended the collaboration capabilities of e-mail and FTP by supporting information sharing in addition to traditional information exchange. BSCW was also used in conjunction with video/audio software for distributed group project work [13].

3.3 Peer Assessment and CS

The Technology-enhanced Learning in Research-led Institutions (TELRI) project was based at Warwick University. The TELRI group evaluated a peer assessment support system developed in the computing department. In this example 240 first-year students studying the design of information structures were asked to peer-assess each other's work. The department used a web-based system to administer the process. It was found to be a cost-effective and efficient means of dealing with the size of class and the administrative overheads of peer assessment [14].

3.4 Tags

TAGS provides generic tools that facilitate the development and management of online groups and resources. It was developed under funding from UMI 2 and ScotCIT (1997-2001). TAGS also provides a collaborative environment for both the project developers and their target teaching groups. TAGS was originally used as the middleware for different subject areas by six Scottish Universities. It is currently used in the Computer Science department in a new form as MMS (Module Management System). TAGS and MMS have been used in providing support for distributed IT project management as reported at the first LTSN-ICS conference [15]. A number of other subject-specific learning environments are hosted by TAGS - such as Finesse, which uses real time stock market data to teach portfolio management strategy [16].

4. DISTANCE LEARNING

It is understood that distance learning requires a division of labour and a long-term use of materials to be cost-effective [17]. This factor has not changed with the use of the Internet to support distance learning [18]. In addition, the different requirements for distance and social or campus learning mean that extra support work is required to keep distance learning students from dropping out, such as that of the e-moderator or learning technologist [19] [20].

A few examples of computer-based distance learning and computer science education exist: in the UK the Open University has delivered computing courses for many years, and has a long tradition of using educational technologies and the Internet to support courses. For Computer Science they have used a variety of computing applications to support learning. These include computer-mediated-conferencing for tutors, CMC for students, web-based delivery of materials to and from students and tutors, and e-mail [21]. Queen Mary, University of London, use TopClass to support their distance learning program. The open and distance learning unit method of developing course material has been noted to require significantly more time [22].

Other international examples of Computer Science distance-learning include the OU in Greece, and a trial VLE from Mexico called EVA, which has been used by very small cohorts. These two examples emphasise the administrative focus of distance e-learning, with e-mail as a main communicating device between students and tutors, but also the need for tutor support to reduce drop-out rates as noted above [23][24].

5. E-UNIVERSITIES

In 2000 a number of e-university projects were launched, such as Fathom, many of which were backed by large prestigious organisations in the US and UK. These were viewed as radical threats to the traditional university system but by 2002 most of these had failed or re-invented themselves as providing online training [25]. Fathom was closed by the main project leader, Columbia University, after an investigation into the cost and short-comings of the project [26]. The USOU, an American venture into distance e-learning, cost the UK Open University in the order of £9M when it collapsed last year [27] [28]. The UK public-private partnerships of the e-university, now called UKeU, has also suffered from difficulties and has recently launched three post-graduate courses based on existing on-line services provided by different institutions [29] [30]. The European e-university venture has failed dramatically at a cost of £1.4M [31]. These failures and difficulties were associated with lack of funding, over-estimation of take-up, bad business plans, lack of understanding

of the work involved in building online courses and the failure to recognise the difference between campus-based and distance learning described above.

6. CONCLUSIONS

We know from looking at IS failure that there are a variety of reasons for any given failure, mostly socio-political [32]. One is the size of the project and how closely it is linked to organisational change [33]. Many of the e-university experiments seem unfocused, over-ambitious, under-funded and ill conceived. It is hard to find out details of project management and to pin down specific pedagogic objectives. Virtual universities are often heralded as being agents of cultural change - a warning sign for any information systems project.

In contrast, many of the Computer Science examples above are successful uses of e-learning. There are some lessons that can be learnt by comparing these projects with those of institution-wide use of generic learning environments, and global universities. The scale of the Computer Science projects is relatively small; expertise in project management and IT support or service is well understood; the objectives of these examples have been well-focused and relatively unambitious; they all meet specific educational needs. For example, Ceilidh was based on the core subject needs of reinforcing programming skills in particular computing languages, and provided a practical and interactive environment in which the student could test skills. This type of teaching cannot easily be delivered by the generic learning environments. Some Computer Science e-learning applications have made the difficult transition into commercial products thereby overcoming the difficulty of sustaining an e-learning venture. In particular it is possible to assess how well these examples met the needs of the educators and those to be educated, unlike many of the failed global e-universities. In contrast, it is hard to assess the pedagogical effect of the use of one particular LE across an institution.

This paper demonstrates that there are specific ways in which e-learning can work, when focused on meeting particular educational needs of particular subjects. It is unlikely that more ambitious visions of e-learning will be productive, especially as those who promote these visions do not have the breadth of understanding of technologies, education and systems that resides in computer and information sciences.

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