The Social Shaping of a Virtual Learning Environment: The Case of a University-wide Course Management System

William H. Dutton
Oxford Internet Institute, University of Oxford, UK
william.dutton@oii.ox.ac.uk

Pauline Hope Cheong and Namkee Park
University of Southern California, USA
pcheong@usc.edu
npark@usc.edu

Abstract: Expectations surrounding the role of e-learning need to be tempered by an awareness of the variety of technical, institutional, social and economic constraints on the innovation process. This paper reports on a case study of the introduction into a university of one of the most central e-learning initiatives in higher education, an enterprise-wide virtual learning environment. Findings identify constraints on innovation and highlight changes likely to evolve from the diffusion of such environments, which can be amplified by interrelated technical changes underway in universities.

Keywords: courseware, course management system, virtual learning environment, VLE, e-learning, information and communication technologies, institutional change, social shaping of technology, online learning

1. Introduction: The diffusion of courseware in Higher Education

Likely outcomes of e-learning innovations in higher education using information and communication technologies (ICTs) have been hotly debated, with utopian excitement about the new media matched by critical concerns over their appropriateness in many contexts (Dutton and Loader 2002). With notable exceptions (Hara and Kling 2000), this debate has been illustrated more by anecdotal evidence than empirical research on the actual role of ICTs in higher education.

This study seeks to develop an empirically-anchored perspective on the implications of e-learning through a case study, informed by work on the social shaping of technology (SST) that highlights organizational, cultural, economic and other factors influencing the process of technological change and innovation (Williams and Edge 1996; Kling 2000). It provides evidence centred on an in-depth analysis of one e-learning innovation, in order to surface patterns and themes of potential relevance to a wider range of e-learning initiatives. The innovation we focused on was an institution-wide virtual learning environment (VLE) designed to support the management and operation of most aspects of an online course: the distribution of multimedia material (such as readings, lecture notes, assignments and images); student-teacher and group discussions; exam and grade administration; and other teaching and administrative tasks.

We chose to study a VLE because such course management 'courseware' systems appear to be among the most rapidly diffusing e-learning technologies across the world.[1] The adoption of this kind of environment has become a symbol of innovation, with many higher-education institutions not wishing to be left without their own system. A VLE can also create incentives to invest further in electronic content, create links to other ICT applications within the university, such as wireless networks and services, and generally enable institutional innovations in learning and education.

Our study seeks to answer questions such as:

- What is the actual experience of implementing VLEs?
- Which main social, cultural, psychological, economic, technical and other factors facilitate or constrain the uses to which the VLE is put?
- To what degree does a VLE complement or replace traditional learning environments?
- What kinds of VLE-based teaching and learning approaches are most effective?
- Which VLE capabilities lead to difficulties or are underused?
- How easily can a VLE be tailored to the needs of particular contexts, teachers, students, administrators, etc?

[1] This applies to both proprietary systems, like Blackboard (www.blackboard.com) and WebCT (www.webct.com), and open source software, such as the Bodington Common (http://bodington.org/index.html).

- Who in educational institutions are likely to be the winners and losers from the introduction of a VLE?
- What kinds of policies and resources are needed to make a VLE effective?
- What are the implications of the way a VLE can be used to reconfigure how faculty, administrators, students and others in an educational institution gain access to people, services, information and technologies (Dutton forthcoming).

The following sections describe our methodology, the patterns of eClass adoption and use we identified, and our findings on the main factors shaping these outcomes.

2. Methodological approach

2.1 The analytical framework: social shaping of technology

Theoretical approaches from the social shaping of technology (SST) were employed to understand the responses of technical staff, administrators, instructors, students and other actors towards the adoption and use of the VLE at the university studied. This framework was chosen because it encompasses a broad perspective that enabled us to move beyond narrow speculation based on the technical functions and capabilities of a VLE to focus on how people design, deploy and appropriate these technologies in actual social settings.

At an institutional level, SST highlights the implications for innovation of the way a university or other educational establishment is, to some extent, organized to support and maintain existing standards and practices. This helps to focus attention on the manner in which an institution resists, assimilates, subverts or otherwise appropriates what is being proposed or imposed when a technical innovations threatens to disrupt the established ways of doing things. Thus, the values and assumptions of all relevant institutional actors need to be understood, including both supporters and critics of e-learning, as does the nature of the technological innovation if researchers are to discern the practical implications of VLE courseware.

In addition, an SST perspective guides researchers to investigate the ways in which specific users shape technological development and innovation. In Bijker's (1995) words, this should aim to include a consideration of the different 'relevant social groups' involved in interpreting a technology, including the determination of whether a technology 'works'. For example, a social-shaping perspective sensitizes research to the role of teachers at a university, since instructors are among the most critical decision makers on the adoption and use of technology in classes and for the way students organise their work with computers (Layton 1994). Decisions regarding computer use in classes are also affected by instructors' teaching styles, flexibility in adapting to new teaching situations, attitudes towards computers, length of experience using computers in their own lessons and their self-perception as computer users (Levin and Arafeh 2002). Other relevant social groups include the specialist developers who implement systems within organizations; students as users; and administrators and senior managers, who often regulate and sometimes mandate the use of technology. Policy choices by those who run school or departmental systems can result in different units having different levels of access to the Internet, dissimilar requirements for student technology literacy skills and different limitations on student Internet access (Levin and Arafeh 2002).

SST also reveals how conceptions and responses across all this range of policy makers, administrators, developers, instructors and students can support or frustrate technologically-enabled change. From this perspective, Dutton and Loader (2002) argued that educational technologies were underpinning the emergence of a 'digital academe' – a change in the institutions of higher education that is supported by the increasing application and use of ICTs across all higher education management, administration and operational processes.

The main premise of this view is that ICTs are becoming increasingly central not only in terms of how higher educational institutions accomplish their tasks, such as promoting their institutions on the Web, but also in relation to the nature of the products and services they provide, for instance in considering new initiatives in distance education and e-learning. This directs attention to discerning just how far VLE technologies are going, and could go in the future, towards being more than 'electronic white boards'. One possibility is that they could alter the whole manner in which faculty, administrators and students will gain access to one another, to information, services and technologies that support these processes and their outcomes. In going further along this route, VLE courseware could undermine or

support the role of traditional gatekeepers in education, such as faculty instructors, at the same time as fostering new gatekeepers, such as the technology administrators and technical support staff that control access to digital library resources and make decisions about technology upgrades.

This SSE background convinced us that we use both a comprehensive survey questionnaire and 'embedded case studies' to undertake more detailed interviews that drill down to get a richer feel for the actual issues confronting everyday use of the system. This provided a balance between institutional and user perspectives. Given the significance of instructors to any innovations in e-learning, we used our research resources to focus on this group, while using knowledge from SST research to take account of the critical role played by others in the innovation process in order to detect more general patterns and issues.

2.2 The case study: A university-wide course management system

We examined the diffusion and use of a proprietary, commercially-marketed VLE at a private US university. To protect the confidentiality of our respondents, individuals involved are kept anonymous and fictitious names are used for the university ('North East University' (NEU)) and VLE ('eClass'). We chose NEU because eClass had appeared to diffuse rapidly within this university. The principal organizational actor at NEU was 'the Centre', which was responsible for the use of ICTs in teaching and research. As the study progressed, we discovered the diffusion and impacts of eClass were more limited than anticipated, which shifted the focus of our study on the social and institutional factors constraining this e-learning innovation as well as the likely impacts for the most innovative adopters.

2.3 Research approaches used

We employed a variety of empirical approaches to gain a systematic understanding of how eClass diffused, and with what effect on learning and education. For instance, we undertook a detailed analysis of the electronic records and reports on everyday use of eClass. These had to be restructured and inspected to develop a reliable count of actual adopters and users. The electronic facilities of eClass enabled us to email all registered current and former instructors, asking them to complete (in about 15 minutes) a Web-based questionnaire, asking for information such as participants' use of eClass and their overall usage of personal computers and the Internet. Two reminders were sent, yielding a response rate matching half of the estimated population. In addition, we conducted in-depth embedded case studies (through interviews of about an hour each). These involved 20 instructors who were among the most intensive or creative eClass users.

These surveys and interviews were complemented by interviews with key staff of the Centre. We also attended training sessions and eClass courses, enabling more participant-observation of these events. These sessions created many opportunities to speak informally with eClass technical specialists, department coordinators and users. Finally, we reviewed the content of selected eClass course sites, focusing on sites of our embedded case studies.

Survey responses from 225 individuals were gathered from January to March 2002, representing about a 50% response rate, based on our estimate of the number of actual users. Of these, 191 were completed fully and the rest were typically from individuals 'registered' for eClass but not actually using the VLE.

3. The multi-layered diffusion of eclass

3.1 Booming eClass Registrations

The Centre introduced a trial version of eClass at NEU in the Spring 1999 semester. Workshops and training sessions for faculty and instructors plus general word-of-mouth recommendations led to rapid growth over the next two years, from six at the start to over 1000 by Spring 2001 (Figure 1).

Despite continuing growth in demand, in Spring 2001 the introduction of new courses was stopped because eClass had reached the limit of the pilot version's capacity. The Centre therefore upgraded in Summer 2001 to a newer version that could support many more courses. When the Centre began migrating older courses to the new system, implementation problems arose that caused many instructors to abandon their use of eClass because they were no longer able to use it effectively.

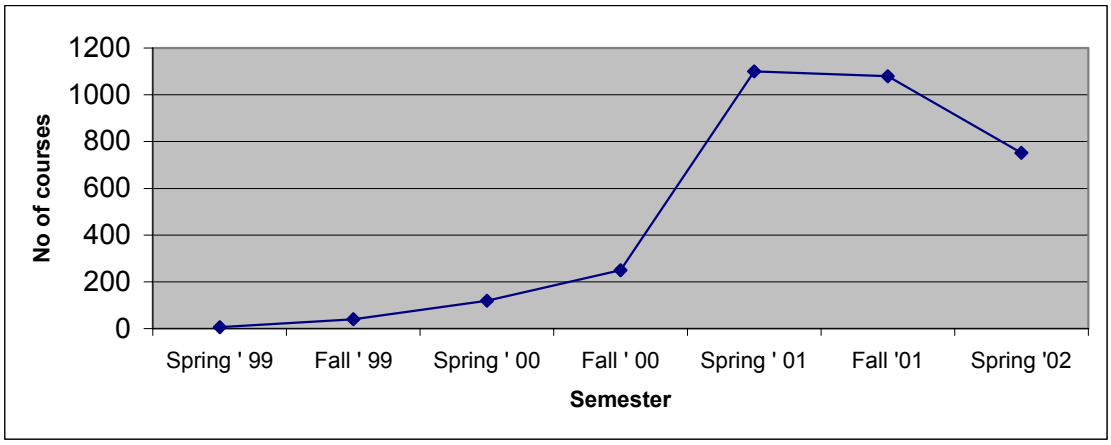

Figure 1: Change in the number of registered eClass courses, 1999-2002

3.2 Discrepancies between actual and registered users

There was real interest in eClass at NEU, but system logs had inflated the actual level of diffusion. Many eClass courses listed as being live on the system's logs were actually old courses. The logs also included 'shell' courses that had been set up by some departments but not used by teachers, along with some of the Centre's own internal training courses, some mislabelled courses and various test runs. Once these were eliminated, the diffusion curve of eClass remained substantial, but significantly less widespread than had been commonly understood (Table 1).

Table 1: The layered diffusion of courses

Semester	Summer 2001	Fall 2001	Spring 2002
Number of courses requested by instructors or departments	355	1080	752
Number of "actual" courses	273	879	700
Number of "actual" users	145	70	110

In analyzing eClass courses in more detail, we uncovered multi-layered levels of innovation. In the spring of 2002, 6,814 courses were offered at NEU, with 752 (about 11%) registered for eClass. Of these, 700 actually used eClass, accounting for about 110 teachers among a faculty approaching 2,000. However, in line with the general perception that eClass was diffusing rapidly, our survey respondents believed eClass was used by many others: 19% said all courses in their department were using eClass and 35% thought most courses were using it. Only 13% said eClass is rarely used in their department, which is probably closer to the reality.

Moving beyond mere adoption to look at actual usage, we found that most did not make extensive use of eClass, although some did. This is one reason why we decided to conduct a selected number of embedded case studies to see how active eClass users applied the VLE in their courses. We also sought to discover emerging patterns of use.

4. Perceptions of the helpfulness and value of the VLE

Questionnaire responses indicated that eClass users spent an average of 2 to 3 hours a week on the system (Table 2), with 60% using it for no more than 2 hours per week. Instructors had used the system for an average of two semesters in about three courses; just 26% used it for three or more semesters and 31% for only one.

Table 2: Average levels of use

Variable	Mean	SD
Hours per week spent on eClass	2.73	2.73
Number of semesters using eClass	2.32	1.49
Number of courses using eClass	2.97	3.13

Despite limited levels of use, most eClass users (71%) felt it was "very helpful" or "helpful"; less than 9% found it "not helpful" (Figure 2). 70% of respondents said they would definitely use eClass, further supporting its perceived value. This is consistent with the attitudes of other users (Kent 2003),

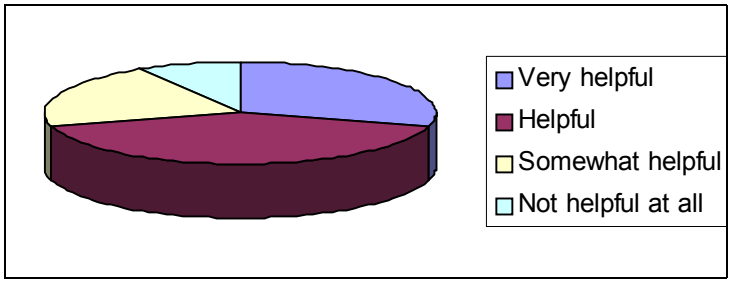

Figure 2: Perceived helpfulness of eClass

The primary value attributed to eClass was its ease of use in posting and distributing documents, assignments and announcements to students (Table 3). An important secondary use was for communication, such as emailing students. E-Class enabled email lists to be generated automatically as students registered for their courses. But most respondents place most value on distributing information rather than in online discussions, group facilitation, virtual chat and other more interactive forms of communication.

Table 3: Perceived value of eClass features

Rating Features of eClass	Very Useful + Useful (%)
Posting course documents	87
Posting assignments	78
Posting announcements	72
Communication via email	58
Posting external links	47
Posting student information	43
Communication via discussion board	27
Viewing usage statistics	27
Using gradebook	25
Using course calendar	23
Creating and facilitating groups	22
Tracking document downloads	19
Using address book	17
Administering exams/quizzes	12
Surveying students	12
Using eClass resource Centre	9
Communication via virtual chat	8

5. Instructors motivations for using a VLE

Respondents saw improvements in pedagogical practices (such as increasing communication among students or helping students learn about online media) and in work efficiency (such as in saving time, as among the main motivations for using eClass, as shown in Table 4). 74% felt ease of use is a major motivator, which also helps to save time and investment in learning to use the software. Other analyses showed that those who rated "ease of use" as an important motivation were more likely to have used eClass in more courses, and those citing pedagogical reasons were more likely to spend more time per week with eClass.

Table 4: Motivations for using eClass

Motivations	Very Important + Important (%)
Increase communication among students	77
Ease of use	74
Save time	68
Help students learn to use online resources	61
Learn more about online course development	48
Keep up with technical change	47
Respond to students' request or interest	45
Comply with school or departmental policy	19

Factor analysis among the motivations identified convenience and effectiveness as two relatively independent defining groups of characteristics affecting attitudes towards eClass (Table 5).

Table 5: Factor analysis of attitudes to eClass

Variables	Factor Loadings	
	1	2
Factor 1. Convenience of eClass		
Students like to use eClass	.803	
eClass is easy for students to use	.882	
eClass is easy for me to use	.680	
eClass is convenient for students to access	.885	
Factor 2. Instructional Effectiveness		
I am teaching in new ways since using eClass		.721
Students' performance is enhanced when using eClass		.710
I interact more with students when using eClass		.737
Some students participate on eClass who do not participate in class discussions		.771

Table 6: Change in time allocation linked to eClass

Time Spent	Increased (%)
Being online	54
Communicating with students	43
Sending and receiving email	42
Preparing for classes	38
Working from home	36
Working in your office	22
Working with teaching assistants	18
Working with course builders	16
Evaluating students' work	14
Working in a computer lab	14
Working one-on-one with students	12
Preparing library reserve materials	10
Reading professional journals	9
Doing library research	7

6. Impacts of Use

6.1 Reallocation of Time and Place

The most widely perceived changes tied to eClass were the respondents' use of time and the geography of teaching and learning. The activities that had increased most by the use of eClass were being online, communicating with students and emailing, followed by increases in the time spent preparing for class and working from home and at the office (Table 6). These also indicate more time at the computer, or what might be called a growth in more computer-centric work patterns.

6.2 Correlation with the Use of Other ICT Media

Access to a wide variety of computer and Internet resources are critical enabling factors in e-learning. We found a clear positive correlation between instructors' use of eClass and other computer-based instructional technologies, such as email, presentation software and the Internet/Web (Table 7). For example, almost all eClass users had a computer at home, 46% had broadband Internet access at home and 76% had a portable computer. Except for white boards, more traditional non-computer-based media had lower rates of use among the users of this VLE.

Table 7: Respondents' use of multiple media (%)

Media	Never	Seldom	Often	Regularly
Email	4	10	20	66
Computer presentations (e.g. PowerPoint)	7	20	23	50
White/chalkboard	12	19	22	47
Internet/Web	17	18	32	33
Overhead projector	14	37	21	28
Videotape	21	40	22	17
Simulation/gaming	52	25	13	10
Groupware/collaboration software	73	21	4	3
Flipcharts	75	20	2	4
35mm Slides	77	17	4	2
Audio conferencing	85	12	2	1
Video conferencing	86	11	2	1

6.3 Challenging e-Learning stereotypes

Only a weak positive correlation was shown between the times spent using eClass and a number of factors conventionally expected to be relevant to e-learning, such as the age of teachers, their computer knowledge and experience and the discipline of the course. The acknowledged ease of use of eClass might have contributed to the lack of

differentiation between more computer-oriented and non-technical schools.

7. Six patterns of use: A typology

The embedded case studies identified six main patterns of use, divided equally between one-to-many and many-to-many forms of communication (Box 1). The most common feature was that eClass was used mainly to enhance and complement traditional forms of classroom teaching (see also Morgan 2003). To help illustrate each pattern type, the following descriptions include some hypothetical instructors based on a composite of actual users.

Box 1: Patterns of eClass use

ONE-MANY

Type 1. eCopier: use of courseware to replace the copy machine.
Type 2. ePublisher: creating electronic content for students.
Type 3. eProjector: replacing the 35 mm projector.

MANY-MANY

Type 4. eProject: facilitate team projects outside of the class.
Type 5. eTeam: student initiated virtual study group.
Type 6. eClassroom: use for distance and distributed learning.

7.1 eCopier: Substitute for the copy machine

eClass was used most often as an alternative to the copy machine, by providing students with online access to assignments, readings, lecture notes and other class documents. This was typified by Professor 1, who felt the system simplified his work and enabled him to concentrate more on his research by freeing the time he previously spent using the copier. He also employed eClass's interactive functions, such as group discussion and asking students to post additional links to relevant materials. Despite these innovations, his teaching was unaltered and he confesses that eClass is more helpful to him than his students.

7.2 ePublisher: Electronic distribution of enhanced course content

The ePublishing mode is distinguished by a commitment to using e-learning capabilities to create and enhance content, as well as to 'eCopy' it. For instance, Associate Professor 2 was eager to "eliminate all paper" by placing online all materials for his large introductory class. This included multimedia, such as cartoons and movie extracts, to enliven lessons. eClass was mandatory for the course and students had to check its Web site regularly for frequent updates of announcements and changes in assignments, which were not repeated during class lectures. He opened an online 'virtual office' using eClass to interact with students at home, and he encourages students to interact outside the class by regularly kick-starting online discussion sessions.

Assistant Professor 2 believes eClass has enabled him to spend more time teaching and preparing for class. Despite some technical problems, he is convinced that evaluations and polls of students reflect favourably on his use of eClass. He senses differential use, with good and conscientious students using eClass to their advantage, while poorer students do not make the effort to engage with their fellow students.

7.3 eProjector: Substituting for the 35 mm slide projector

Professor 3 teaches in the art history department, so is interested in the technology's obvious value in handling visual images electronically. eClass has been very helpful to her and her students by giving online access to high-quality images they could previously see only at a library or museum, or in relatively poor-quality reproductions. She found that online discussions were not important to the class and were monopolized by a few students. She rarely used other eClass features. Professor 3 believes that eClass has changed the time and place of her work, as she can prepare visual images for her classes online from home rather than at the University or a library. However, she is concerned that using eClass has reduced interpersonal interaction with her students.

7.4 eProject: Promoting group work

Assistant Professor 4 teaches accounting primarily with undergraduates He uses eClass for Type 1 e-copying but sees its main value lying in the discussion board, as it helps students to learn how to work with technology in virtual teams. For instance, students are required to post their solutions to assigned problems on the discussion board so that other students can comment. He believes this exercise of peer critique assists the development of a "spirit of excellence". In a central part of this course where students must work in small groups to analyze case studies, eClass functions as an electronic gathering place for students who do not wish to meet on campus. Professor 4 can occasionally check students' progress by accessing all the archives of the discussion board and virtual classroom meetings.

7.5 eTeam: Grassroots innovation in student groups

In at least one case, students obtained permission to reconfigure eClass software to form a virtual student study group. These computer-science graduate students were working on a group project to evaluate the use of various courseware systems. Although their instructor did not utilize eClass, the group decided they wanted hands-on experience of such a system. The Centre provided them with an eClass account, which they used on a regular and frequent basis for personal group discussions and research.

The students' team leader said eClass facilitated online group discussions by giving flexibility and convenience in scheduling discussions because group members did not need to be on campus for meetings. For instance, using the virtual chat feature for fruitful discussions online with colleagues accustomed to working late into the night. The group also posted relevant papers and external links online via eClass, enabling them to maintain an evolving group-reading list that eventually helped them to write the literature review for their final paper. Their use of eClass also aided them in critically evaluating the system and offering suggestions to the Centre for improving the software for student use.

7.6 eClassroom: Substituting the virtual for the real

Only a couple of instances were identified of eClass being used in ways that approach e-learning visions of truly 'remote' or 'distributed' learning. For instance, Professor 6 used it to create a 'semi-distance' approach for a Technology in Contemporary Education and Training course for 40 graduate students. This restructured the courses he had taught for 20 years in a traditional classroom setting. Materials for the course, including online instructions, assignments and course readings, were filed in an 'evolving' workbook on eClass. Students on the course have to meet on campus only a few times a semester, including an initial orientation session, a mid-semester 'get-together' and a 'wrap-up' final session. They use eClass for individual work and small live and/or electronic work groups. Their final product is a student-created portfolio of work presented in class as a PowerPoint presentation and posted on eClass for others to review.

Professor 6 sees his role as a "facilitator of learning". He is available on campus during weekly office hours, schedules virtual office and classroom meetings via eClass and encourages interaction via email, telephone, fax and post. Two teaching assistants offer administrative support to help him respond to students efficiently and with personalized care. One summer he taught the same course with students from other universities in a complete distance education format, in which he substituted the campus meetings with interactive television sessions.

8. Constraints on innovation in higher education

The embedded case studies revealed some individuals who worked hard to experiment with new approaches to their teaching. Taken together, however, the cases reinforced our other findings that most uses of eClass were anchored in traditional teaching approaches, with eClass used primarily as a substitute for the copier or projector to support one-to-many forms of lecture-based instruction. Most professors did not adopt eClass, while those who did tended to use it to support their current practices, although the same technology could clearly support a variety of approaches to teaching.

This analysis highlighted a number of significant influences shaping the use of courseware in this institutional context, which could be relevant to a much wider range of social and institutional settings. This would be supported to the degree that similar themes emerged from other case studies. In this case, the SST framework enabled us to identify

factors constraining innovation that had led to the conservative patterns we found in this context and to appreciate how addressing these potential constraints could release spread innovations that are valued by key actors.

8.1 Technology shaping technology: Technical limitations

The Internet, Web and e-learning have been built on the shoulders of technical breakthroughs, so it is somewhat ironic that some of the most critical constraints we found were limitations of the technology. Responses to an open-ended question in our survey were almost uniformly focused on technical glitches in the software and telecommunication infrastructure on and off campus.

The implementation of eClass was plagued by slow response times, trouble in updating courses from registration data and many other problems. For example, when a subset of students in one class was unable to log-on for several weeks because of errors in assigning unique passwords to students with the same last name, the entire class was delayed – indicating the importance of protecting all students from specific problems. Another class was frustrated by difficulties in downloading materials for use by the instructor and his students, which contributed to his teaching evaluations plummeting and consequent modifications to his initial course to ensure there was hard-copy backup of all compulsory class materials. And difficulties in upgrading eClass courses caused extreme frustration among an accounting professor's students when the course's Web site was frequently unavailable at times when they needed to upload their assignments.

The degree of technical interdependencies involved was another significant break on innovation. Instructors can often optimize use of an e-learning system only if they also have appropriate access to the right equipment, in the right place – whether it is a projector in a classroom or access to the courseware from home. For instance, an art professor was frustrated when she used eClass for students gaining access to digital images of art work since there was a lack of adequate projection equipment for her classroom to display images from the Web. Technical advances should therefore move in parallel in the classroom, offices, households and dorms.

These kinds of technical problems frustrated the easy implementation and use of eClass and represented a more substantial barrier than anticipated. Moreover, these were barriers that could not be overcome simply by technical know-how on the part of instructors. Ensuring the technology works smoothly and can be easily operated and flexibly tailored by users remains as a difficult challenge, but its accomplishment could greatly improve opportunities for more radical changes. Continuing advances in courseware and the wiring of households, classrooms and universities, such as through innovations like wireless networks, could help to achieve far greater take-up, and more imaginative uses of VLEs by diminishing many of the types of technical limitations encountered in the case we studied.

8.2 ICT paradigms and practices: Old paradigms in new e-Learning bottles

A characteristic of higher education culture throughout the world is that instructors generally teach the way they were taught: using a traditional one-many teaching paradigm based on class lectures and discussion. With notable exceptions, such as the one on one tutorial approach, this paradigm is entrenched in most university cultures, which generally tie teaching rewards to the quality of lectures and discussion. These paradigms are key influences shaping outcomes from the introduction of a VLE and other ICTs within institutions of higher education.

Traditional teaching paradigms are in fact designed into many e-learning products, such as eClass. They are even sold using analogies to what teachers already know in order to make the system's functionality more understandable. BlackBoard, for example, uses the analogy of the 'chalk-and-talk' to convey its centrality to traditional conceptions of teaching. The Bodington Common employs an analogy to university buildings to help teachers and students understand how to move around in its virtual space. However, these traditional analogies can lead to built-in constraints on the use of VLEs. For instance, eClass was not designed to enable students to form their own groups; it took an engineering class to have the know-how to create a system to support their study group.

However, ICTs such as eClass are more than just a better white board. Without a new paradigm for education and e-learning, educators are likely to see ICTs as a means of carrying on doing things as before – perhaps

more quickly or professionally, but with more expensive technologies (Dutton 1999, p 216). It takes time for individuals to discover how new technologies enable them not only to do things in new ways, but also to do new things.

8.3 Institutional policy and practices: Risk-adverse academic cultures

Two aspects of the culture of campus-based higher education can constrain innovation outcomes: the strength of entrenched values underpinning university teaching and the degree to which students and systems of teaching evaluation can discourage risk taking in the classroom.

Expectations about the number of hours instructors meet with students are enshrined in rules and norms of universities. For instance, an NEU administrator warned us that some innovations in virtual classrooms could easily lead to a professor being accused of not meeting his class sufficiently, assuming that a virtual classroom is not a 'real' one. The expectations and values of students are therefore as much a constraint on innovation as those of top administrators. One professor stopped distributing his lecture notes electronically when he realized that students were deciding not to come to class as they could read his notes online. Associate Professor 2's plummeting evaluations following technical problems also illustrate how technical failures can reflect poorly on the instructor, making it safer not to experiment.

Crook and Light (2002) examined the self-reports of undergraduate students and found that the ability of students to access ICT and email did not lead to change in the more communal aspects of learning. For instance, computer-resourced students did not spend more time on study-related activities or report a greater academic productivity than their non-networked peers. Networked students also did not spend less time in scheduled classes, in libraries and other campus resource areas. Participation in traditional classroom formats was still considered an important experience by all students, suggesting that the cultural context of higher education constrained the role of innovations in ICTs.

The culture of academic freedom in higher education is another important influence in universities. For example, the dean of an NEU school instructed his staff to put every class in the school on eClass. But only a few of the instructors actually used the system. Such difficulties for top university management in enforcing particular policies means successful innovation cannot usually be imposed from above, but depends on diffusing new ideas among the rank and file. Copyright was mentioned explicitly as a constraint on innovation by only one professor in our study. However, this is one factor that has made the copy machine less useful to instructors and one significant uncertainty surrounding the provision of electronic access to course readings, images and lectures.

9. Emerging opportunities and problems

The pilot eClass system at NEU was not ready for widespread deployment at the time of our study. Nevertheless, among the predominantly traditional approaches to using eClass we did discern emerging opportunities and problems in e-learning innovations that we believe are relevant throughout higher education.

First, we could not dismiss the value that instructors placed in a VLE supporting traditional tasks, such as in distributing their required readings. Efficiency and medium matters, especially as teachers and students expect more material to be online. In the long run, this is not simply an enhancement of the efficiency of copying functions, but an adaptation to a more fundamental change in how students prefer to get access to course materials, which could have dramatic implications on the geography of access, such as where students study.

Secondly, the degree to which the lack of access to other ICTs undermined the use of VLEs and vice versa suggests that VLEs are likely to become more central as laptops, wireless and multimedia classrooms continue to diffuse. This is already apparent in high-end multimedia classroom environments, where access to the Internet, VLEs and other multimedia systems can create a synergistic effect on the use of each technology. It is in these classrooms that the students appear to gain the greatest role in managing information and communication resources in a multimedia, multitasking environment, for better or worse.

Box 2 summarizes the main factors we think must be addressed in an e-learning strategy aimed at nurturing the opportunities and reducing the problems.

Box 2: Strategic e-Learning policy aims

Accept the continued value of traditional educational paradigms in guiding early use of VLEs and explore new possibilities as instructors gain experience and experiment with other new ICTs, such as wireless.
Rethink teaching practices embedded in university cultures and rules that make innovation in online learning difficult.
Enable new forms of content and communication media to support new educational patterns and paradigms, such as group work and multitasking.
Diffuse e-learning innovation by motivating grassroots take-up of new electronic media, as e-learning policies cannot be imposed top-down.
Offer ample training and support to encourage better management of information and communication as a university becomes more dependent on ICTs.
Complement e-learning with appropriate face-to-face contact.
Provide sufficient resources to support effective innovation not only in the classroom, but also in the offices, libraries, households and dormitories of students and teachers.
Do not expect an overnight revolution, as much time is needed for teachers and students to understand how to utilize e-learning capabilities fully.
Identify, target and support key likely benefits of e-learning, such as saving teachers' time, supporting individual and group student working and opening new ways to reconfigure the geography and timing of class activities.

Centre staff at NEU concluded that the findings of our research underscored the need for training to extend beyond the knowledge of how to use its features. We found no evidence of what Pea (in Perkins 1990, p.21) calls the "fingertip effect" that occurs "when administrators and teachers presume that people will automatically take effective advantage of the surrounding new media just because it is there to take advantage of". New techniques for screening, filtering and prioritizing information and communication demands will also become ever more critical to effective learning.

Despite the many technical glitches and limitations of eClass, its restricted capabilities were still valued by most users. This has been supported by other studies of VLEs (Kent 2003; Morgan 2003). This indicates that the value of such courseware to academic staff and their students is likely to increase as the technical constraints are addressed. The growing availability of more online content and better communication facilities is also likely to move e-learning more centre-stage in higher education. This could lead eventually to the emergence of sustainable new e-learning paradigms. These are illustrated by the emerging subtle shift we found from one-to-many to many-to-many forms of teaching and learning, as well as by signs of an emerging multimedia-multitasking classroom in which students are online – in class as well as out of class.

10. Building on the case study's findings

Our research discovered that the VLE at NEU was highly valued by many users and used innovatively by a few. The embedded case studies added a 'human face' to the social and institutional factors affecting an e-learning innovation such as the introduction and use of this kind of courseware. This showed that a great deal of optimism about e-learning opportunities at NEU had been dampened by a variety of specific technical, institutional, economic and other social constraints. As a result, the VLE was limited to uses that primarily supported traditional patterns of classroom instruction. Research by others has also noted this conservative role of e-learning in support of traditional classroom activities, in what some have called 'blended learning' (e.g., Crook and Light 2002; Morgan 2003; Williams 2003).

The NEU case shows the value of the SST framework in fostering a rounded assessment of change that reveals the key social and technical dimensions that need to be understood and addressed if innovations like eClass are to fulfil their potential for enhancing learning and education. For instance, the relatively limited use of the VLE at NEU in the time period of the study does not support the anti-technology stance of some critics of the more visionary, technology-driven predictions for e-learning. But it does back the view that educational institutions are not just providers of information or codified knowledge, but are vibrant learning communities offering contextual and social cues that are vital to shaping learning and education outcomes (Brown and Duguid, 2000). VLEs can be used, and were used at NEU, for supporting communication, study groups and learning communities in valuable new ways that can complement traditional media and methods, rather than replace them.

The in-depth case study was sufficiently rich to provide substantive evidence to identify some important general themes and patterns. However, we are aware that our findings need to be refined and expanded on by further research on the many relevant institutional, social and technical dimensions highlighted in this case. For instance, much of our study was seen primarily from the instructor's viewpoint. Further research should explore the use of courseware from the perspectives of administrators, students, technicians and other actors. Comparative research on the diffusion of educational technologies in institutions at all levels, starting from elementary schools, and studies lasting for longer time frames than available to us could also help to better illuminate the unanticipated consequences of e-learning innovations like the VLE in our case. Investigations into interactions between a VLE and other innovations in the use of wireless networks, laptop computers, and other new ICTs in higher education could also improve understanding of how more innovative e-learning approaches can be fostered, even in environments strongly influenced by traditional educational paradigms and teaching methods.

11. Acknowledgments:

An earlier version was presented to the 2002 European Conference on e-Learning at Brunel University. The authors thank Malcolm Peltu and our anonymous reviewers for their assistance in the preparation of this manuscript.

References

Bijker, W Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change, MIT Press, USA (1995).

Brown, J S and Duguid, P The Social Life of Information, Harvard Business School Press, USA (2000).

Crook, C and Light, P 'Virtual society and the cultural practice of study' in S Woolgar (ed.) Virtual Society? Technology, Cyberbole, Reality, Oxford University Press, UK (2002) pp 153-175.

Dutton, W H Society on the Line: Information Politics in a Digital Age, Oxford University Press, UK (1999).

Dutton W H 'The Internet and Social Transformation: Reconfiguring Access' in W Dutton, B Kahin, R. O'Callaghan, and A. Wyckoff, (eds) Transforming Enterprise, Cambridge, Massachusetts: MIT Press (2004), pp forthcoming.

Dutton, W H and Loader, B D (eds.) Digital Academe: New Media and Institutions in Higher Education and Learning, Taylor and Francis/Routledge, UK (2002).

Hara, N and Kling, R 'Student distress in a web-based distance education course' Information Communication and Society, Vol 3 No 4 (2000) pp 557-579.

Kent, T 'Supporting staff using WebCT at the University of Birmingham' Electronic Journal of eLearning, Vol 1 No 1 (2003) www.ejel.org

Kerr, S T 'Toward a sociology of educational technology' in D H Jonassen (ed.) Handbook of Research for Educational Communications and Technology, Simon & Schuster Macmillan, USA (1996) pp 143-169.

Kling, R 'Learning about information technologies and social change: the contribution of social informatics' The Information Society, Vol. 16 No. 3 (2000) pp. 217-232.

Layton, D 'Technology and the classroom teacher' in T Husen and T N Postlethwaite (eds.) The International Encyclopedia of Education, Vol. 11 (2nd edition) Pergamon, USA (1994) pp 6283-6292.

Levin, D and Arafeh, S *Digital Disconnect: How Students Use the Internet During School*. Pew Internet and American Life project. www.pewionternet.org (2002).

Morgan, G Faculty Use of Course Management Systems. Paper published by the Educause Centre for Applied Research (ECAR), Washington DC and Boulder, Colorado (2003, May).

Perkins, D N Person Plus: A Distributed View of Thinking and Learning. Paper prepared for the annual meeting of the American Educational Research Association, Boston, USA (1990).

Williams, R 'Editorial comment' Electronic Journal of eLearning Vol. 1 No 1 (2003) www.ejel.org

Williams, R and Edge, D 'The social shaping of technology', in W H Dutton (ed.) Information and Communication Technologies: Visions and Realities Oxford University Press, UK (1996) pp 53-68.

