E-learning developments and experiences

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Abstract

The focus of much e-learning activity is upon the development of courses and their resources. Successful e-learning takes place within a complex system involving the student experience of learning, teachers' strategies, teachers' planning and thinking, and the teaching/learning context. Staff development for e-learning focuses around the level of technological delivery strategies when other issues such as the teachers' conception of learning has a major influence on the planning of courses, development of teaching strategies and what students learn. This article proposes a more comprehensive framework for the design, development and implementation of e-learning systems in higher education.

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Introduction

Over the past five years, institutions of higher education in Australia and overseas have been investing increasingly larger sums of money in a range of e-learning initiatives. RMIT University, for example, has allocated AUS$50 million over the period 1999-2001 for aligning information technology to the needs of the core business of the university[1] and The University of Melbourne has allocated $12 million since 1997 for multimedia enhanced teaching and learning development[2].

This increased investment in e-learning initiatives appears to have occurred as a reaction to the view that higher education is in crisis. The crises centre around three issues – access to education, the cost of providing education, and dwindling public revenues (Daniel, 1997; Johnstone, 1992).

Both authors believe that the use of information and communication technologies (ICT) in teaching and learning will provide at least part of the solution to many of these issues. Daniel (1997, p. 14), for example, believes that "technology provides the most fertile ground for growing these key ingredients of university renewal: lower costs and unique attractions".

Bates (1997) believes there are four reasons for using technology in higher education:

(1) improving the quality of learning;
(2) improving access to education and training;
(3) reducing the costs of education; and
(4) improving the cost-effectiveness of education.

Green and Gilbert (1995) noted:

> . . . the stated hope is that computing and information technologies will yield new levels of institutional and instructional "productivity". The stated expectation is that the infusion or integration of new technologies into instruction will, at minimum maintain and ideally enhance student learning while significantly reducing instructional costs.

The second catalyst for the interest in e-learning appears to be centred around concern that higher education might not be able to continue its monopoly on the delivery of education. One area of potential competition is alleged to come from internation institutions of higher education, and an article in *The Australian* on 22 November 2000 claimed that Australian

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higher education faces competition from overseas universities: "Australian universities face a threat from foreign institutions if they fail to bring their online learning systems to international standards".

Others such as Twigg and Oblinger (1996) see the competition as coming from non-traditional providers:

> The most aggressive competition facing traditional institutions today is not from within higher education but from new providers of postsecondary educational services. These include an increasing number of proprietary institutions – some of which are modeled on the traditional construct – such as the University of Phoenix, whereas others are more reminiscent of training institutes – such as the DeVry Institute or Motorola University.

Much of this activity is fueled by claims by people such as John Chambers, CEO of Cisco, who said in 2000:

> The next big killer application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make email usage look like a rounding error[3].

Regardless of the reason for the investment decisions, much of the activity in e-learning is taking place at the level of development of courses and their resources. Only a small number of institutions have recognised that successful e-learning takes place within a complex system, composed of many inter-related parts, where failure of only one part of that system can cause the entire initiative to fail.

This articles proposes a framework for the successful design, development and implementation of e-learning systems within higher education. The framework is based on Trigwell's (1995) work on the levels of influence on student learning and is informed by the outcomes of a range of evaluation studies, including a national, two-year study (Alexander and McKenzie, 1998) led by the author which sought to determine the outcomes of 104 e-learning projects across Australia. The major finding of this study was that the use of information technology does not of itself improve learning. Rather, a range of issues were identified which contribute to the success or otherwise of learning and teaching with technology. Each of these issues is discussed within the framework developed.

The starting place for the development of this framework is to review what is known about the influences on students as they learn and as they engage in a range of e-learning activities.

Begin with the end in mind

Ultimately, the aim of all education initiatives (regardless of the medium used) is to make it possible for students to learn, and Trigwell's (1995) model (Figure 1) highlights very well the range of influences on students as they learn.

The diagram is a section through a set of concentric spheres which places the student at the centre or core. The layer closest to the student represents what the teacher does (teachers' strategies) while the next layers involve the planning and thinking done by teachers. All levels are surrounded by the outer layer which is the particular teaching/learning context.

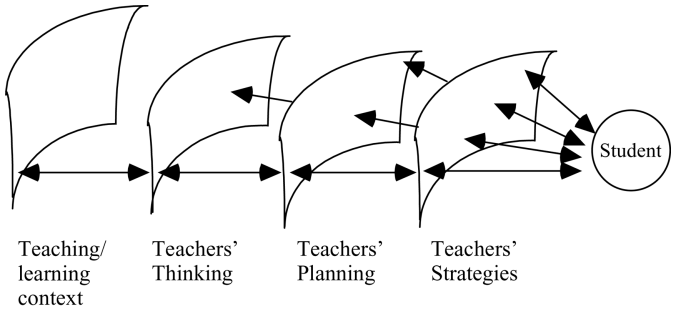
Unfortunately, much of the staff development for e-learning initiatives is focussed around the level of teachers' strategies – courses on Powerpoint slide development, Web page development, use of online conferencing systems etc. abound, but we know that other issues such as the teachers' conception of learning has a major influence on the planning of courses, in development of teaching strategies, and ultimately on the what and how students learn.

A review of the range of student experiences of e-learning is the starting point for the argument for a systems approach to e-learning development.

The student experience of e-learning

Much of the literature on e-learning is merely a description what the teacher could do or has

Figure 1 Trigwell's (1995) levels of influence on student learning



done online, while the student experience of those activities goes largely undocumented. What literature there is, reports significant variation in that experience as one might expect. If the view of e-learning as a system is accepted, then there is no single "experience". Rather, the experience of a particular student or group of students is a direct result of the particular combination of factors which make up the e-learning system described in this paper.

Within the diversity of student experiences, however, there are some common factors which have been reported in the literature as significant determinants of student satisfaction with the online aspect of e-learning.

Students consistently rate communication and support from faculty and other students as having the major influence on their online learning experience (Weller and Mason, 2000; Fredericksen *et al.*, 2000; Hara and Kling, 1999; Myerton, 1999, Rossman, 1999; Powers and Mitchell, 1997). Specifically, students value prompt and informative feedback on their work, clarity of faculty expectations of their work, and welcome high levels of participation by other students.

A second factor is that of time available to devote to the course (Weller and Mason, 2000; Powers and Mitchell, 1997). Mason (2001) has proclaimed that "time is the new distance", as lack of time, rather than long distance, has become one of the primary reasons that students withdraw from courses.

The third issue is the student experience of the technology. Students report that their own level of skill with information and communication technologies has a significant impact on their participation in e-learning activities (Fredericksen *et al.*, 2000; Hara and Kling, 1999). Adequate access to technical support was reported as essential to these learners in achieving successful learning outcomes.

The Alexander and McKenzie study (1998) reported a number of major issues from the student perspective.

The experience of group work was a significant factor in determining the student experience. Regardless of the learning design being used in the projects, those students who did not have a positive experience of working in groups did not appear to have achieved the desired learning outcomes and were very negative about their experience. Only a small number of students reported previous experience of group work, yet few of the faculty provided any kind of preparation of students for this experience.

Assessment of learning was an issue which comprised several parts. First, if the e-learning activity did not count towards assessment of the subject, students simply did not use the materials or participate in the activity. Second, where assessment of student learning was not modified to reflect any changes made to the content and process of learning, students did not participate. For example, if a project was designed to foster improved understanding of subject content, yet the assessment of learning tested students' memorisation of subject content, then students became aware of that very quickly, and adjusted their approach to learning towards that of memorisation.

Third, a degree of resistance to new forms of learning was observed, in particular amongst groups of students who were not experienced learners. Many of these students believed that the best form of learning occurred when teachers gave lectures, and resisted all attempts by teachers to involve them in activities which facilitated knowledge construction rather than reception of information.

The issues raised by the student experiences reported above highlight a range of factors.

At the level of teacher planning, increased attention must be paid to design of the assessment – ensuring that e-learning activities are assessed in appropriate ways, that students receive prompt and useful feedback on their work, and that the assessment reflects the learning objectives of the e-learning project.

Adequate preparation of students for qualitatively different learning activities cannot be over-emphasised. Students need to be briefed on the views of learning which underpin particular learning strategies, and encouraged to be reflective about their own learning.

Students also need preparation for working in groups. Few students have experience of group work and therefore should undertake preparatory work for the activity, and opportunities should be provided for support of the activities and de-briefing of the experience.

Finally, time management skills need to be embedded in the learning activities of courses.

All of the above skills – meta-cognition, working in groups, and time management – are considered to be lifelong learning skills, and hence the time spent in planning for student acquisition of those skills is well worth the investment.

At the level of university context, the results above highlight the need for staff development opportunities which support the development of online communication skills. They also emphasise the great importance of a reliable technology network, and a technology support service for both students and staff.

The level of influence that is closest to the student is the teaching strategies used.

Teachers' strategies

This level describes the actual student experience – the teaching strategy. In traditional face-to-face teaching the common experience would be that of lectures, tutorials and sometimes laboratory classes. In Alexander andMcKenzie's (1998) study of e-learning projects, the following teaching strategies were reported as used by the e-learning project developers (p. 30):

- presentation of a collection of multiple media (n = 24, 22 per cent of responses);
- presentation of a collection of information (22, 20.6 per cent);
- case studies (17, 15.9 per cent);
- simulation (11, 10.3 per cent);
- tutorial/module (11, 10.3 per cent);
- problem based learning (6, 5.6 per cent);
- hypertext (6, 5.6 per cent);
- self-assessment (4, 3.7 per cent);
- individualised instruction (3, 2.8 per cent).

When asked about intended and actual outcomes of projects for students, project leaders from the study reported as shown in Table I (p. 54).

The reported actual outcomes for students were rather different from the intended outcomes and a number of explanations are put forward for these findings.

One interpretation of these results could be that the majority of projects have not been successful in achieving their intended outcome. As noted above, 43 per cent of the e-learning projects were based on collections of multiple media or of information. These projects were not successful in general, especially if supporting materials were not available to students (e.g. guides to using the resources), if student exploration of the collection was not assessed, or the collections were supplementary material for the course.

Second, many project evaluations did not involve the collection of meaningful evidence of student learning outcomes, making it difficult to claim the anticipated outcomes. In the study project, leaders were asked about the indicators they had used to determine the success of their project. Students' reactions were the main focus of responses; the majority of project leaders used positive student response and students' enjoyment in using the program as indicators of success.

While feedback from each of these groups is important, evaluation methods which might have enabled the project leader to determine the actual learning outcomes were not often used. Project leaders cited lack of time and lack of knowledge of evaluation methods as factors inhibiting a detailed evaluation of student learning outcomes.

The actual development of the teaching strategies as e-learning products is very time consuming on the part of the academics involved and was reported by 78 per cent of project leaders as being greater than expected. When asked about factors that had hindered the development of the projects, the major category of response (35 per cent) related to lack of time. Other factors hindering

Table I Intended versus actual outcomes of project for students

Outcome of project for students	Number of responses		Percentage of cases	
	Intended	Actual	Intended	Actual
Improved quality of learning/outcomes	111	28	87.0	37.3
Improved attitudes to learning	22	47	16.0	62.7
Improved learning productivity and access	42	9	39.0	12.0
Other	–	7	–	9.3
Not used/no impact/problems/difficulties	–	6	–	8.0

Note: Base: excludes respondents who answered "too early to determine" in an earlier question.

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development of e-learning projects include (p. xii):

- inadequate access to technical advice, expertise and support;
- academic team members who felt they could perform all the technical functions, such as programming, graphic design, etc., but were not able to do so;
- presence of staff on the project team who did not value the different skills required and available for the successful project completion;
- project teams which were unable to resolve differing opinions;
- project development teams which did not include a member with responsibility for project management, and which did not foresee the need for project planning and/or documentation;
- a project leader who, in view of his or her teaching release to develop the project, was allocated an extra administrative load by the head of department;
- a project leader who was located in a faculty or school where the head of department was not supportive, often because he or she felt the time would be better spent on research, or did not value the project;
- project was developed which was operational on the development computer only, and could not be run on the implementation computers because of inadequate memory, disk space, etc., or because of non-existent CD-ROM drives;
- project was developed for implementation on computers which were expected to become available in the future, but which did not become available;
- evaluation conducted (if at all) only when the project was complete, and discovered that changes were required for which funds were no longer available;
- did not evaluate the project in the anticipated context of use, prior to implementing it.

Again, a number of issues arise from the evaluation data at this level. The importance of faculty development is emphasised once again, an issue that must be addressed at the level of the university context. Faculty need development and support in project management, team work, evaluation, and time management. They also need support for the development of those teaching strategies which have been demonstrated to result in improved learning outcomes. Management support from the faculty or school was also shown to be critical, thus highlighting the importance of an e-learning plan for the institution, and for the communication of that plan to all levels of the university so that e-learning activities are valued rather than seen as detracting from the "real work" of the department.

The experiences described here also highlight the importance of a technology plan for the university so that faculty may engage in planning for e-learning activities with confidence that the particular technologies will actually be available for their students to use.

Teachers' planning

Where e-learning is contemplated, the first stage of planning should include the following questions adapted from Alexander and Blight (1996), which will provide evidence on which to determine whether implementation will be successful, and guide thinking about the appropriate use of ICT:

(1) *Context of learning*:
   - who are the learners (age, experience of learning independently etc.)?
   - what is the most appropriate location for these learners to engage in independent learning activities (home, work, other)?
   - what kinds of technologies are available in those locations?
   - what level of technological expertise do the learners have?
   - what level of learner support is available in their location of learning and from the institution?

(2) *Information technology*:
   - is this technology available and accessible for this group of learners?
   - what is the cost of this technology to the learner?
   - does this technology support the most suitable learning design for this content?
   - what kinds of interaction are possible with this technology?
   - what level of support does this technology require?

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- is this technology a viable option in this context, and does it enable the most appropriate learning strategies to be used for this particular content, and for this group of learners?

(3) *Teaching/learning design*:

- what kinds of learning are needed?
- what teaching strategies will best meet these needs?
- what kinds of learning designs are made possible?
- what kind of assessment activities do learners engage in?

The e-learning projects reported in the Alexander and McKenzie (1998) study which were not successful were deficient in the following areas of planning (p. xii). They:

- were overly ambitious in terms of desired outcomes for the budget and time available;
- utilised particular information technologies for their own sake, without sufficient regard for appropriate learning design;
- did not change the assessment of learning to reflect changed learning outcomes;
- failed to recognise the importance of the project's context of implementation and the need to think through and plan for this;
- commenced software development without adequate planning;
- did not adequately prepare students for participation in learning experiences which they had not encountered before, such as working in groups;
- over-estimated students' willingness to engage in higher level learning activities, especially when they were not related to assessment;
- used resources in the project development for which copyright clearance had not yet been obtained, and could not subsequently be obtained.

The issues raised above highlight the importance of support at the university level for more detailed analyses of potential students, their characteristics, and circumstances of learning. This is a task more suited to a specialist team within an institution with experience in market research.

Teachers' planning of learning experiences (which includes development of the aims, objectives, and assessment) is strongly underpinned by their thinking about what learning means.

Teachers' thinking

When asked about the intended learning outcomes, project leaders' responses from the Alexander and McKenzie study (1998) were categorised as "improved quality of learning" if their focus appeared to be on the learning outcomes that students would achieve from using the project materials. These responses were sub-categorised to reflect the level of learning outcome described, using a scheme modified from the literature on conceptions of learning (Marton *et al.*, 1993).

At the simplest level, ten responses (from 111) indicated a desire for students to be exposed to information or ideas, sometimes of a kind unavailable in the standard classroom environment, with a further 16 indicating that they would like students to develop an awareness of, explore or experience various phenomena.

In both of these categories, the described learning outcome could be related to Marton *et al.*'s conception of learning as increasing one's knowledge, with the main focus on broadening students' knowledge or awareness.

In the next category (30 responses), learning was still described as an increase in knowledge, but the focus was on improvement of existing learning or learning approaches, where the nature of the improvement was not always specified. "Learning more" and "reinforcing learning" were included in this category.

In the next category, the focus was on students acquiring and applying skills (21 responses), relating to Marton *et al.*'s category of applying or acquiring facts, procedures, skills etc. for later application. These skills could be generic (computing skills or problem solving skills) or more specific practical and professional skills related to the discipline or field of practice.

The final three learning categories could be related to Marton *et al*'s two categories of learning as understanding and learning as seeing something in a different way. They focused on students developing understanding (27 responses), integrating knowledge from a range of sources (nine responses) and becoming more selective and

discriminating in their use of knowledge (three responses).

Clearly, there was a wide variation in teachers' thinking about learning, ranging from a view that learning occurs if students are exposed to information, to a view that learning is about understanding, or making sense of something.

In general, faculty who view learning as "increasing knowledge" or "learning more" were more likely to develop collections of multiple media or collections of multiple media. At the other end of the spectrum, faculty who viewed learning as "understanding" were more likely to plan and develop strategies such as simulations and problem-based learning activities. The latter were more successful in achieving those learning outcomes, although some failed for many of the reasons identified elsewhere in this paper. For example, where the students were not amenable to activities which were different from those they had experienced previously, the project did not achieve the desired learning outcomes.

This highlights the absolutely critical importance of supporting faculty as they increase their understanding of student learning.

Teaching/ learning context

Clearly, from the issues highlighted above, for any e-learning initiative to be successful, a number of support mechanisms must have been developed. The most sophisticated learning design will not help students to learn if the technology does not work, if faculty are overloaded and cannot or do not know how to provide support to students, if the students have a negative experience of working in groups, or the students do not value the opportunity to participate in qualitatively different learning experiences.

What should institutions do to develop a system to support e-learning?

First, they need a plan for e-learning development, a plan which clearly identifies the reason/s for embarking on e-learning development. Without this, faculty are likely to "second guess" the reasons for the initiative, which may lead them to by-pass the significant phases of thinking about learning and what it means for their students, as they move straight to the teaching strategies they believe will address the concerns of the university. For example, a university which simply announces that all of their courses will be taught online may cause faculty to simply place all of lecture notes online and call it an online course. Gone are the phases of thinking through the context, the ways in which students learn the content and so on.

As noted earlier, a reliable technology system is critical to the success of e-learning initiatives. This system not only includes the technologies themselves, but also the support for staff and students as they learn to use the e-learning projects. Students will readily give up on a course if they cannot get the technology to work, and they do not receive support.

Back to the beginning

The good news is that when the right balance of the above factors is achieved there is evidence of positive learning outcomes for students. The Alexander and McKenzie (1998, p. 244) study summarised the benefits of the successful projects for students as being of four kinds:

(1) improved quality of learning;
(2) improved productivity of learning;
(3) improved access to learning; and
(4) improved student attitudes to learning.

More specifically, the study found a range of positive learning outcomes which resulted from students' use of e-learning products, including (p. 232):

- the opportunity for students to interact with others internationally and gain a more sophisticated and global understanding of complex international political issues, while gaining information technology literacy in the process;
- improved understanding of concepts which students are known to have difficulty with in a range of disciplines, through the use of interactive multimedia animations, simulations and microworlds;
- the development of information and technological literacy in the context of learning to solve real-world problems through the use of databases and e-mail;
- enhanced communication between part-time students and their lecturer, through

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the use of a computer-based conferencing tool over the Internet;
- the acquisition of information such as language learning, where a high component of factual recall is required;
- learning the skills and knowledge of a particular discipline in the culture of its use in a working organisation, through participation in a simulation over the Internet;
- the facility for students to assess their own learning of concepts, through computer-based qualitative and quantitative assessment modules.

Some of the case studies from the study also showed the following evidence of improved productivity in learning and teaching:
- decreased time to learn through the use of animations;
- increased content of learning in a given time through the availability of multiple representations;
- increased interaction between academics and students through the use of a computer-based conferencing tool on the Internet.

Unfortunately, these positive outcomes represent only a small proportion of the e-learning projects investigated in the study. Some of the projects failed to deliver an outcome at all, while others failed to achieve any evidence of learning outcomes for the variety of reasons outlined elsewhere in this paper.

Conclusions

If higher education is to meet the forecast challenges of this century, initiatives in e-learning will need to encompass more than the current focus on teaching strategies. This article has described a framework for developing the capacity to deliver e-learning courses as follows:

University context
Provision of the following support and development mechanisms constitutes an integral part of an e-learning initiative:
(1) A vision for e-learning at the institution.
(2) Development of technology development plan.
(3) Development of faculty workload policies which relate to e-learning.
(4) Maintenance of a reliable technology network.
(5) Facility for providing technology support to staff and students.
(6) Market research support.
(7) Faculty development opportunities in:
   - student learning;
   - good practice in course design, development and implementation;
   - project management;
   - team work;
   - evaluation; and
   - time management.
(8) Provision of time release for faculty engaged in e-learning developments;

Teacher thinking
Faculty are strongly encouraged to make use of staff development opportunities which encourage them to reflect on their views of learning and the ways in which those views impact on the planning of learning, and the use of particular teaching strategies. It is only through increased understanding of how students learn, that high quality e-learning opportunities are made possible.

Teacher planning
At the planning phase of e-learning, faculty must pay attention to:
(9) Developing an increased understanding of the students.
(10) Design of the assessment of e-learning activities such that they complement the aims and objectives of the course.
(11) Mechanisms for providing useful and timely feedback on students' work.
(12) Preparation of students for qualitatively different learning activities.
(13) Preparation of students for working in groups.
(14) Embedding time management skills in the learning activities of courses.
(15) Planning for the particular context of implementation.
(16) Obtaining copyright clearance on all materials used.

Teacher strategies
Faculty are encouraged to provide:
(17) Feedback to students which is timely and informative.
(18) Opportunities for students to come to understand the learning process prior to engaging them in learning activities

which they may not have previously encountered.

(19) Activities which assist students to develop their skills in group work.

This combination of factors will enhance the student experience of e-learning, and ultimately enable the institution to realise its particular vision for e-learning.

Notes

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