
It is posted here for your personal use. No further distribution is permitted.
Factors influencing the Widespread Adoption of E-learning in Tertiary Education

Dr Rob Phillips
Teaching and Learning Centre, Murdoch University
Perth, Western AUSTRALIA
r.phillips@murdoch.edu.au

Introduction

Educational Technology has evolved over the last decade. In the early 1990’s, the emphasis of educational technology was on interactive multimedia – stand alone packages on computer hard disks or CD-ROMs, which integrated a range of media forms. As the internet evolved in the mid- to late 1990’s, the focus shifted to largely text-based material available to anyone with appropriate access to it. Currently, with improvements in technology and bandwidth, fully interactive multimedia capabilities are available on the internet, and the focus is on learning objects rather than monolithic applications. At the same time, web-based learning management systems arose, and evolved into enterprise information systems. None of these changes have been driven by educational factors.

While educational technology will continue to evolve, the hardware, software and network infrastructure is sufficiently mature that the focus should shift to how to use the technology most appropriately to facilitate learning. This leads us into a discussion of the factors which influence the widespread adoption of e-learning.

What is e-learning?

While a large number of terms has been used to describe the range of educational technology applications, the currently-popular term is e-learning. However, there is confusion about what e-learning means in different contexts. People tend to use e-learning in a ‘one size fits all’ manner, and this confounds discussion about the appropriate use of e-learning, and confuses both practitioners and policy-makers.

There are distinctive differences between, for example, a use of a simulation learning object as part of a school laboratory practical, a training CD used by a corporation, and a tertiary course offered solely online by an open university, but these are each commonly referred to as e-learning.

A recent paper (Phillips, 2004) has attempted to resolve this confusion by proposing four independent e-learning design dimensions. These are summarised in Table 1, together with their extreme values. The four dimensions are based on the interactions that a student may have in a technology-supported learning environment: with other students, with their teacher, with learning resources and with their computer.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Extremes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student-student interaction (SS)</td>
<td>Individual, Social</td>
</tr>
<tr>
<td>Student-teacher interaction (ST)</td>
<td>Present, Absent</td>
</tr>
<tr>
<td>Student-resource interaction (SR)</td>
<td>Traditional (paper), Digital</td>
</tr>
<tr>
<td>Student-computer interaction (SC)</td>
<td>Passive (navigation between screens only), Interactive (interactions designed for learning)</td>
</tr>
</tbody>
</table>
A demonstration of the usefulness of the dimensions is provided by analysing the three examples given above. See Table 2. Each scenario is characterised by four letters corresponding to the first letter of the chosen extreme of each type of interaction.

### Table 2. Examples of use of the four e-learning design dimensions.

<table>
<thead>
<tr>
<th>Description</th>
<th>IPTI</th>
<th>IADI</th>
<th>SADP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation learning object</td>
<td>The student is likely to work individually</td>
<td>The student works individually</td>
<td>Students are likely to work socially with one another</td>
</tr>
<tr>
<td></td>
<td>The teacher is present</td>
<td>The teacher is absent</td>
<td>The teacher is absent</td>
</tr>
<tr>
<td></td>
<td>Resources are likely to be on paper</td>
<td>Resources are digital</td>
<td>Resources are digital</td>
</tr>
<tr>
<td></td>
<td>The student interacts with the computer</td>
<td>The student is likely to interact with the computer</td>
<td>Computer use is passive, with interactions only for navigation.</td>
</tr>
</tbody>
</table>

Current research about learning with technology indicates that effective e-learning environments have the SPTI combination of dimensions:

- Students work socially with each other;
- The teacher is present;
- Resources are available in print (and also online for flexibility);
- Students purposively interact with the computer.

A cogent description of representative products and their design criteria is given in Reeves & Hedberg (2002: Chapter 1).

However, the variety of teaching contexts and the circumstances of learners means that compromises need to be made in many cases in the ways that e-learning courses are presented to students. For example, in some circumstances, students are forced to work individually, and in others they may not have a teacher close by to discuss and reinforce their understandings.

Some of these compromises can lead to effective learning outcomes, if well-designed, while others, arguably, may not. Many university learning experiences are based on traditional approaches to teaching which do not align well with current research about how people learn. The traditional approaches tend to adopt a “transmission-of-content” approach, which has been shown to lead to surface learning. Unfortunately, the majority of examples of educational technology reported in the literature and available on the market have been developed according to a transmissionist model (Reeves & Hedberg, 2002; Schank & Cleary, 1995). In this erroneous view, educational technology is seen as leading directly to learning, rather than as a tool to assist learning. Unfortunately, this view underpins much of the debate about e-learning.

**What is learning?**

The US National Research Council recently commissioned a literature review of research results, over the previous 30 years, across several disciplines, about how people learn (Bransford, Brown, & Cocking, 1999, 2000). Some key findings are:

- There is a clear distinction between learned problem-solving skills in novice learners and the specialised expertise of individuals
- Individuals can be taught to be metacognitive and self-regulatory;
• Participation in social practice is a fundamental form of learning;
• For learning to be effective, it needs to be transferable to other contexts and it needs to have a long-term impact.

For tertiary students to become experts, they need to attain a deep, organised and contextualised understanding of their discipline, and the learning environment needs to support this. Bransford et al. (2000) indicate that learning environments should be:

**Student-centric:** acknowledging that students use current knowledge to construct new knowledge.

**Knowledge-centric:** acknowledging that knowledge needs to be accessible and applied appropriately in order to think and solve problems.

**Assessment-centric:** focusing on formative assessment supporting the learning process, by:
• providing regular feedback;
• providing opportunities for revision;
• improving the quality of thinking and understanding.

**Community-centric:** acknowledging that learning involves social discourse between peers.

These four characteristics of an effective learning environment imply that the student takes part in activities which are intended to lead to learning, and these are drawn from outcomes that the students are expected to achieve. For effective learning to occur in a tertiary setting, the design of the learning environment should emphasise:
• A constructivist pedagogical philosophy (Duffy & Jonassen, 1992; Marra & Jonassen, 1993; Reeves & Hedberg, 2002);
• A deep approach to learning (Biggs, 1999; Gibbs, 1992; Ramsden, 1988, 1992);
• A student-centred approach to teaching; and
• Outcomes-centred course design.

This analysis leads to three important conclusions:

**Educational technology is a tool,** not a means in itself. Like any technology, educational technology does not lead to learning, but, together with teacher support, it can facilitate effective learning activities. Figure 1 provides a visual representation of the preceding points.

**There’s no such thing as e-learning.** Learning is an internal, cognitive activity which can be facilitated by contact with others. Learning is not something which can be ‘delivered’, by human or computer. E-learning should be an adjective, not a noun.

Figure 1. The role of educational technology in facilitating a deep learning, student-centred approach to the design of learning activities.
The major issues associated with the effectiveness of e-learning environments are not related to technology. They are related to our understanding of learning and the mismatch between empirical results about how people learn and the actual practice of teaching.

How effective has e-learning been?

The research outlined so far indicates ways in which educational technology can be designed to be effective in higher education. However, this style of e-learning has not been widely adopted. Where e-learning has been widely adopted it has been through replication of traditional teaching techniques (Reeves, 2002).

There are several factors which have influenced the low take-up of effective educational technology. One factor is the individual beliefs about teaching and learning held by academic staff who develop e-learning projects. These beliefs influence academics’ choices of pedagogical approaches and use of educational technology (Bain, McNaught, Mills, & Lueckenhhausen, 1998a, 1998b; Kennedy & McNaught, 1997).

However, a range of other issues, beyond individual factors, influences the success of educational technology development projects. Alexander & McKenzie (1998) reviewed 104 ed projects, and derived the characteristics listed in Table 3.


<table>
<thead>
<tr>
<th>Factor</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Design</td>
<td>The project:</td>
</tr>
<tr>
<td></td>
<td>• aimed to address a specific area of student need;</td>
</tr>
<tr>
<td></td>
<td>• used a learning design/strategy which has been well thought through;</td>
</tr>
<tr>
<td></td>
<td>• was integrated into the learning experience;</td>
</tr>
<tr>
<td></td>
<td>• prepared students for new learning experiences.</td>
</tr>
<tr>
<td></td>
<td>The designers:</td>
</tr>
<tr>
<td></td>
<td>• modified assessment of student learning;</td>
</tr>
<tr>
<td></td>
<td>• realised that students were unwilling to engage in higher level learning activities, especially when they were not related to assessment;</td>
</tr>
<tr>
<td></td>
<td>• did not utilise ICT for its own sake;</td>
</tr>
<tr>
<td></td>
<td>• evaluated both usability and student learning.</td>
</tr>
<tr>
<td>Project Management and Teamwork</td>
<td>• the development team included a skilled project manager;</td>
</tr>
<tr>
<td></td>
<td>• software development was adequately analysed, planned, scoped and designed prior to commencing the development;</td>
</tr>
<tr>
<td></td>
<td>• the anticipated outcome was realistic, in the context of the time and budget available;</td>
</tr>
<tr>
<td></td>
<td>• the project’s context of implementation was planned;</td>
</tr>
<tr>
<td></td>
<td>• the project team had shared goals and could resolve conflict;</td>
</tr>
<tr>
<td></td>
<td>• members of the project team were committed;</td>
</tr>
<tr>
<td></td>
<td>• academic team members realised that they could not perform all the technical functions;</td>
</tr>
<tr>
<td></td>
<td>• staff on the project team valued the different skills required for successful project completion.</td>
</tr>
<tr>
<td>Institutional Issues</td>
<td>• projects were embedded in the department’s normal teaching;</td>
</tr>
<tr>
<td></td>
<td>• funding was available for implementation and maintenance of the project;</td>
</tr>
<tr>
<td></td>
<td>• the Head of Department/School and the Dean were supportive of the project;</td>
</tr>
<tr>
<td></td>
<td>• staff were supported through access to technical support and educational software development expertise;</td>
</tr>
<tr>
<td></td>
<td>• students had access to appropriate hardware, software and support;</td>
</tr>
<tr>
<td></td>
<td>• copyright and intellectual property issues were resolved;</td>
</tr>
</tbody>
</table>
teaching development projects funded by the Australian government which made significant use of a range of educational technologies. They identified a range of characteristics of educationally-effective projects, together with a range of factors leading to unsuccessful outcomes. These characteristics have been summarised and reorganised in Table 3 under three headings, educational design, project management and institutional issues.

The educational design for effective learning issues in Table 3 are largely consistent with arguments presented earlier in this paper.

The second factor in Table 3 is Project Management and teamwork. Project management is essential if educational innovations are to be implemented and reach the ‘classroom’. Academics are not used to working in teams, especially multidisciplinary e-learning development teams, and team management is therefore important. While there is a growing literature on project management and teamwork issues associated with educational technology development (see, for example, Bates (1999), England & Finney (1999), Phillips (1997), Phillips (2001)).

Institutional issues are the third factor displayed in Table 3. Any of these issues can impact on the effectiveness of an educational technology development project, and they are largely outside the control of the development team. Laurillard (1994) reviewed a number of evaluation studies of new technology, reinforcing several of the characteristics listed in Table 3. In particular, Laurillard identified two specific institutional issues:

- Full potential was not achieved because of organisational/ logistical/ technical problems;
- Senior management support influences success.

Similarly, a range of institutional issues were identified by McNaught, Phillips, Rossiter, & Winn (2000) in a study investigating factors affecting the adoption of educational technology in Australian universities. This report identified a number of factors which, when all present, could lead to widespread adoption of ICT. Three major themes were identified: the institutional culture, the policy framework and the support infrastructure. McNaught et al. (2000) represent the three components as a Venn diagram in Figure 2, recognising that where change takes place there is an overlap between the three components, policy, culture and support.

The policy theme includes leadership, specific institutional policies, the extent to which policies were aligned and congruent in a particular university, and the strategic processes such as grant schemes which flowed from policies.

The culture theme comprises factors such as the extent of collaboration within institutions, the personal motivation of innovators, as well as characteristics of the institution such as staff rewards, teaching and learning models and attitudes towards innovation.

The third theme, support, represents the range of institutional infrastructure designed to assist and facilitate the adoption process, such as the library and information technology services, professional development of staff, student support, educational design support and IT literacy support for staff and students.

The conclusion was drawn that an institution which addressed all of the themes shown in Fig. 2 would be likely to achieve high uptake rates of any educational innovation.
How can change be managed?

Two common approaches to achieving change in organizations are the top-down approach and the bottom-up approach (Anderson, Johnson, & Milligan, 1999; Bates, 1999; Miller, 1995). The top-down approach imposes central policies in attempting to achieve change, using power-coercive strategies – i.e. change is forced through strategic, financial or industrial means (Miller, 1995). The bottom-up approach, on the other hand, involves organic change arising from innovators and early adopters (Rogers, 1995), or through academics driving issues through the university by provoking discussion and contributing to democratic decision-making processes.

In terms of the model presented in Fig. 2, policy is identified with the top-down approach, and culture is associated with the bottom-up approach.

A recent paper (Cummings, Phillips, Lowe, & Tilbrook, 2004) has contended that there is a third approach to achieving change in organisations, and that is a ‘middle-out’ approach. The middle-out approach is appropriately aligned with the support component in Fig. 2. While McNaught et al. (2000) portray the support theme as reactive, implementing policies and supporting teachers in their work, our experiences at Murdoch University indicate that the support role can be proactive rather than passive, “driving change from the middle-out, through operational planning and project management, solving problems and facilitating a connection between central vision and chalk-face practice” (Cummings et al., 2004).

While each approach can be effective in driving change, for change to be fully effective, and to achieve the maximum overlap in Fig. 2, all stakeholders able to take ownership of the innovation.

Figure 2. Three phase technology-adoption model (from (McNaught, Phillips, Rossiter, & Winn, 2000)). IP = Intellectual Property; ITS = Information Technology Services; T&L = Teaching and Learning.
The remainder of this paper presents a case study illustrating how the preceding considerations have been implemented at Murdoch University.

**How does Murdoch University fit in?**

**The Institutional Context**

Murdoch has been offering both face-to-face (internal) and distance (external) modes of education since 1976. Historically, about one third of units of study have been available in external as well as internal mode. The external mode used the centrally-administered correspondence model developed by the UK’s Open University, incorporating specially-written Study Guides and Unit Readers1 usually supported by audio cassette tapes.

During the 1990’s, the University devolved its external studies provision to academic divisions. This, together with budget cuts, led to a decreasing emphasis on external studies. The proportion of students studying externally fell from 35% in 1991 to 21% in 2000. Furthermore, two-thirds of external students enrolled in 2001 actually lived in the vicinity of the University, and indicated they enrolled externally either because of timetable clashes or because they wanted free access2 to printed unit materials.

**Online and Flexible Learning**

In 1998, as the world-wide web became widely available, Murdoch began to offer units online, and implemented the WebCT Learning Management System as the vehicle. Most online units comprised conversions of existing print materials, supplemented by discussion forums, hyperlinks and online quizzes. Lecturers were encouraged to build online learning activities into their units. Uptake of WebCT was strong, being currently used by 75% of students (Phillips, 2002). In line with Gartner Group research (Harris, Yanosky, & Zastrocky, 2003), 90% of students used WebCT in blended mode, as a supplement to traditional teaching.

Murdoch University faced a crisis in 2001 when confronted by the question of whether it could afford to continue to offer units to external students using distance education approaches and how it could administratively manage its increasing online course provision. After considerable discussion and debate involving both the University’s senior executive and Academic Council, a new flexible unit model was developed and implemented by a group of middle managers. This new flexible model of unit design reversed the previous approach of delivering different versions of unit materials (study guide, unit readings and tapes of previous lectures) to internal and external students. Instead, a flexible access approach was taken, where a single set of unit materials (designed for face-to-face, in print and online) could be accessed in a way that students could choose according to their circumstances.

This enabled the university to make considerable savings in the production of unit materials, reduced the need for unit coordinators to produce different materials for different student cohorts and enabled the university to make better strategic use of its ICT infrastructure such as WebCT and a system which digitally records face-to-face lectures and makes them available to students online in near real time. The University’s strategic plan now includes the goal that all units be converted to the new flexible model.

However, it should also be noted that this approach is simply a replication of traditional teaching practices, and it has been adopted because of the administrative efficiencies to be gained.

---

1 Collections of relevant references published in one volume.
2 In Australia, Government regulations require all external students to be provided study materials free of charge.
Improving learning by integrating graduate attributes

Over several years, Murdoch identified and refined a set of graduate attributes. These are generic academic and life skills which all students should be able to demonstrate on graduation. For these skills to be achieved, they have to be learnt at some stage of each degree programme, and Academic Council required an audit to be done showing where each graduate attribute was learnt. This top-down approach was rejected by academics as meaningless managerialism.

However, the Teaching and Learning Centre (TLC), as a driver of middle-out change, saw the opportunities of the auditing process to facilitate wider curriculum change. Because the process of analysing where graduate attributes were learnt was complex, a web-based Graduate Attributes Mapping Program (GAMP) was developed (Lowe & Marshall, 2004) to simplify the mapping of graduate attributes to units of study and degree programmes. On the completion of the mapping process, GAMP provides graphical and textual reports which clearly show where the graduate attributes are embedded in learning objectives, content topics, learning activities and assessment. This information can then be aggregated across all the units in a specific degree programme. At a glance, it is possible to see where attributes are addressed and whether there are significant gaps which need to be addressed.

The mapping process enabled TLC educational designers to encourage academics to reflect on their curriculum and engage with them in improving it. In this way, a managerial chore was converted into a productive quality improvement activity, and this had the potential to change the nature of e-learning provision.

The school development process

The success of the innovations outlined above and increasing government interest in teaching and learning led to the adoption of a strong strategic vision for teaching and learning, which is being implemented through a single integrated approach to curriculum change, called the School Development Process. This is a coordinated approach to enhancing teaching and learning where each teaching school at Murdoch University undergoes a review every five years. Part of the process involves the renewal of curriculum, including the integration of graduate attributes, the conversion of units to the flexible model and the use of blended approaches to learning where this is appropriate.

Conclusion

This paper has analysed the nature of learning and the role of educational technology in developing effective e-learning environments. The conclusion was drawn that educational technology is a tool to facilitate learning, not a form of learning in itself. The major issues impacting on wider use of e-learning are educational and institutional and are not related to technology, but involve educational design, project management and institutional issues.

While research has provided guidelines for effective educational design and project management of e-learning developments, further research is needed into broader institutional issues which may prevent individual teaching innovations from being successful.

The paper concluded with a description of how one university had achieved widespread penetration of e-learning and emerging changes in teaching and learning practice, together with an analysis of how this occurred in the context of the earlier literature material. These changes were initiated by a middle-out approach to change-management which achieved significant buy-in from by teaching academics and university administration.
Initial developments with online and flexible learning have been very successful, but have tended to be replications of traditional practice in a transmission model. As time went by, a rising awareness of pedagogical issues arose, together with an understanding, that to be successful in facilitating learning, educational technology needed to be integrated with the entire curriculum. E-learning developments have evolved into a curriculum renewal process at the degree level, integrating graduate attribute analysis with a school development process. While this process is still continuing, progress is promising. The changes in pedagogy are starting to impact on the effectiveness of e-learning, although there is some unresolved tension between the transmission approach of the ongoing flexible learning initiative and the research-based approach of the school development process.

References


