

How compelling is the evidence for the effectiveness of e-Learning in the post-16 sector?

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A review of the literature in higher education, the health sector and work-based learning and a post-review stakeholder consultation

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Executive Summary

The findings of the modified systematic review of the literature were presented to a

Specific recommendations for future research

In each section of the review chapters we make recommendations for future research. We summarise them here.

In *higher education* we should look at

- Students' attitudes to different methods of assessment when using e-Learning
- The effect of faculty use of technology on the attitudes and behaviour of students (role modelling)
- The impact of the integration of learning activities with assessment in a networked learning environment
- When collaboration works and when it breaks down
- The impact of e-Learning strategies on the higher education institution

In *medical education* we should look at

- The experience of the off-campus or long distance learner
- The contextual nature of learning by including more than one level of evaluation of e-Learning e.g. gauging the reactions of the learners (self report) and also observing the behaviour
- Student, practitioner and faculty use of handheld devices in more depth

Definitions of e-Learning in education

The DfES consultation document 'Towards a Unified e-Learning Strategy' presents us with a broad definition

Working definition for the review

We have adopted the following definition of e-Learning in this review.

e-Learning is a portmanteau term covering:

A style of learning with a particular focus on technology-mediated

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learning. Key factors in e-learning were identified as being learner confidence, prior knowledge (both operational and conceptual), the presence and involvement of the Teacher, communication (the dialogues between teachers and learners and the cultural issues relating to managing change. This level of detail in itself identifies the

1: Post-Systematic Review Consultation; the emerging Policy and Research Issues

Introduction to the Chapter and its purpose

This chapter summarises the work carried out since the completion of the REVEEL Systematic Literature Review (which starts at Chapter 2). The purpose of this work was to take the findings of the Review and use them to engage in an iterative debate with key academics and policy makers to evaluate the relevance and usefulness of the findings.

Part 1; the e-learn 2006 Roundtable Discussion Paper

This section reproduces the e-learn Roundtable paper, which began the Consultation process on the findings of the REVEEL Review. The subsequent outcomes and issues all emerge from this paper so this is seen as setting up the discussions from which the Research and Policy issues and concerns at the end of the chapter are drawn.

1. Introduction

This paper gives a brief overview of this work. The roundtable discussions at e-learn 2006 will allow us to elicit feedback on these from International stakeholders and thereby enrich the review. In this paper we offer an initial definition of e-learning and discuss the subject areas of Work Based Learning, Undergraduate Education and Medical Education. We offer a different approach to the discussion of each in order to provide something that is relevant to as wider audience as possible and in this way to provoke discussion of the key emerging issues at the roundtable event. With respect to Work Based Learning we discuss the scope of our review, its audience, and what

E-learning is a portmanteau term covering:

- The **set of skills** that enables learners to exploit technology in order to develop understanding or capability;
- The use of **computer technology** in learning with a particular focus on internet technology
- A **style of learning** with a particular focus on technology-mediated interactivity and collaboration

Point for discussion at the roundtable: Is this a good definition?

3. Where and what is the evidence about the effectiveness of e-learning?

The evidence that can be found within journals, websites, conference papers and presentations

2. Prior knowledge at both the operational level (how to do it) and the conceptual level (understanding) is important

On the social level:

3. The presence and involvement of a teacher/trainer can have an impact on how well e-Learning works
4. Communication - the continuing dialogue between the teacher and the learner and also between learners is important
5. Tutors, faculty members, and fellow workers can have an impact on the learning process

Point for discussion at the roundtable: What are the international Drivers?

6. Undergraduate Education: a contextualized case study

This case study describes an institutional decision making process about the need to invest in e-learning. Our review needs to offer institutional managers and policy makers clear information about why they should invest money in e-learning and what is likely to best meet their needs. Through this case study we highlight the issues that are pertinent to this audience. The institution used as the case study has made little investment in e-learning to date and is wanting to make a decisions about what it should do next. They are operating in a context where the Higher Education Funding Council have highlighted the needed for institutions to develop e-learning strategies and have allocated some resources for this purpose.

Why should an institution invest in e-learning?

Investment in e-learning could help the institution to:

- Achieve its Institutional aims
- Address Key Performance Indicators such as: student satisfaction levels and students Employability.
- Catch up with similar institutions and reposition itself. Not doing this could impact on their ability to attract the students they want
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value the aspects of E-Learning that could be provided via an e-Learning package.

3. Creating a draft e-learning strategy for the institution: an initial small group of staff from different units created a map of the activities they normally complete in order to support teaching and learning. These activities were matched to potential technologies and used as the basis for scenarios about life

Part 2; Issues emerging from the Roundtable Discussion.

Introduction

This section covers the debates and the issues that emerged from the Roundtable Discussions held at the e-learn 2006 conference on Sunday October 15. Despite an earthquake 3 hours before the session it was well attended with 15 researchers and practitioners involved. Roundtables are debates, which anyone at the conference is free to join in. In this case a paper was submitted which was available for participants to read before the session. During the session a number of key points were re-iterated and used as the basis for discussion. These were

- Possible definitions of e-learning
- Evidence about the effectiveness of e-learning
- 5 key factors influencing e-learning effectiveness
- Work-based e-learning
- Universities and e-learning

Process

During the roundtable the chair used the issue of definitions of e-learning to open up the debate and then move through the five key points listed. The focus of the debate was on definitions of e-learning, the key factors and the university context. From which the nature of research evidence was debated. Due to time constraints, and the expertise of those involved, work-based learning was not discussed. Participants came from the USA, the UK, Canada, Australia, Germany, India and included representatives of Carnegie-Mellon and Stanford Universities.

General Issues about e-learning emerging from the roundtable

e-learning and prior learning assumptions

Learners arrive at e-learning with their own set of assumptions concerning;

- a) Learning processes, which depend on how they have been schooled previously, and are usually based on formal “stand and deliver” models
- b)

have some input into them. So e-learning was viewed as working most effectively when **co**

understand its educational effectiveness we need to take long-term views and gather longitudinal data. In the main research is less interested in this approach.

The participants took the view that the key point is that learners change their **mode of learning** in e-learning. They no longer memorise and cram for exams, but they expect to take a “research-based” approach; finding sources, testing for validity and applying the information they find in answering problems that they are trying to solve. The communication dimension of learning is expanded and they are actively involved in applying their learning practically and demonstrating that they have learnt facts and their relevance.

Summary on evidence

Research needs to look at the transformational nature of e-learning and how it affects the process of learning rather than mapping it to traditional outcome measures.

Five Key Factors

The participants were prompted with the findings from the literature review of the **five** key factors reported in the research literature;

had requested them. For example, let us consider the earlier point that e-learning involves a degree of co-creation and that consequently the teacher's role changes and becomes dynamic within the e-learning process. Unfortunately institutions tend to see learning as a static process and don't allow for dynamic developments in the learning process. One participant reported being moved off an e-learning course once she had developed its initial form. The institution saw the course as having a new but fixed design in its e-learning formulation which any instructor could then come in, pick up and deliver, but they failed to see the qualitative differences asked of the teacher, which in fact require new skills in practitioners.

Institutions are typically using traditional Key Performance Indicators (KPI's) to evaluate the effectiveness of e-learning. For example student satisfaction is typically measured using traditional evaluation forms designed to measure traditional face-to-face learning contexts; so quantitative evaluation measures are based on qualitatively different learning processes and contexts.

Institutions are still seeing e-learning primarily as delivering institutional efficiency gains.

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Workshop discussion on “General Issues”

The discussion on general issues, which concerned both “prior assumptions about learning” and “independent learning”, occurred in passing as the overall context of the discussion on the effectiveness of e-learning was established. This discussion was mostly concerned the key workshop theme that we are coming to the end of “e-learning” as a subset of learning so we need appropriate preparation for learning in all its forms. This overall concern with learning was partly addressed by the contention that both Learners and Practitioners need to be prepared for "designing for learning" in multiple contexts. So “prior assumptions” about learning brought by learners into new learning contexts are seen as constantly evolving. The current situation is complicated by the behaviour of what Oblinger calls the “net generation” (see http://www.educause.edu/content.asp?PAGE_ID=5989&bhcp=1) and the observations found in the DEMOS review “Their Space” which describes the styles of young people in using new technology (see <http://www.demos.co.uk/publications/theirspace>).

So there is a need to prepare learners for the “independent learning” characteristic of “e-learning” which could be addressed through training for “designing for learning”. It was argued that preparing practitioners and learners to “design learning” would enable a formalisation of the co-creation of learning processes, which is a possible Research Issue. It was also argued that the co-creation of learning could come from the dynamic use of formative assessments even though these aren’t the only processes of learning. This was tempered by the observation that learning “doesn’t stop at institutional boundaries”, so a further set of contextual issues would also need to be addressed (a potential Research Issue).

which was characterised as “independent learning”. The following points expand on these two “general issues”.

1. We are coming to the end of a period where we can have a separate focus on e-learning so the clearly delineated separation of e- and non-e prior learning assumptions is changing and become less clear and less easy to define.
2. The nature of prior learning assumptions is changing (ibid see DEMOS “Their Space” for a list of characteristics of technology adept young people) and learners may already be technologically proficient in using web-based and new technology tools to support their learning, but in ways that do not match to the expectations in the new learning context.

processes was all that is needed was challenged with the observation that we "don't know where conversations about learning take place". This was not to gainsay the importance of understanding how to use these conversations about learning but rather that they exist in multiple contexts and consequently are complex and raise a research Issue.

The debate moved on to the question of what is the definition of e-learning? It was argued that whatever definition you come up with someone will challenge it. For

1. It was agreed that the four of the five original factors of confidence, prior knowledge, involvement of the teacher and communications were key factors in “e-learning” and could be used to develop a description of a necessary learning skill set.

Conclusions on Institutions and Key Performance Indicators

In light of the points above concerning the change in learning processes and behaviours brought about by e-learning it was recognised that institutional KPI's themselves have major limitations as they are designed to measure traditional learning outcomes through enrolment and destinations.

1. The limitations of KPI's in developing learning were accepted because they capture traditional learning outcomes or current policy imperatives. However the opportunity for self-assessment reviews to make KPI's more relevant to measuring effective learning in "in technology-rich environments" was highlighted.
2. It was also noted that no one has effectively linked implementing e-learning to quality improvement.
3. A key issue related to this concern of the ongoing measurement of effective learning is that both learning and technology are developing dynamically in parallel and in complex ways but are not connected formally. KPI's are not connected to teaching and learning or technology development.
4. The appropriate integration of technology into multiple learning contexts is seen as a key issue in developing the more responsive institution and measures that support this need to be identified.

Workshop discussion on Research Evidence

The prompt for this discussion was the question about whether we should be looking at research about outcomes (that is using evidence about the traditional measures of the effectiveness of learning), or about process (that is using evidence concerning the transformational aspects of e-learning).

The participants at the roundtable arrived at the unanimous view that e-learning was transformational and that if we are to understand its educational effectiveness we need

1. It is recognised that the learner changes their mode of learning in different learning contexts, but in what way and how this can be supported is unclear.
2. Research needs to look at the transformational nature of e-learning and how it affects the process of learning rather than mapping it to traditional outcome measures; new measures of effectiveness are needed.
3. Whilst it was argued that preparing practitioners and learners to “design learning” would enable a formalisation of the co-creation of the learning processes how this is to be done precisely is not clear. However identifying the change roles of practitioners and learners is critical and “designing for learning” may be the best way of integrating

Part 4; Summary of Research and Policy Issues as they relate to relevant stakeholders

The issues as they stand at the end of this post systematic review discussion process can be summarised as follows:

1. "e-learning" has

Learning and learning discourse in multiple contexts means a greater use of libraries, museums and archives as both resource centres and learning locations. Library 2.0

Learning was seen as being about learning discourse and the role of the practitioner in making learning effective was in their ability to promote the “theorising and socialising” which characterises this discourse and then to make “timely interventions” in order to scaffold effective learning. It is hoped that LLUK will promote an understanding of these changing communication patterns as part of future proofing the lifelong learning workforce.

UCU

As e-learning develops into learning in technology-rich environments the role of the practitioner changes; they need their traditional subject skills but also need the ability to support learning in an expanding range of contexts. A new set of learning management skills are emerging which need to be deployed dynamically. Unions need to ensure that their member’s new skill sets are adequately accounted for in ITT and CPD and are both supported in deployment and rewarded adequately.

Institute for Learning

It is hoped that the Institute for Learning will have similar concerns for its members in the Learning and Skills Sector

TDA

It is hoped that the TDA will look at these findings and identify ways to develop

Transformational Government Agenda

Part 5; Summary of this Post Systematic Review work

The **Roundtable** outcomes focussed on four points from the Systematic Review; firstly the definitions of e-learning which were seen as needing to be extended to account for the changed nature of communications (“theorising and socialising”) around learning, secondly the “Five Factors of e-learning” which were seen as needing

built on self-assessment and self-review, moderated through inspection, which will enable the adaptation to the transformational nature of “learning in technology rich environments” indicated here.

2. Learning, e-Learning and evaluation

2.1 Introduction

4. Trialability – the extent to which an innovation can be experimented with on a limited basis. New ideas that can be tried out in a gradualistic or partial manner are adopted more quickly than those that are not divisible. ‘An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn from doing’ (p 16).
5. Observability – the visibility of the results of an innovation. If individuals can easily observe the results of an innovation then they are more likely to adopt it.

The attributes of an innovation such as e-Learning can be judged, for instance, based on its relative advantage (is it better than what was available before?), compatibility and its observability (can we see that it is better?). The diffusion of innovations model will have relevance when looking at Kirkpatrick’s fourth level of evaluation – the impact of e-Learning on the organisation.

However before looking at e-Learning as an innovation, where the focus is on the role of the mediating technology and infrastructure, it is important to first look at theories of how we learn. What influences the quality of the learning?

2.4 Learning theories

One question that could be asked at the start of a review of e-Learning in the post-16 sector and specifically in higher education, medical education and work-based e-Learning is – Is the learning qualitatively different from that in the school sector? For instance, as post-16 education is not compulsory, motivational factors can play a different part in learning. However despite the differences there will still be generalisations about how we learn. It is therefore useful to revisit theories of learning in instructional contexts.

Laurillard (2002) suggests that a conversational framework model is needed in higher education which entails a discursive, adaptive, interactive, and reflective approach by both the teacher and the learner. This approach is not often considered within the context of work-based e-Learning where the notions of training and instructional design (e.g. Gagné, 1985) are the dominant approaches. Learning theory is sometimes implicit rather than explicit in the literature on the effectiveness of e-Learning in higher education, work-based e-Learning and medical education.

2.4.1 Learning theory and work-based e-Learning

As early as 1913 Thorndike (cited in Byrnes, 2001) described a theory of learning where neurally-based associations between situations and responses regulated learning for the student. Teachers primarily used rote repetition and rewards to encourage learning. This theory is related to Gagné’s (1962) conditions of learning approach that is the underlying thinking behind instructional design and therefore used extensively within the work

Coffield, Moseley, Hall & Ecclestone (2004) did not find learning styles to be as unproblematic as some have suggested. They carried out an evaluation of the concept of learning style and its potential use in post-16 education and training for the Learning and Skills Development Agency and identified 69 theory-based models of learning style which have been productive in terms of research and/or practice. They grouped these into six categories of learning styles which they evaluated

learning styles or learning styles are made aware of the learning styles of their students

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information in smaller units and giving the student enough time to learn the units or (2) organising single pieces of information into clusters that form 'chunks'. All these strategies would be useful in an e-Learning environment and again relate to prior knowledge and problem solving strategies.

Vygotskian notions of knowledge and learning are used in the e-Learning literature, particularly in higher education, when looking at the effectiveness of collaborative learning environments. For Vygotsky (1962, 1978), knowledge was made up of concepts and functions. Unlike Piaget, he focused on particular concepts known as categories by which he meant a class of things that had a label (e.g. a square). Language, thinking, perception, attention, and memory were termed functions and Vygotsky considered language to be of particular importance. Knowledge acquisition is the process of internalising the language and actions of adults and more able peers. Properly organised learning results in mental development but is not equivalent to development per se. Vygotsky emphasised the importance of the zone of proximal development (ZPD) '...the distance between a

3. Review Methodology Applied

primarily on the teachers but also gave information on the learners. The studies varied in their design from experimental to the more naturalistic and observational. The majority of the studies were in the secondary or post-secondary sectors and were carried out in Australia, the UK, USA, and Canada. Not all these studies would be relevant to this present review of e-Learning in the post-16 sector. Hassan et al's review concluded that although the studies reported positive findings for synchronous audiographic conferencing no study was used in the in-depth review as they did not meet the inclusion criteria. The authors of this review recom

4.2.4 Summary

There are few systematic reviews of the evidence for the effectiveness of e-Learning in higher education. In a meta-

their lessons via mobile phones and 93% felt that it was a valuable teaching method (Thornton and Houser, 2005).

Attitudes to e-Learning can be influenced by both personal and situational factors. The role of individual attitudes toward the web as a survey tool based on theories and personal perceptions was explored by Huang and Liaw (2005). They used a survey to

collaborative learning. This study also pointed to the individual needs of students in terms of assessment requirements thwarting some collaboration.

4.3.3 Mixed attitudes

It is essential to provide students with experiences in online collaboration (Reisslein, Seeling and Reisslein, 2005). However in Reisslein et al's study they found that although the students (33 on-campus students and 4 distance learners split into 8 teams) had very positive attitudes toward the project they were indifferent to the online aspect of the project. Nearly half of the students indicated that what they liked least about the project was that it was all online and over a third indicated that having some project work face to face would improve it. This is an argument for a blended approach to learning that takes into account the students' need for some face to face interaction. How social interaction can be achieved in a virtual environment is one of the foci of social presence research.

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4.3.4 Summary of studies, comparison with previous reviews and recommendations for future work

Students' satisfaction with their learning can vary dependent on **context** and this includes their **skill level**. In one study students preferred virtual lectures to web pages and positive attitudes were expressed for a **blended learning** format (part online, part face to face) compared to a traditional course. The **quality of the interaction with the tutor** was a factor that influenced student satisfaction. In another study, students' attitudes to the web were influenced by their judgment of their own capabilities to achieve a

4.4.1 Effective e-Learning and learning styles

Hypertext has been used in a number of studies to explore how students learn effectively. This has relevance to the development of learning skills and also to learning styles. Bromme and Stahl (2005) described how 40 psychology students with no previous experience of hypertext construction were given introductory explanations on the text format 'hypertext' based on either a book (linear) or space (non linear) metaphor. The focus topic was linking nodes about the internet and a 'prior knowledge of the internet' test was given before the task was undertaken. The book metaphor produced a more linear way of viewing hypertexts and this conflicted with the complexity of the content to be processed. The 20 students in the space metaphor group created significantly more links than the 20 students in the book metaphor group. Based on these findings it was claimed that the book (linear) and space (non-linear) metaphors had significantly different effects on the constructed hypertext, the construction process, and knowledge acquisition. The space metaphor is more useful for preparing learners to deal with the complexity of content structures and hypertext structures. However it was acknowledged that performance on a knowledge test showed that metaphorical knowledge does not ensure deeper learning processes i.e. the space (non-linear) metaphor students did not gain more knowledge about semantic relations and more transfer knowledge than the book (linear) metaphor group. Therefore it would seem in this study that the hypertext did not facilitate deep learning processes.

Another study using hypertext questioned the link between an individual's preferred cognitive style (this can be understood as learning style) and the manner in which they access information (Calcaterra, Alessandro & Underwood, 2005). This study looked at the influence of cognitive style (analytical-sequential (linear) vs holistic-intuitive (non-linear)), spatial orientation and computer expertise on hypertext navigation patterns and learning outcomes when 40 undergraduates interacted with a hypermedia presentation. Calcaterra et al. referred to the argument that hypermedia should facilitate learning because of its similarity to human associative memory. This is related to the schemata theory of learning where meaningful learning occurs when students integrate fresh information into an existing schema or when a new schemata is created by acknowledging similarity to existing schemata. However the researchers found that hypermedia navigation was linked to computer skills rather than to cognitive styles and that neither cognitive styles nor abilities affected learning outcomes (as measured by a post test). Higher performance was associated with re-visiting hypermedia sections and visiting overview sections in early stages of hypermedia browsing. This type of behaviour is related to self-explanation and deep learning and is related to a constructivist approach to learning.

So are prior knowledge and also computer skills more important than learning style in computer environments? Mitchell, Chen & Macredie (2005) stated that it is a student's prior knowledge that makes a difference in terms of their learning and argued that hypermedia allows for less knowledgeable students to make greater improvement than knowledgeable students. This means that an understanding of a student's prior

These different learning preferences or styles would seem to be fixed according to the studies presented so far. In fact, Dunser and Jirasko cite Ramsden (1988) who stated 'Learning styles can be described as the habitual use of a set of similar strategies. Thus they indicate a learner's learning behavior, which is more or less stable'. This would seem to be the general opinion of researchers designing experiments using hypermedia/hypertext. This notion of a fixed and immutable learning style possessed by each learner allows for experiments to be designed on the basis of this being a stable variable. However, the lack of consensus across these studies would seem to have brought the stability (and description) of this variable into question. This is also confirmed by Coffield et al., 2004 who point out that almost all learning styles in the models that they evaluated were assessed using self-report methods. This seemingly simple task (assessing learning styles) is complex as so many learning styles models and instruments are being developed.

4.4.2 Comparing the quality of the learning

There are not many direct comparisons between traditional and online learning partly because, as the DfES in the UK argue, 'Traditional teaching methods and e-Learning can and should complement each other' (DfES, 2005). However one proposed method of gauging the learning gain (effectiveness) is through the comparison of online learning

Does the presence of a tutor or instructor in different learning environments have an effect on the quality of the learning? In a qualitative approach to learning Heckman and Annabi (2005) described the similarities and differences in the learning processes that occurred within a face to face (FTF) environment and in an asynchronous learning environment (ALN) with 120 students in four groups. Using discourse analysis they measured the content-relevant communication between learners and instructors. The results were analysed in terms of the discourse process where it was found that the number of utterances in the average FTF were greater than the average in the ALN. The teacher presence was more evident in the FTF compared to ALN. The FTF discussions were more question driven whilst there was more indication of continuing the thread in the ALN. In terms of the teaching process – there were more examples of traditional teaching in the FTF with 125 instances of direct instruction in FTF and

attendance at lecture. The students in the online environment could work through voluntary comprehension checks but only 50% took advantage of this. Students could print out the modules stripped of the comprehension checks and all interactive material. There was an indication that performance on final exams suffered because of the omission of the interactive aspect of the online course. The results of this study again presented the case for blended learning. Scheines et al. make a valid point in terms of the potential effectiveness of any e-Learning environment - it is important to build online learning environments that support students not only with content and interactivity but also with *advice* as to how best to exploit the resources available.

4.4.3 Motivation, self-efficacy and assessment

effectiveness of the active learning exercises. In terms of motivation, the hybrid cohort

learning environment (ALP) that was designed as a game-like realistic simulation in which students played the role of a junior consultant. The results showed that although there was no significant relationship between intrinsic motivation and the

One indicator of motivation is when students choose, voluntarily, to engage in learning outside the compulsory requirements of a course. Grabe (2005) looked at the



Engaging learners through interaction with the medium can support deep learning and familiarity with the internet will enable those users to exploit interactive features (Ford & Murphy, 2002).

4.5.1 Interaction and Collaboration

construction appeared. By higher knowledge they mean the knowledge as categorised by the 5 phase model of; sharing/comparing, dissonance/inconsistency, negotiating/co-construction, testing tentative constructions, statement/application of new knowledge. This was a study of collaborative learning based on a proportion of data taken from a massive data set using 23 groups of 10 students over 4 months. This study highlighted the fact that immense amounts of data can be available from virtual interactions.

Collaboration in most studies is seen as a 'good' outcome or process even if the motives of the students are more individual and competitive than collaborative. Reisslein, Seeling and Reisslein (2005) argued that it is essential to provide students with experiences in online collaboration. The study focused on an online team design

environment? This could lead to decreased motivation, fear of failure (to communicate), low self esteem, and anxiety. A shared environment could be perceived as more threatening to the less computer literate.

4.5.2 Summary of studies, comparisons with previous reviews and recommendations for future work

Collaboration is seen as the sharing and exchanging information and high levels of participation can be gained by setting up structural incentives and social pressures. Different environments encourage different types of **collaborative behaviour**. A shared workspace can be used as a location-

Learning. Twigg (2003), in an extensive USA study made strong claims about the improvement of quality and the reduction of costs linked to e-Learning. The study monitored the progress of a programme whose purpose was to encourage colleges to 'redesign their instructional approaches using technology to achieve cost savings as well as quality enhancements' (p 1). The first round of projects involved ten institutions over two years from 1999 to 2001. It was set up as the pilot project for the overall program and redesigned courses included sociology, statistics, mathematics, computer literacy, American government, astronomy, psychology, chemistry and algebra. Five of the ten projects reported improved learning outcomes, four reported significant difference and one was inconclusive. Most of the learning outcomes were based on tests/grades. Seven of the ten projects showed improvement in course completion/retention rate. All ten projects made significant shifts to a more active learner-centred enterprise. The most effective quality improvement techniques as reported by the ten projects included: continuous assessment and feedback, increased interaction among students, online tutorials, and undergraduate learning assistants (ULAs).

In terms of cost reduction strategies and successes, Twigg reported that the approach most favoured (7 out of 10 of the projects) was to keep student enrollments the same while reducing instructional resources. Seven of the ten projects showed a decrease in drop/failure/withdrawal (DFW) rates. The most effective cost savings techniques, taking into account that the single most costly item was personnel, were reducing faculty time and transferring some tasks to technology assisted activities. The main techniques used by the projects included: online course management systems, online automated assessment of exercises, online tutorials, shared resources, staffing substitutions, and reduction of space requirements. This program encouraged colleges to redesign their instructional approaches in order to use technology to achieve cost savings as well as quality enhancements. The learning outcomes however were less clearly defined. The courses were diverse (e.g. sociology, algebra) and there was no insight into any differences between the courses in terms of measurement of learning outcomes and students response to the learning.

5. How compelling is the evidence for the effectiveness of e-Learning in medical education?

Greenhalgh (2001) produced a systematic review of computer assisted learning (CAL) in undergraduate medical education. In this review she listed the decisions to introduce CAL into the undergraduate curriculum, which include; (1) it is convenient and flexible with possibly fewer face-to-face lectures and seminars therefore placing fewer geographical constraints on staff and students (2) it is suited to subjects that are visually intensive (3) the possibility for personalised learning where learners can progress at their own pace (4) once an application is set up the cost of offering it to more students is relatively small (5) a medical school using e-Learning extensively might have a competitive advantage (6) the ultimate goal of higher education is achieved – linking people in learning communities (7) the virtual campus can potentially alter the relation between people and knowledge. She points out that

- Reduced funding, rising student numbers, geographical dispersal, and increased competition in a complex global market have put medical schools under pressure to embrace computer assisted learning.
- New technologies may have important educational advantages, but without support and training for staff and students they could prove an expensive disaster.
- Expansion of computer assisted learning requires cultural change as well as careful strategic planning, resource sharing, staff incentives, active promotion of multidisciplinary working, and effective quality control (Greenhalgh, 2001 p 40).

Greenhalgh's review of articles on CAL in medical education identified 200 potentially relevant studies that reported on comparative studies where the same topics had been taught using traditional and computer-based methods.. Only 12 of these were 'prospective randomised studies with objective, predefined outcome criteria' (p 41). The 12 studies were diverse and were therefore not directly comparable. But a general overview of the studies provided indications that about half showed significant differences between conditions (n.b. some studies were not direct comparisons of online and traditional learning). Interestingly, Greenhalgh states that most studies had methodological problems which included lack of statistical power, potential

- 5 studies reported statistically significant differences in outcome measures (scores on multiple choice, written or oral tests, and clinical performance) favoring CAL over comparison group(s),
- 6 studies reported no statistically significant differences.
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medical education looked at the reactions of the learner and participant satisfaction. They found that there was limited research demonstrating any change in behaviour linked to e-Learning and recommend evaluative research on web-based CME ‘...to examine in greater detail the *nature and characteristics of those web-based learning technologies, environments and systems which are most effective* in enhancing practice change and ultimately impacting patient and health outcomes’ (p 561, our emphasis).

According to Sandars and Walsh (2004) there has been increasing interest in e-Learning for general practitioners (GPs) in the UK. They suggested that it is important that future developments and policy decisions regarding GPs and e-Learning are evidence-based. They reviewed the literature of the past five years (1998 – 2003) in which e-Learning had been used by GPs for continuing professional development, and also for training future GPs. They identified 352 articles and out of these 29 were relevant to the review. The majority of the studies identified were carried out in the USA and Canada with only two studies that had been performed in the UK. There were only two studies that resulted in changes in clinical or professional behaviour. Furthermore there were no studies that compared different methods of e-Learning. They found no reviews that evaluate

The literature on mobile technologies in the health context was reviewed by Walton, Childs & Blenkinsopp (2005). They found that most mobile technology applications were occurring in the USA. At the time of the review, in 2004, 'the most prevalent mobile technologies were PDAs, laptops, WAP phones and portable radios with use being concentrated around doctors in the acute sector' (p 51). They also identified a range of advantages and disadvantages to the technology. In their review they found that mobile technologies were mainly being used for clinical rather than learning applications and that students showed a low level of awareness of the technology but placed great importance to accessing learning resources from the community. They point out that there are many developments and changes in mobile technologies and that since their review, podcasting and videocasting is now being used by health professionals. However mobile technologies are not yet used widely enough to enable, for instance, nursing students to remotely access learning resources. The reasons for this are:

- low level of student awareness,
- limited relevance of software and limitations in the hardware

did they think about the process? Previous reviews have shown that factors that influence the reaction of students to e-Learning include; levels of computer expertise, the skills of the novice computer user, computer anxiety, different online learning environments which require different skills and learning styles, and the students awareness of the potential of a particular system or application. The initial focus in this section is on interactivity, flexibility and ease of use and then issues of confidence, self-efficacy, and the influence of computer experience are raised.

Doyle (2002) referred to Kirkpatrick's four levels of evaluation in relation to the evaluation of medical simulation programs. He described the four levels as involving four kinds of measurement (1) Reaction/measurement of satisfaction – how did the

year dental students (n = 113) found that the important features of web-based

the medical decision making facility th

a computer in their medical studies. In most studies discussing e-Learning and medical education the proportion of male and female participants is not reported. This study is therefore unusual although the findings are not reported extensively.

5.3.2. Understanding what is possible: Confidence and self efficacy

A key issue when discussing computer confidence and medical education is to ask whether this has changed over time. An intuitive answer would be yes. Certainly in e-Learning in higher education it has been shown that there was a difference in computer

questionnaires where students confirmed that the program was easy to use and that their confidence in planning oral rehabilitation had been enhanced through using simulated patients. This means that, although there were a number of interesting aspects of this study, self reported confidence measures of 12 students cannot be accepted as a robust finding. However this paper did include an example of the type of study that could be expanded.

Another example of self-reported effectiveness was a study to assess the utility of internet-based training in airway anatomy and evaluation. Euliano, Lee, Melker & Schmalfluss (2003) looked at whether 80 individuals (including medical students, nurses and surgeons) who completed pre and post tests on airway evaluation found the internet based training useful. The majority of students felt that their knowledge of airway examination improved after completion of the virtual tasks on the internet site. This essentially means that their confidence had increased.

The issue of confidence is not directly mentioned but is implicit in a study by Weicha, Gramling, Joachim & Vanderschmidt (2003) who believe that advances in electronic technology have created opportunities for new instructional designs of medical curricula. They described a qualitative study with ten students from two medical schools after a 4-week online elective course for medical students to teach the cognitive basis for interviewing skills. The students firstly studied online modules on interviewing concepts and viewed videos illustrating the concepts. They then participated in asynchronous discussion groups designed to reinforce course concepts, stimulate reflective learning, and promote peer learning. The results of this study included the learners reporting (1) improvements in self-awareness (2) increased understanding of interviewing concepts. This is related to the information processing

5.3.3 Summary: Perspectives on technology

The students' and practitioners' reactions to e-Learning concur with previous reviews which have shown that levels of computer expertise and the skills of the novice computer user are important. Although computer anxiety is not mentioned specifically in our review, related issues were raised linked to self-efficacy and

students to work with. To counter these problems Bergin and Fors (2003) developed an interactive simulated patient (see also Bergin et al. 2003 below).

But how well does this interactive media work? An early study by Jaffe (1997) explored whether the students ($n = 72$) gained greater knowledge if they controlled the information sequence in interactive media and whether different information processing styles influence the manner in which media interactivity affects self-efficacy in a particular knowledge domain. The findings from this study included:

- The higher interactivity group (who could control the information sequence in interactive media) did not show higher degrees of conceptual knowledge
- The interactive media users who indicated a preference for help-hints showed greater self-efficacy gains than those who preferred perseverance or those who used less interactive media.

This is an interesting paper that relates self-efficacy to use of interactive media. Jaffe argued, based on his findings, that interactive media, including hypermedia, may not be the 'magic' of

5.4.2 Comparing the quality of the learning

Is there a difference between classroom teaching and learning on the web or from a CD-ROM? Are different types of online learning or a combination of online and face to face learning more effective? Does the context and what is being taught play a part?

In a large-scale, straightforward comparison between online CD ROM training and instructor-led training for nursing staff (n = 1,294) it was found that the computer-based training was significantly more effective than the face to face instruction based on performance on a knowledge test (Harrington and Walker, 2004). The training was on a fire-safety programme and it was found that the online learners took less time to

In a more recent study Karnath, Carlo & Holden (2004) investigated learning of pulmonary auscultation using computer-based learning alone or combined with faculty led teaching it was found that there was no difference in learning between the students who used computer-based learning alone (n = 113) compared to the students who used computer-based learning combined with faculty led sessions (n = 79). However the students who received faculty teaching did perform better than those that did not although this difference was not significant.

The deficienc

problem which they had to solve. They could only proceed to the next part of the tutorial when they had typed a response explaining their clinical decisions.

The personal touch is evident in this study where the researchers acted as moderators by participating in web discussions and providing formative feedback. Each group of students also met their facilitator three times a week. The students could log in from any terminal and discuss the eight clinical case studies representing orthopaedic problems. The control group attended lectures, bedside tutorials, ward attachments, and outpatient clinics. The teacher contact in both the intervention and the control group was similar. At the end of the 3 week module students were assessed by computer based assessment, a clinical examination test and also with patients on the ward. There was no difference between the two groups on the premodule test results. However when the postmodule results were compared the mean score for the intervention group was significantly greater than the control group. There was also a significant difference in the time spent in the wards beyond that allocated for bedside tutorials with the control group spending an average 5.15 hours and the intervention group spending 7.0 hours. This could mean that the scenarios provided to the intervention group provided them with the confidence to engage in clinical problem solving.

The designers of this intervention wrote enthusiastically about their intervention and had obviously put a lot of time and effort into it. They were almost willing the intervention to work. However they acknowledge this factor 'The enthusiasm of the facilitators ... and the intensification of their interaction with students may have been significant contributing factors'. They argued that web based tutorials stimulate students to think and may complement the teaching resources of clinical departments. It could be added that the enthusiasm and involvement of the researchers in these circumstances also had an impact and contributed to the effectiveness of the intervention.

In order to use distance education effectively, healthcare professionals need to be prepared. Bangert et al. (2002) interviewed 57 healthcare professionals - the majority of whom were doctors. The aim of their study was to conduct an educational needs assessment as part of an overall programme to create a set of web-based interactive distance learning modules. These interactive modules were designed to enhance the utilisation of telemedicine by health care providers and improve the quality of the learning. The study identified four learning clusters (1) fundamentals of telemedicine (2) clinical applications (3) organization and management (4) technical systems. These clusters informed the structure of the web-based interactive curriculum.

5.4.3 Summary: Quality of learning

The educational or training context was an important factor that influenced how well an e-Learning intervention worked, as different studies came to conflicting conclusions. A key factor is the personal involvement and enthusiasm of the facilitators.

Previous studies have confirmed that the contextual differences means that it is difficult to make comparisons across studies. Even when comparisons are made there are conflicting results as to whether blended learning works better than traditional learning.

We recommend that any comparative study of the quality of e-Learning in medical education should also use at least one other level of evaluation. The contextual nature of learning can be explored at the individual level through gauging the reactions of the learners either through self-report or observation of their behaviour (or both), or at the organisational level by looking at the impact that e-Learning has on the institution or organisation. We also recommend that more qualitative studies looking at the influence of the personal involvement of the tutor are undertaken.

5.5 Does e-Learning alter the behaviour of the learner?

In this section the evidence for whether e-Learning changes the behaviour or performance of the learner is examined? In a review of e-Learning for general practitioners, Sandars and Walsh (2004) found that there is increasing interest in e-Learning for general practitioners (GPs) in the UK. However after reviewing the literature of the past five years in which e-Learning had been used by e W0 T Tthny rund

updateable handheld computer knowledge access system the physicians used the handheld devices in their clinical environment for a 12-month intervention period. The intervention was evaluated by tracking use of the handheld computer and by conducting surveys and focus group discussions. Before and after the intervention period, participants underwent simulated patient care scenarios designed to evaluate the information sources they accessed, as well as the speed and quality of their decision making. Participants generated admission orders during each scenario, which were scored by blinded evaluators.

The results from this study showed that ten physicians (59%) used the system regularly, but predominantly for non-medical applications. Eight out of 13 physicians (62%) who completed the final scenarios chose to use the handheld computer for information access. This group exhibited a significant improvement in admission order score as compared with those who used other resources. It was concluded that an updateable handheld computer system is feasible as a means of point-of-care access to medical reference material and may improve clinical decision making. However, it was acknowledged that acceptance of the system was variable. Improved training and new technology may overcome some of the barriers that were identified. This is very definitely an area where more resehe3 (f) 9 (e)3 ()] TJ ET Q&9 (-3 (47.56e)1 (h) 9 (22 (-3 12 (e) 8 () 1

in 2002 (n = 24). Assessment of percentage of students accessing the site, attendance rates at face-to-

In a 2005 Becta report 'Research into the use of ICT and e-Learning for work-based learning in the skills sector' a definition of work-based e-Learning is proposed 'The delivery and administration of learning opportunities and support via computer, networked and web-based technology to help individual performance and development, undertaken in or linked to the workplace'.

curriculum, United Health use distance learning technology to provide access to course work, and the Ford Motor Company offer training via a digital worldwide network.

Taylor (2003) suggested that corporate universities (CUs) are a corporate response to educational deficiencies and that the boundaries between education and business are becoming less distinct. The corporate university serves the needs of people within that organisation. For instance, Motorola University - one of the first corporate universities - provided basic numeracy and literacy skills for employees who had missed out on a full education. Taylor (2003) discussed the CUs in terms of higher education symbolism and practice and points to the utility of the term for raising the status of training and development through 'relabeling'. He suggested that higher education has been getting closer to corporations through the funding of academic posts and students by multinationals. Corporations have also been getting closer to higher education in their emulation of and perhaps their competition with HE institutions (Taylor, 2003).

Birchall and Woolfall (2003) in their UK report on corporate e-Learning discussed five companies who aim to 'improve overall productivity through e-Learning' (p 3). They also interviewed senior learning and development executives in manufacturing, retail, defence, telecommunications, professional services, aggregates and automotive services. Looking to the future they assert that the focus should be on increasing 'levels of learner engagement and participation, integrated approaches to design and delivery, a stronger business case and the effective management of resulting projects' (p 2). They make a key point about evaluation – there needs to be an improvement in how the impact of e-Learning 'on the bottom line' is evaluated, otherwise senior management will be unconvinced of the business benefits.

6.3.2 University for Industry (Ufi) and Learndirect

Ufi Ltd is the organisation responsible for 'Learndirect', the largest government-backed supported e-

6.4.6 Summary of other reviews

subjective norms (social influence) would be related to increased system misuse. It was found when attitudes are poor and subjective norms are high then there is a non-linear tendency to misuse the technology. This means that engineers using the system were likely to pretend to use the technology but ignore or misuse its 'output' and this misuse could be attributed to social influence. Workman suggests that strong subjective norms (social influence) are more likely to affect *how people use a technology rather than whether they actually use the technology*. It is also suggested that these findings are related to trust in the system. This study raises the issue of motivation linked to individual characteristics (the appraisal of how easy it is to do something) and social influence (how people who are important to the individual can affect their behaviour). Another study using the theory of planned behaviour (Luarn & Lin, 2005) explored the 'behavioral intentions' of individuals (n = 180) to use mobile banking. This paper addressed issues of attitudes to technology.

It is worthwhile introducing a note of caution into the discussion of the empowering nature of e-Learning. Macpherson, Homan & Wilkinson (2005) described case studies of three corporate universities. They suggested that e-Learning is no more likely to motivate the person who doesn't want to learn than any other form of learning, and therefore the problem of motivation remains. They further argue that the lack of the assessment of the learners' experience is a problem: 'the learner's voice is almost silent in the assessment of e-Learning' (p 45), and that the culture of the company may play a significant part in the acceptance, or not, of e-Learning. The learner's voice is of course important and is not discussed extensively in the work-based e-Learning literature. Therefore it is useful to explore the notion of user consultation as a more indirect measure of the learner's voice.

6.5.2 User consultation: understanding the learning needs and capabilities of the learner

The literature on user consultation covers a wide range. The term usability did not feature in the higher education review but is referred to in the WBL literature. It can be defined as an evaluation and measurement of a computer program's overall ease-of-use. In this sense usability can be seen both as an outcome and as a process. For example, outcome measures are used by Calisir & Calisir (2004) who look at the relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with enterprise resource planning systems. They use a usability characteristics survey to assess end-users' satisfaction (n = 51) and focus on the practical aspects of a system already in place. This type of study does not really address users' needs in the same way as user consultation, where users are consulted while the design of the system is being undertaken. Olsson & Jansson (2005) report on a participatory design with train drivers. They suggest that participatory design creates an efficient learning process where decisions are backtracked and revised. In order for users and designers to communicate effectively and create a design they suggest that there needs to be:

- Mutual respect – where users are taken seriously and feel that their knowledge counts
- Active participation on equal terms – it is useful to let users outnumber designers
- Common goals – both users and designers share common goal of design of future interface
- Common language – in depth discussion will lead to common domain language
- Two way communication – designer must listen carefully to the users' narratives
- Reflective design - refrain from immediate implementation thinking – designers need to avoid thinking about solutions immediately. The discussion of technical constraints may distract from more important implementation issues.
- Simple tools that reveal what the work is about – simple sketching tools work best

These points have been raised before in a previous section but warrant another

6.5.3 Why Flexibility is Important

6.5.4 Barriers to e-Learning: Computer experience and computer anxiety

The importance of computer experience is highlighted in a number of papers. Ford & Murpy (2002) claimed that an organisation must be able to assess the IT skills required by their workforce to enable them to use computer based training effectively. They also argued that completion of training needs to be tied in to a professional development scheme. Computer experience was also discussed in relation to the size of an organisation. Kekeale, Pirolt, & Falter (2002) stated that their results suggest that most small companies are not yet ready to use the latest IT technologies in their personnel training. Furthermore new IT solutions rarely produce what they promise for small companies. It seems that not many of the IT solutions are developed with small companies in mind. They suggested that to enable small companies to take advantage of IT solutions there needs to be (1) more effective system of dissemination of best practices organized either by training providers or by local national policy actors (2) work towards raising the general IT literacy level among adults especially among the SME workforce.

A number of issues linked to computer experience as a barrier to use were raised by Rhodes & Carter (2003) when they described a project that aimed to develop collaborative learning amongst networks of suppliers and to extend accreditation achieved in the workplace. The focus of the research was on the automotive sector. There were 4 project objectives (1) the clarification of organisational and inter-organisational learning needs (2) identification and utilisation of distance learning technologies matched to SMEs learning needs (3) support for SMEs to expand their innovative capabilities (4) investigation of ways that ICTs might support an inter-company context. The main question was: 'How could practical engineering-centred workshops be integrated with computer-based activity and reflective learning?' (p 277). A number of factors that were mentioned:

- Unfamiliarity with the web – good quality web based materials

and computer anxiety. Solutions to the computer anxiety problem seem to be user involvement, training and a work design that permits sufficient interpersonal relationships and social support.

6.6 What is the quality of the learning?

In this section we look at the quality of the learning experience And gthe factors that influence it.

Overall, there was no support for the hypothesis that the multimedia participants would perform and retain content better than manual condition participants. The presence of a trainer had a negative effect on recall of information for both the

interface for learning from emergencies. They described how the simulation interface appeared to team members, how agents are integrated and how shared mental models are the intended outcomes. Here they are suggesting that using simulations alters the behaviour of the learners in emergencies.

Behaviour in terms of collaboration and communication combined with user consultation on a larger scale was investigated by Russell, Calvey, & Banks (2003) who explored how small and medium sized firms (20 UK companies) that produced e-Learning materials collaborated and communicated with their clients, external agencies and end users. They visualised the steps as (1) the sourcing of the content from the client (2) the increasing need to draw advice from external 'learning experts' (3) the involvement or conceptualisation of the end user in the development process. Russell et al. raised the issue of 'how firms can effectively interact and collaborate with others in order to create, distribute and evolve effective e-Learning products' (p 34). They proposed that there are 3 interlinked issues for businesses in the e-Learning field: learning about learning, acquiring subject knowledge, and learning to become part of a wider community. They argued that these issues cannot be conceptualised through the communities of practice but need to be extended to 'learning communities'. By this they mean that the creation of e-Learning products requires 'new convergences of technology, media, skills, and, increasingly, individuals and organisations themselves' (p 42). This point is related to the diffusion of innovations model where the

the flexibility of the system and the choice on the part of the employee to engage in this informal communication behaviour.

6.7.3 Summary of studies, comparison with previous reviews and recommendations for future work

based learning was also mentioned. In addition to the difficulty in assessing how much e-Learning costs, for some organisations (and perhaps this is relevant to the sector - see Hills and Kappler's review, 2004) there is also an unwillingness to incorporate e-Learning into their business practices.

An example of unwillingness to incorporate e-Learning into to business practice is an study of the usage of the internet and the perception of online learning in small and medium sized hotels in Austria, Ireland, Great Britain and Switzerland (Collins, Buhalis & Peters, 2003). A questionnaire was sent to 250 hotels in the four countries and 55 questionnaires were completed (22% response rate). Limitations that were acknowledged in this survey included the hoteliers' response to the 'academic' research which was seen as having little relevance in helping them understand e-Learning. The majority of respondents (93%) used the internet as a mechanism to promote the hotel. Hotels did not use the internet for inter and intra-

- Trialability - can it be tried out without taking it on in its entirety?
- Observability - can we see that it is better? Can it be seen to work?

A culture that supports new ways of delivering learning is essential and requires

7. What works? How do we know it works? What are the factors that influence how well e-Learning works in the three sectors?

In the reviews of the evidence for the effectiveness of e-Learning in higher education,

Table 7.1 Key factors that influence how well e-Learning works in the higher education, medical education and work-based learning

7.2 The experience of e-Learning in higher education, medical education and work-based learning

There are similarities across the three sectors in terms of what influences the learner or trainee's satisfaction with e-Learning. An important factor is individuals' confidence

undergraduates and learners in the workplace but was rarely mentioned in the medical education literature.

7.4 Changes in behaviour due to e-Learning in higher education, medical education and work-based learning

Studies of changes in behaviour as a consequence of e-Learning inevitably focused on the social aspect of learning. Collaboration, creating a social environment and becoming part of a learning community were facilitated as a result of interacting in an e-Learning environment for both undergraduates and learners in the workplace. Some uncertainty

where we are trying to compare studies and interventions, which at first sight seem comparable e.g. two studies of students' attitudes to blended learning. In the field of e-Learning where there are as many attitudinal scales as there are students' attitudes, comparison is not always easy. There can be no comparative measure of students'/learners' attitudes until we know that we are using the same scale. In

Finally, a fifth level of evaluation, the societal implications of e-Learning has only been touched on in this review. This is because there is very little evidence (see further discussion in next section). Our focus was on higher education, medical education and work-based e-Learning where the social implications were less relevant than if we had included, for example, a review of informal learning. In terms of methodology, the diffusion of innovation literature that divides the intervention into the type of attributes of an innovation (e-Learning) would be useful in developing research methods both at the organisational and the societal level. For instance, is e-Learning

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Welsh, E., Wanberg, C., Brown, K. & Simmer

Appendices

Appendix 1 . Definitions of e-Learning

1. Education

The Department for Education and Skills consultation document ‘Towards a Unified e-learning Strategy’ presents us with a broad definition

If someone is learning in a way that uses information and communications technologies (ICTs), they are using e-learning (DfES, 2003)

Brunel University (2004) equates an e-learning strategy with web-enhanced learning.

Bristol University (2003) defines e-learning as

The use of electronic technology and media to deliver, support and enhance teaching, learning and assessment. It includes elements of communication within and between communities of learners and teachers, as well as provision of online content, which may be locally generated or developed elsewhere (draft e-learning strategy)

2. Learning and Skills Sector

The term Information Learning Technology (ILT) is used, particularly in Further Education, to refer to the use of computer and communications technologies for learning and the management of learning (LSDA, 2003). The Learning and Skills Council (LSC) and the Learning and Skills Development Agency (LSDA) acknowledge that the term e-learning could be used in its place. They use a definition of e-learning which states that e-learning is a

Term covering a wide set of applications and processes, such as Web-based

learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive TV, CD-ROM, and more.

LSDA (2003) also define e-learning as

The use

resources (2) learning networks (3) contact, administration and assessment (4) information management skills.

4. Commercial/Training Sector

The Training Foundation's definition of e-learning is

A learning environment supported by continuous and collaborative processes

Refers to any type of learning that uses electronic media. It means many different things to people but is a popular media buzz word and should be avoided.

Appendix 4. Acronyms

BECTA British Educational Communications and Technology Agency

DES Department for Education and Skills

DOH Department of Health

DTI Department for Trade and Industry

HEA Higher Education Academy

HE Higher Education

HEFCE Higher Education Funding Council for England

JISC Joint Information Systems Committee

LSC

Appendix 5. Measures of effectiveness

Table A5.1 Measures of effectiveness of e-Learning based on evidence collated and 2nd Expert Seminar feedback

Process/outcome measures of effectiveness of e-

	'drop out'
Social relationships - feeling of connection.	Employability – e-Learning experience leads to greater value in job market.

Table A5.2 Factors that contribute to the effectiveness of e-Learning based on evidence collated and 2nd Expert Seminar feedback