

How e-learning can be used to enhance learning and teaching

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***Abstract:** E-learning based teaching uses computer and Internet (or Intranet) resources to provide a medium for student learning. This teaching medium is an alternative to traditional face-to-face teaching, and is not necessarily either better or worse. For instance, Schramm, in 1977, maintained that effective learning depends more on the content and instructional strategy, or the teaching and learning pedagogy, than on the technology used to deliver instruction. There are, therefore, two questions: can e-learning enhance teaching and learning? If it can, then how can teaching and learning be enhanced, relative to traditional methodologies, through e-learning?*

In this era of Internet-savvy students the blurring of boundaries between face-to-face instruction, and e-learning is breaking down. This paper examines the blurring of the boundaries to see if we can construct a new methodology that promotes the best aspects of both face-to-face and e-learning modes of instruction.

Can e-learning enhance teaching and learning?

In order to ‘enhance teaching and learning’ it is necessary to define the baseline against which the enhancement is to be measured. In this case the baseline is face-to-face, or traditional teaching and learning.

Bonk and Reynolds (1997) identify a necessary condition for promoting ‘higher order thinking’ – a characteristic of deep learning defined by Biggs (2003) – when they say that:

online learning must create challenging activities that enable learners to link new information to old, acquire meaningful knowledge, and use their meta-cognitive abilities.

However, this is also a necessary condition for face-to-face teaching, so it merely sets a condition for any acceptable teaching and learning pedagogy. Kozma (2001) suggests that computer technology holds a significant advantage over face-to-face teaching and learning since it is capable of bringing ‘real-life models and simulations to the learner’. While it is not implied that the computer itself is responsible for enhanced student learning, the appropriate design of real-life models and simulation, and the relevant instruction set, can, according to Kozma, lead students to enhanced learning through effective interactions with the models and simulations.

Similarly, Biggs (2001) feels that online learning holds the promise for enhanced learning, when he says,

...e-learning, when done well, can improve learning and deliver enhanced learning outcomes and has the prospect to transform the way education is conducted in these settings.

Another avenue for addressing the question is to look at the benefits of e-learning, remembering that these must be balanced against the disadvantages.

As Cole (2000) puts it, ‘online learning allows for flexibility of access, from anywhere and usually at anytime.’ This has distinct advantages over face-to-face teaching and learning for those students who are, for one reason or another, unable to access real life lecturers or tutors, either because of the location or time of instruction, or both. Cole cautions, however, that there is still a need for the e-learning instruction to ‘engage the learner and promote learning.’

Perhaps the chief disadvantage in learning through on-line studies is the lack of the immediate feedback that occurs in face-to-face interactions. This feedback more than just answers questions, but acknowledges the communication that occurs through eye contact, and body language. These potential drawbacks need to be understood, and overcome if enhanced learning is to take place in on-line settings.

In summary, we acknowledge that e-learning can certainly enhance teaching and learning for a proportion of people unable to access face-to-face instruction; it may also offer learning advantages to another proportion of people who would otherwise choose face-to-face instruction, but it is useless to those without computer access. For the purposes of this discussion we shall consider the case of people who have the option to choose between face-to-face instruction and e-learning.

How should teaching and learning be achieved through e-learning?

According to Ron Oliver (2003) the best pedagogies maximise the effectiveness of the learning setting and provide the greatest return on investment. In other words, it is sufficient to identify the best e-learning pedagogy in order to answer the question.

Oliver defines pedagogy as the science of teaching. However, *Pedagogies of Elearning* (2008) defines pedagogy more usefully as:

a set of learning theories that can inform us in designing and evaluating courses, learning and assessment activities that meet the desired educational objectives.

Traditionally teaching is seen as consisting of classroom lectures, tutorials, assignments and examinations. Courses are seen as discipline based and are intended to deliver content. Assessment is intended to judge the amount of knowledge acquired by the students.

Currently accepted, though not always implemented, pedagogies are quite different (see Russell, 2009a and 2009b). Learning is centred on the student and teaching involves the provision of resources for the student to achieve desired learning outcomes. Assessment, therefore, is intended to judge whether the student has achieved the learning outcomes and to what level.

Constructivism, one viewpoint on learning discussed in today's literature, involves the 'belief that learning is an active process, unique to the individual, where knowledge is constructed from information and prior experiences' (Cooper, 2004). Learning, therefore, is what happens inside a student's head, not what a teacher teaches a student.

Other viewpoints of learning include *behaviourism* and *cognitive psychology*. According to Anderson & Elloumi (2004) these involve:

- **Behaviourism** – the belief that 'observable behaviour' indicates whether or not a learner has learned something, and not what is going on in the learner's head.
- **Cognitive psychology** – the belief that 'learning involves the use of memory, motivation, and thinking, and that reflection plays an important part in learning.'

Some, such as Ertmer and Newby (1993), believe that all three schools of thought on learning can be incorporated into one 'taxonomy of learning'. Behaviourist strategies can be used to teach facts (the what's); cognitive strategies can be used to teach procedures and principles (the how's); and constructivist strategies can be used to promote higher level thinking (the why's).

However, it is probably true to say that the constructivist viewpoint is currently the most popular, and it has the greatest influence on developing better pedagogies for learning.

One way to enhance constructivist learning in an on-line environment, as discussed by Garrison, Anderson, and Archer (2000), is to develop a *Community of Inquiry*. In this environment the important elements are social, teaching and cognitive, and the interactions between each of them.

Social interactions are capable of alleviating 'misunderstandings and misinterpretations that can occur through a lack of social cues and face-to-face interactions.' The critical role of social learning is most commonly associated with the work of Vygotsky (1978).

A teaching presence guides or facilitates the learning process so that it is focussed on achieving specific learning outcomes. The teaching role is to construct the learning environment, organise and instruct the activities, motivate the students, provide guidance throughout the course, and provide feedback on outcomes.

The cognitive presence is the student's own ability to construct meaning from the environment. According to Biggs (2003) in his *SOLO Taxonomy*, the levels of constructed meanings range from the 'extended abstract' abilities involving theorising, generalising, hypothesising and reflection, to the 'surface learning' level of identifying facts and understanding simple processes.

In order to achieve the highest levels of learning and cognitive abilities in a discipline students should be presented with open-ended complex and challenging tasks (Biggs, 2003; Ramsden, 2003). While the collaborative environment helps to achieve the higher levels of understanding through discussion and reflection, it is up to the teacher to provide suitable tasks, and it is up to the student to construct the necessary levels of meaning.

Other ways of constructing meaning include 'critical', 'radical', and 'cognitive constructivism' (see, for instance, Kanuka and Anderson, 1999). However, social constructivism is thought to be the most appropriate or useful theoretical framework for on-line learning (Stacey and Rice, 2002).

How can teaching and learning be enhanced using on-line media compared with face-to-face instruction?

This is not an analytical question with quantifiable outcomes, as it depends on many uncontrollable influences, and qualitative inputs. Nevertheless, there have been some attempts to map out commonsense approaches to e-learning practices, based on the constructivist approach. One of these strategies, by Herrington & Oliver (2002), recommends the following six steps:

1. **Plan the intended learning outcomes** so that objectives are expressed in terms of 'learner performance and competency.'

An example for the course at the Systems Engineering and Complex Problem Solving (SECPS) course at University of South Australia is for students to be able to hypothesise on how the principles of systems engineering may be applied in a complex design project, and reflect on the critical issues and means for addressing them. Students for this course are postgraduates, who have worked as engineers for a number of years.

In the face-to-face version of the course the students need to carry out the learning process through instruction over either one week (in block mode away from Adelaide), or over five weeks for courses in Adelaide. On-line students are able to self-pace over a period of ten weeks, giving them a much greater 'soak time' – the time over which learning can occur. This allows the on-line students to develop a greater depth of understanding of the core material, an opportunity that is not available to the face-to-face students.

2. **Plan the learning tasks** so that learners engage in a variety of complex and challenging activities that demand higher order cognition and skills. The best tasks are meaningful and authentic.

An example from SECPS is for students to:

- Design a new Adelaide airport – carried out by the complete student cohort
- Design a major subsystem of a new Adelaide airport – carried out as a group
- Design a new bicycle network for Adelaide – carried out individually

The philosophy is for students to learn what the basic steps in the design process are supposed to be as demonstrated in the presentations, and applied to designing the overall Adelaide airport system. In their groups they are required to apply the same process to their choice of a subsystem of the airport. Every second week, groups post a PowerPoint presentation on the part of the process under consideration, and provide feedback on the work of the other groups. This culminates in an overall presentation by the group, which is handed in and graded.

Finally, they demonstrate all that they have learned by applying the process to another complex system, Adelaide's bicycle network. This includes constraints such as limiting Adelaide's carbon footprint, ensuring the system is cost-neutral, ensuring low maintenance costs and resources; and satisfying the needs of the major stakeholders, including government, public transport, motorists, pedestrians, and cyclists.

Students have to gather the necessary information, address the needs of the various stakeholders, construct requirements, carry out functional analyses, derive physical architectures, synthesise solutions, trade-off solutions to find the best one, and write the specifications of the chosen solution. Above all, however, the students need to clearly articulate and justify their choices.

These same tasks are carried out by the face-to-face students. The difference is that the on-line students are forced to plan their group activities to a larger extent, since they are not co-located, and there is a great deal more opportunity for useful feedback from the lecturer. This may not be intuitive, since the lecturer is available to give more direct feedback in the face-to-face situation. The difference is that in the on-line case the lecturer can continually guide the students towards the desired learning outcomes over an extended period of time. This makes a difference since the students take time to construct meaning in their minds.

- 3. Choose assessment strategies** – these need to be derived from the learning outcomes, and should not only judge their level of achievement of learning outcomes, but provide guidance to advancement in understanding.

Examples from SECPS are as follows:

Task 1 – design airport: no marks, as this is carried out as a class exercise

Task 2 – design major airport subsystem: formative feedback is provided for the intermediate presentations, including both peer assessment as well as instructor assessment. Marks are awarded for the depth of peer assessment, as well as for the final PowerPoint presentation with voice-over.

Task 3 – design cycle network: summative feedback is provided, and the marks contribute the greatest weighting towards the overall grade. This is an opportunity for students to demonstrate the highest level of understanding they have attained throughout the course.

Again, the same assessment strategy is followed in face-to-face mode, the only difference being the more extended use of peer assessment in the on-line mode. While peer assessment can also be used in face-to-face situations, it can work better through on-line comments since it may be seen as less confronting for the student.

- 4. Plan support strategies** – design the roles and interventions for the instructor and the other learners as peers.

For SECPS, the instructor provides weekly feedback on focussed questions in the course material, according to the inputs posted on the discussion forums, and provides additional inputs particular to the study for that week. Every second week the instructor provides formative feedback on the presentations. Peer assessment takes place within three days of posting the presentations.

The latest presentation of the course also involved two face-to-face meetings for most of the students, one at the beginning to introduce the course and assessment tasks, and one at the end to hear, judge and feedback on the final presentations. Interstate students were able to attend synchronously via teleconferencing. Additional synchronous meetings were held on-line using Adobe ConnectPro, at a time chosen by the students, particularly intended to set up the groups and their chosen subjects. These intense interactions were greatly appreciated by the students, and they requested group meetings using ConnectPro as and when they needed them.

- 5. Plan the resource needs** – including course material, text books, journals, online sources, and industrial standards.

In the SECPS example, course material is provided in the form of PowerPoint slides, with or without audio content, posted on the web-site, and additional reading material and web links. Exemplar work from previous courses are also provided to help understand what is expected, and to what level.

All these resources can and are made available for both face-to-face and on-line students. The point is that the face-to-face students are now making use of these resources and chat sites, and document sharing facilities in the periods when they are away from the lecture room – or indeed, during lectures. There is no longer a need to print lecture material, as notes can be added to the documents on computer as the lecture progresses.

6. Plan the organisation strategy for the online materials – use appropriate online course delivery systems, such as WebCT and Blackboard.

For SECPS the online delivery system is the standard system used by UniSA. This includes a resources section, message board, document sharing and discussion forums. From next year deliveries of this course will be based on Moodle.

Other options include the development of electronic journals, immediate feedback quizzes delivered on-line, or quizzes presented face-to-face where students respond using electronic clickers. These all have a place in learning, depending on the situation, and all of them depend on electronic media.

Conclusion

It is evident from experience with this course that e-learning is not simply a new medium for presenting didactic lecturing – it is an opportunity to take learning to a new level, and actually enhance learning through the many and varied electronic and on-line tools available and being developed.

This paper presents an appreciation of the underlying pedagogies of e-learning that need to be addressed for enhanced learning to take place. The constructivist viewpoint has been discussed, and the need for social constructivism in particular is acknowledged.

In the future, additional resources will be added for the on-line delivery which will include voice-over for all lectures (using Adobe Presenter), as well as an increased use of synchronous on-line meetings.

Face-to-face lectures will be enhanced using electronic and on-line resources and activities, and new ways of achieving learning may emerge. Experience at UniSA suggests that ‘blended-mode’ learning might be the way of choice in the future, as it offers advantages from both modes of presentation – immediate feedback in face-to-face mode, and any time anywhere in the more extended on-line mode. This involves a true blurring of the edges between on-line presentation, with their several face-to-face and synchronous on-line meetings, and the move of face-to-face learning towards providing greater on-line resources and opportunities.

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