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SEARCHING FOR DISRUPTIVE PEDAGOGIES! MATCHING PEDAGOGIES TO THE TECHNOLOGIES ¹

What might prove best matches between technology use and pedagogy to ensure its impact on learning? If our investment in e-learning is to be recouped then we need a paradigm shift to the employment of ‘disruptive pedagogies’, using teaching strategies that exploit the currently underused capacities of technologies in such a way as to enable student engagement, motivation and higher order thinking.

The enthusiasm of protagonists of e-learning (see, for example, Bonk & Graham 2006; McConnell 2006; Salmon 2004) needs to be viewed alongside the more dismal picture painted by others regarding the limited ways in which information and communication technologies (ICT) are being employed in learning. Fraser (1999), for example, suggests that we need to move beyond the provision of information into something more interactive:

The extent to which a student gains the same pedagogical benefit from a printout of your Web resources as from the resources themselves is the extent to which you have done nothing of pedagogical value by using the Web (Fraser 1999).

In many education contexts, often teachers have never used e-learning strategies for their own learning, nor had any practical experience in using e-learning strategies in their teaching, yet they are asked to teach using these approaches. The rapidly changing ICT environment makes the challenge more difficult.

Russell, Bebell & O’Dwyer (2005) provide evidence that schools despite having invested in technologies find that they are little used by teachers and students often have limited access to them. However, they also suggest that, because teachers’ use of ICT is multifaceted, it is important to collect multiple measures and to take into account of the fact that teachers value different technologies in different ways. Nevertheless the issue remains: how can teachers effectively use e-learning technologies in the face of the obstacles which are part of the organisational structures of teaching?

ICT as ‘disruptive innovation’

Should we realistically expect that ICTs would make a major difference in most teaching and learning contexts? If we consider ICT in terms of what Christensen (1997) terms a ‘disruptive innovation’ — one that eventually takes over an existing

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dominant technology, even though it is radically different it and often, initially, performs worse than it on existing measures of performance then we might be more successful. Consider a recent example, which relates to the medium used for photography. For many decades acetate film was the medium used. The rise of the educational audiovisual movement was supported by the advent of cheap and accessible methods of capturing views of the world, and situating challenges and learning in real-world contexts, through the use of the photographic image. Then, in the second half of last century, the potentially disruptive technology of the Polaroid film process made it possible to view a photograph almost immediately after it was taken, making it particularly useful for purposes such as passport photographs and ID cards. However, as recording processes moved from analogue to digital mechanisms, images could be deconstructed, manipulated and retrieved at will. Digital images could also be transmitted anywhere in the world, to be reconstructed to the same level of quality as they were sent. The disruptive technology of digital photography has largely replaced both the photographic film and the Polaroid process in recording images of our world.

While curriculum managers may have initially seen e-learning as a potentially disruptive innovation, there is yet no evidence that ICT has replaced traditional pedagogies or dominant paradigms. However, e-learning has enabled the curriculum of the educational institution to be more efficiently recorded and transmitted to learners in many different contexts. It has encouraged many students and teachers to change their daily meeting times and places. It has enabled every institution to become a potential provider of distance learning. Students who still meet in formal classes may ask for many aspects of their course to be provided online so that they can combine a complex work and study schedule. However, while e-learning possesses potential to be a disruptive innovation in Christensen's terms, so far its use in teaching and learning has been generally restricted to activities and strategies not dissimilar to traditional classroom group instruction.

Using ICT to support a 'disruptive pedagogy'

Information and communication technologies make it possible for learners to view and hear information within software packages, and to represent ideas in high-quality form by using tools that support the transduction of information from one form to another. It is possible, for example, to represent field data visually and succinctly in a graph or animated display in order to explain ideas. In fact, Jonassen (1996) has emphasised the role of ICTs as cognitive tools or mindtools in supporting the thinking processes of learners. Instead of using ICTs just for *presenting* and *representing* information in a variety of modalities, it is important to explore their capacity for *generativity*, for enabling learners to construct their understanding of phenomena. Examples of these three uses are presented in Table 1.

Table 1: Three uses of ICT in teaching and learning

<i>Form of use</i>	<i>Example of teachers' use</i>	<i>Example of students' use</i>
Presentation	Using PowerPoint to construct and structure a visual presentation	Using PowerPoint to report the findings or outcomes of a discussion, and enabling non-linear presentation if so desired
Representation (transduction)	Using Excel to convert numbers and to show relationships; or saving a sequence of charts into a format in order to create movement and animation where none existed before	Researching, writing, visualising and shooting a script, and then using iMovie to create a narrative documentary.
Generation	Using an outliner (that allows switching between plan and execution) to demonstrate a text structure	Using web pages to build a game, which requires the development of understanding of a topic and converting that understanding into a motivating structure and presentation

The success of e-learning will depend, however, on a revolutionary move away from replicating traditional classroom-based teaching practices. Ong (2005) points out that Pierre Ramus, in creating the first textbooks in the 1500s, used an affordance of the most recent technologies (Gutenberg's printing press) to collect what was to be learnt into the one place. The invention of the printing press enabled books to be produced more efficiently and also made them more easily and quickly shareable because they could be produced in large numbers and delivered to diverse locations.

Many writers have noted the capacity of the Web to extend access to information. The Web has enabled students to be less dependent on the teacher for access to authorised texts; and the advent of the search engine and its increasing sophistication is making such access customisable. The technologies are supporting constructivist approaches to teaching and learning and a return to dialogic literacy (Bereiter & Scardamalia 2005), which mimics the Ancient Greek dialogue that was a central method of learning prior to Ramus' textbooks:

In every kind of knowledge-based, progressive organization, new knowledge and new directions are forged through dialogue ... The dialogue in Knowledge Age organizations is not principally concerned with narrative, exposition, argument and persuasion (the stand-bys of traditional rhetoric) but with solving problems and developing new ideas (Bereiter & Scardamalia 2005, np).

Such approaches, however, increase the challenge to teachers and learners by requiring higher-order skills of the learner.

If they are to support a constructivist (and potentially disruptive) pedagogy, ICTs that are presently used just for presenting and representing ideas, need to be associated with a range of interactive activities that employ digital resources provided by the teacher or generated by the learner. The learning within these activities would be scaffolded or supported in other ways by cognitive tools that assist learning performance. The involvement of digital elements can expand learning performance beyond the reproduction of facts and concepts in a single product to emphasise the processes through which the student has attained the learning outcome, because use of digital elements makes it easier to show versions of an essay, to get a student to comment on how they changed things and why, and to get them to assess their own progress towards the goal, than is the case in a non-e-learning context. There is also far less effort in keeping a digital record of the journey, compared with a paper trail of notes and ideas.

Within an e-learning setting, learning interactions come to be characterised by personal construction and the collection of artefacts that represent a constructed learning state. By comparing artefacts it is possible to document how learners' thoughts are changed or modified (the personal construction of understanding), and even the source of the influence on those thoughts (the social interactions that have contributed to the journey). The importance of the social interactions in the process is emphasised by many writers and practitioners of e-learning (see, for example, Salmon 2004).

Zemsky and Massy (2004) suggest that the use of content management systems represents a second stage of e-learning innovation. Today's content management systems allow the teacher to organise resources in a predetermined sequence that prescribes the structure of the learning strategy. This type of structure mirrors traditional classroom practice, rather than suggesting a disruptive innovation or a radically different pedagogy. However, a closely related alternative strategy – use of digital repositories as alternatives to content management systems – provides users with the opportunity to take control of their access and selection of resources. By using these resources, students can create new resources and even develop their own learning strategies, in a process that resembles the kind of learning and teaching that occurs in the creative arts. Such a student-centred learning strategy supports other modern constructivist approaches to pedagogy. In shifting the control of choosing learning topics and sequences towards the learner, constructivist approaches, which require more emphasis on higher-order learning outcomes, are potentially disruptive pedagogies that can be highly challenging to some teachers but that would better suit the lifelong learner.

Digital repositories may come to be viewed as a disruptive innovation that supports a disruptive pedagogy. Digital repositories support learners in the construction of their own knowledge. They afford the capacity for personalised project management in that learners can collect resources from more than one source, and compare and contrast information obtained in the light of the learning goal. While the teacher's role in developing resources is diminished, their role in assessing students' learning may, if not well constructed, become more demanding.

For the digital library to be used as a component of a disruptive pedagogy in which students form their own strategies of interaction and judge for themselves the relative importance of the different forms of information representation to which they have access, content management systems are deficient. In order to ensure that learning tasks can be successfully undertaken, content management systems need to offer students the chance to explore, but to do so with the support of some scaffolding or other forms of learning support.

Matching pedagogy to technology

In examining the relationship of pedagogy and technology, it is useful to examine why learners chose to commit time and energy to learning. Several writers have suggested that strategies such as games and three-dimensional virtual worlds might contribute to a disruptive pedagogy (see, for example, Barab et al 2005). It is acknowledged that the use of games and three-dimensional virtual worlds is highly motivating for participants; and that opportunities for learners to construct their own spaces challenges them to perform at higher cognitive levels (Lim, Nonis & Hedberg 2006).

Metros (2003) suggests the additional element of engagement. She argues that e-learning should be redesigned to move learners through processes that *transfer*, *translate* and *transcend*, which she defines in the following way:

Transfer. Transfer conventional instructional tools, strategies, communication and delivery to a technology-enhanced learning environment.

Translate. Redefine and shift conventional instructional tools, strategies, communication and delivery to the technology-enhanced learning environment.

Transcend. Go beyond conventional instructional tools, strategies, communication and delivery to invent new paradigms for teaching and learning.

Educational games provide examples of transcending current pedagogy to deliver a new paradigm for teaching and learning. Games can be sufficiently realistic that participants ignore the real-world distractions around them. The game is a learning strategy that can provide suitable scaffolding and tools for supporting the learner's cognition, their making choices about authentic problems that are situated in meaningful contexts and their production of results.

Current e-learning activity, however, is characterised by transfer and driven by the teacher. We now need to choose pedagogical options that introduce more 'transcending', that create learning environments in which learners experience views of the world that are multimodal and that require a range of literacies not only to understand the different representative descriptions but also to employ tools with which learners can construct their ideas and communicate them to others.

For pedagogy to match the potential of ICT for learning experiences, the role of the learner needs to change from a passive participant to an active engaged constructor of their own experience. For this to occur there needs to be a rethinking of learning activities, an exploration of how interactions are managed and facilitated, and a choice of the right tool for each pedagogical task.

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