

# Designing Learning Experiences: Supporting Teachers in the Process of Technology Change

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**Abstract:** As teachers adopt technology in their classrooms and develop the pedagogical models that will allow them to make use of the affordances of the technology, we are seeing improved learning outcomes and high-quality learning demonstrated. The pedagogical models that are showing the most promise come from ideas about how designers can implement the class of theories referred to as constructivism. Designers of technology-based learning environments can draw on the work of the many writers who have sought to develop guidelines and heuristics to support new modes of learning (see for example, Grabinger, 1996; Hannafin & Land, 1997; Squires, 1996). Constructivist frameworks are based upon the argument for learners being placed in authentic environments that incorporate sophisticated representations of context through such constructs as virtual “worlds”. Learning experiences, which adopt these approaches, designed around bounded resources, such as CD-ROM technologies, are now well documented and many teachers have been making extensive use of these environments for some time. One such project, Exploring the Nardoo, which has been developed within constructivist frameworks as a virtual world has been acclaimed for its illustration of these concepts. The product displays varying degrees of fidelity of representation, learner immersion and active participation and has been shown to offer learning advantages for users.

However, teachers need to continue to address the constantly changing nature of the capability of the technology, and potential learning opportunities offered by these changes. Unbounded environments, such as the World Wide Web, have offered a new set of affordances and now the concept of learning objects is set to again require teachers to re-conceptualise learning experiences for their students. The concept of a ‘learning object’ has developed from the movement to create reusable learning resources. Significant investment in content, described in terms of standards, which can be reused and re-purposed in education settings, is becoming a priority nationally (The Learning Federation, [http://socci.edna.edu.au/newcms/view\\_page.asp](http://socci.edna.edu.au/newcms/view_page.asp)) and internation-

ally (Ariadne: <http://ariadne.unil.ch/>, Merlot: <http://taste.merlot.org/>, LRX: <http://www.lrx.com.au/>). Teachers are now seeking tools to make effective use of the myriad of learning objects that are now being developed, in such entities as digital libraries, to construct meaningful learning environments.

This paper will review the changes in pedagogy which ICT based learning environments have been able to facilitate, report on research findings on learning outcomes for a series of innovative bounded CD-ROM learning environments, and review the potential of learning object technologies to again challenge teachers striving for high quality learning from their students.

## 1. INTRODUCTION

As teachers adopt technology in their classrooms, safe in the understanding that the weight of argument and evidence supports pedagogy, not the technology (Clarke, 1985, 1999), as the key to successful learning design, we are seeing the development of pedagogical models which will allow teachers to make use of the affordances of the technology. The pedagogical models which are showing the most promise in demonstrating improved learning outcomes and high quality learning come from ideas about how designers can implement contemporary theories of learning which support knowledge construction through learner-centred settings (e.g. Bostock, 1998; Duffy & Cunningham, 1996) via activity-based tasks and collaborative learning which are scaffolded and supported by teachers or tools (e.g. Vygotsky, 1978). Designers of technology-based learning environments can draw on the work of the many writers who have sought to develop guidelines and heuristics to support new modes of learning (see for example, Grabinger, 1996; Hannafin and Land, 1997; Squires, 1996). These frameworks are based upon the argument for learners being placed in authentic environments that incorporate sophisticated representations of context through such constructs as virtual worlds. Learning experiences that adopt these approaches, designed around bounded resources, such as CD-ROM technologies, are now well documented, and many teachers have been making extensive use of these environments for some time.

However, teachers need to continue to address the constantly changing nature of the capability of the technology, and potential learning opportunities offered by these changes. Unbounded environments, such as the World Wide Web, have offered a new set of affordances. With this development broader concepts about learner-learner interactions have been illustrated and are being implemented through a broad range of curriculum initiatives. This access to rich resources from world-wide sources has resulted in significantly wider use of technology, but has also helped to drive the broader view of reusability.

The current significant investment in content, described in terms of standards, which can be reused and re-purposed in education settings, is becoming a priority nationally and internationally. The resulting construct of 'learning objects' is set to again require teachers to re-conceptualise learning experiences for their students. Teachers are now seeking tools and exemplars to construct meaningful learning environments through making effective use of the myriad of learning objects that are now being developed, in such entities as digital libraries.

This paper will review the changes in pedagogy which ICT based learning environments have been able to facilitate, report on research findings on learning outcomes for a series of innovative bounded CD-ROM learning environments, and review the potential of learning object technologies to again challenge teachers striving for high quality learning from their students.

## **2. BOUNDED LEARNING ENVIRONMENTS**

*Exploring the Nardoo* (1996) is an innovative project that illustrates the development of learning environments based on contemporary theoretical constructs. This project was developed as a virtual world and has been acclaimed for its illustration of these concepts. The product displays varying degrees of fidelity of representation, learner immersion and active participation and has been shown to offer learning advantages for users. *Exploring the Nardoo* (Harper et al., 2000a, 2000b; Hedberg et al., 1998a, 1998b) has been well described and has been the focus of a number of specific studies in classrooms which have investigated learner response, the use of genre embedded templates and simulations and problem solving. The learning environment is characterised by a research centre (Figure 1) within the context of an inland river environment. A set of cognitive tools (Harper et al., 2000) supports learners in their investigation of authentic problems, with a rich set of resources as reference sources.

In an initial investigation of a broad view of learner response to the package, a structured and an ill-structured problem were set for two groups of year nine students and the construction of ideas by collaborative pairs of students was logged. Details of the study have been reported in Harper et al. (2000). Students perceived the rich tasks as being in context, motivating and worth spending a significant amount of time to develop possible solutions to the investigations. Students needed minimal instruction in the use of the cognitive tools and they developed extended arguments with multiple solutions to the investigations undertaken. In general, the ill-structured

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