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SUPPORTING THE DEVELOPMENT OF PEDAGOGICALLY SOUND LEARNING ENVIRONMENTS USING LEARNING DESIGNS AND LEARNING OBJECTS

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ABSTRACT

In a climate where Information and Communication Technology (ICT) is becoming mainstream within the higher education sector, academics are faced with the ongoing challenge of incorporating World Wide Web and Internet technology within their teaching practices. Coupled with a “quality” agenda, academics will be required to examine their instructional strategies and to offer high quality learning opportunities. Reuse, in the form of sharing learning resources and modelling expert practice are seen as strategies to help academics in this change process. Whilst online repositories of learning resources (learning objects) are flourishing, what is lacking are tools to support academics to design pedagogically sound learning environments. This paper describes a prototype tool, the Smart Learning Design Framework (SLDF), that uses “learning designs” to assist academics construct high quality learning environments in which learning objects are incorporated.

KEYWORDS

Learning design, learning object, reuse, higher education

1. INTRODUCTION

In higher education, an effective educational setting is characterized by high quality teaching based on contemporary views of learning. Whilst much of the influential research in learning has been school based, higher education has developed a significant history of research interest focused on moving what is traditionally been instructivist practices in teaching, (well behind the trends in pre-tertiary education), to practices based on contemporary theories of learning (Schön, 1995) or the so called “new pedagogy”. This situation is not unexpected as pre-tertiary education is characterized by well trained teachers exposed to not only best practice models, but also underpinning theoretical models to support implementation of practice. However, the Higher Education sector, until recently, has not valued teaching skills as an important attribute

for academics. As a consequence, many learning experiences designed for students are modeled on dated instructional strategies that academics themselves may have experienced in their own tertiary learning (Van Driel & Verloop, 2002).

This situation is changing rapidly as governments worldwide implement policies within which “learning has been explicitly identified as the main catalyst for economic competitiveness and growth” (Cullen et al., 2002, p. 12) and mechanisms for quality assurance for learning in higher education sectors are being used to drive these policies. As a consequence and additionally as funding models for higher education shift worldwide to user-pay systems, both students and their institutions can no longer afford to tolerate high levels of student attrition or poor learning outcomes related to poor teaching (Higher Education Attrition Rates 1994-2002: A Brief Overview, 2004).

Some countries have moved strongly toward supporting academics in improving their teaching process. National bodies, government policies and forums encouraging innovation in teaching practice have been established across most western countries. For example, in the United States, there is a range of support to foster high quality teaching such as The Carnegie Foundation for the Advancement of Teaching (<http://www.carnegiefoundation.org/>), the “Improving University Teaching” annual conference (<http://www.iutconference.org/>), the Teaching, Learning and Technology group (<http://www.tltgroup.org/>), and The National Teaching and Learning Forum (<http://www.ntlf.com/>). In the UK, there are a number of initiatives taking on different forms of dissemination, such as journals and magazines to stimulate and encourage the sharing of ideas about current practices in teaching and learning in higher education (e.g., Exchange Magazine (<http://www.exchange.ac.uk/>) and web sites such as the recently formed Higher Education Academy (<http://www.heacademy.ac.uk/>).

In Australia, the Australian Universities Teaching Committee (<http://www.autc.gov.au>) and the recently formed Carrick Institute for Learning and Teaching in Higher Education (<http://www.autc.gov.au/institute.htm>) are supporting these processes with government policy moving toward teacher qualifications for new academics (Transcript of the Launch of the Carrick Institute for Teaching and Learning in Higher Education, 2004). Additionally, some countries are tying funding to requirements such as institutions having published learning and teaching plans, provision of public access to student reviews and academics having recognized teaching skills. The Australian government, for example, has set aside a pool of normally allocated funding for universities, as the Learning and Teaching Performance Fund, which universities “win back” if they have in place a raft of learning and teaching requirements (http://www.dest.gov.au/highered/learning_teaching/p_fund_default.htm)

Of course, even with instructional skills, academics have another set of requirements in research and development and should not be expected to have teaching as their only focus. An effective and efficient way forward would be to improve teaching in higher education and still maintain the other necessary research activities essential in academic tenure. Trends in e-learning may offer opportunities to address this. The current push to reuse existing learning resources via the use of learning objects as well as efforts to describe educational strategies in consistent notational forms (referred to as design patterns and/or learning designs) are strategies that may encourage academics to implement different and innovate teaching practices. This possibility of sharing and modeling expert practice will not eliminate the need for academics to have an understanding of contemporary learning theories and their applications, but this approach would provide academics with a scaffold to help them design high quality learning environments without investment of excessive amounts of time. Additionally, this movement has the potential to be a catalyst to improve the quality of teaching in higher education generally. However, tools to support academics to implement these strategies are not yet available. This paper describes a research project that investigated these issues by developing a prototype tool. The prototype, the Smart Learning Design Framework (SLDF), aims to assist academics to develop pedagogically sound learning environments by using learning designs to model expert practice, and provides support to select and integrate appropriate learning objects within those learning designs.

2. REUSE AS A CATALYST FOR CHANGE

Learning objects (LOs), considered broadly as discrete chunks of learning material, have gained international recognition as a mechanism to encourage the sharing and reuse of educational resources. There has been much activity in creating learning object repositories (some examples include: Multimedia Educational Resource for Learning and Online Teaching (MERLOT) (<http://www.merlot.org>), Canadian network of Learning Object Repositories (eduSourceCanada) (<http://www.edusource.ca/>), The Learning Federation (<http://www.thelearningfederation.edu.au/tlf2/>) and Education Network Australia (EdNa Online) (<http://www.edna.edu.au/>)). In accompaniment to these developments, there is much discussion taking place about how to effectively retrieve learning objects from repositories via the use of metadata (information or annotation about a learning object) (see for example, Duval & Hodgins, 2003; Farance, 2003; Friesen, Roberts & Fisher, 2002). A predominant focus in learning object research and development has taken a technical perspective with issues such as access and interoperability taking priority (e.g. see Najjar, Ternier, & Duval, 2004). This focus continues to dominate as evidenced in current initiatives such as the recently formed Global Learning Objects Brokered Exchange (GLOBE) alliance (<http://resource01.nime.ac.jp/globe/>) which is examining interoperability and interconnectivity amongst learning object repositories to foster “ubiquitous access to educational material”.

Despite these R&D efforts, the debate about what constitutes a learning object continues and there is acknowledgement that research needs to focus on how learning objects can be actually reused. Bennett and McGee (2005) argue “much of the learning object community has focused on construction and dissemination, with little concern about embodiment and use” (p. 25). Thus, an ironic situation could emerge in which the global push to encourage reuse of learning materials via learning objects, could inadvertently stifle reuse because of the lack of consensus about their definition and the limited knowledge about how they are and can be reused. Certainly, there is research investigating the reuse of learning objects (e.g., Christiansen & Anderson, 2004; Faiidhi, J. & Mohammed, 2004; Collis & Strijker, 2003), but further work is necessary to establish a greater understanding about how learning objects can be used to create high quality learning environments.

Another significant trend in the e-learning arena with a focus on reuse is that of documenting expert teaching and learning practice in a consistent notational form so that it can serve as a model or template. These forms of documentation are being referred to as learning designs (e.g., <http://www.learningdesigns.uow.edu.au>), design patterns (e.g., Goodyear, 2005), pedagogical patterns (e.g., <http://www.pedagogicalpatterns.org/>), and learning activities (<http://www.lamsinternational.com/>) and are being documented in a range of representational forms such as textual descriptions, flow charts, Universal Modeling language (UML) activity diagrams, etc. (see Richards and Knight, 2005).

The concept of modeling “good practice” in the form of learning designs or design patterns is gaining support as a mechanism to bridge the divide between research-based evidence of effective teaching and learning and actual practice (Goodyear, 2005). This is evidenced in a recently completed Australian project referred to as the Learning Designs project (<http://www.learningdesigns.uow.edu.au>). The Learning Designs project focused on the development of generic learning designs, based on exemplary teaching and learning practice in higher education supported by information and communication technology. A graphical representation was devised to illustrate the learning designs in terms of the tasks, content resources and support mechanisms and how they are sequenced for students (Oliver & Herrington, 2001). An example of one of the generic learning designs devised is illustrated in Figure 1. This graphical representation is accompanied with rich textual information that explains each aspect of the learning design and provides guidance on how it can be implemented.

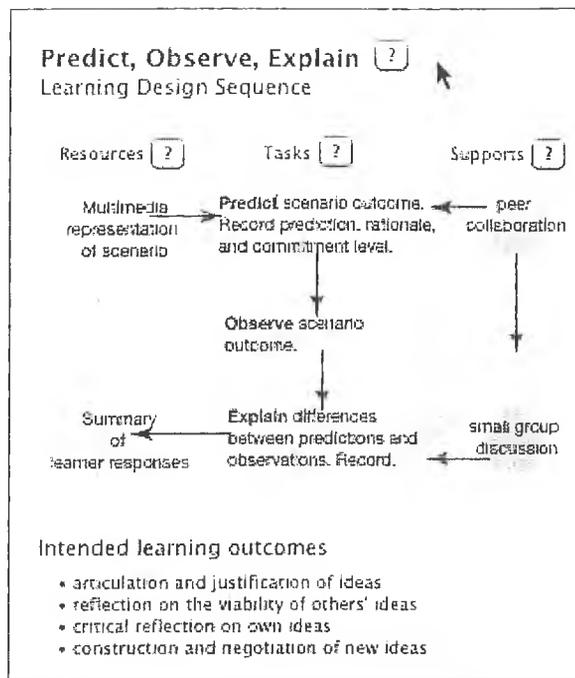


Figure 1. One of the designs formalised in the Learning Designs project

Some of the generic learning designs in the Learning Designs web site are available in the form of web-based templates which academics can easily download and contextualize to suit their context. Most, however, are available as textual documentation that can serve as a checklist but require the academic to construct the online environment in their context from scratch. The new e-learning specification, IMS Learning Design (IMS Learning Design Best Practice and Implementation Guide Version 1.0 Final Specification, 2003) is a development that documents a learning design in a machine-readable format (an XML file) so that it can be shared as a “unit of learning” and can be played in an IMS LD-player in a similar way that HTML code can be played by an internet browser. In this context the term learning design has two meanings: the set of machine-readable instructions that describe the design, and the pedagogical underpinning of the design when implemented. The learning design construct employed by the IMS LD specification is similar to that of the Learning Designs project in that it describes the tasks students are required to complete and the content resources to be made available. IMS LD specifies in more detail the roles that students and teachers undertake in the learning design and the sequence of tasks is described in the form of acts as in a play. Buzza, Bean, Harrigan and Carey (2004) have investigated representing some of the learning designs documented in the Learning Designs web site as IMS LD units of learning. However, the IMS LD standard claims to be pedagogically neutral and adopters of IMS LD need to know how to construct pedagogically sound units of learning, using the modeling language. Tools being developed for implementation of IMS LD do not yet include mechanisms to incorporate simply well researched and effective learning designs.

3. AN INTEGRATED LEARNING DESIGN AND LEARNING OBJECT FRAMEWORK: THE SMART LEARNING DESIGN FRAMEWORK (SLDF)

There is a growing realization that one way in which learning objects could be effectively reused is by incorporating them within a learning design. For example, Pitkänen and Silander (2004) argue that learning objects “need an environment and a pedagogical framework that defines how they are used in learning processes” (p. 247). In this project, the Smart Learning Design Framework (SLDF) project, a follow-on project from the Learning Designs project, a prototype tool has been developed to investigate this idea,

namely, how a learning design can be presented in the form of a template and with wizard-type support to assist a teacher to design a potentially high quality learning environment that incorporates learning objects.

The SLDF prototype guides the user through a series of steps to contextualize a selected learning design in terms of the topic, the particular task(s) and suitable resources (learning objects) required. The output from this process is referred to as a “unit of study” (based on the work by Koper, 2001). The data structure of the saved unit of Study (UOS) is in the form of an MPEG-21 Digital Item (Bormans & Hill, 2002) which enables customization of content delivery.

An explanation of how the prototype generates a unit of study based on a learning design is provided as follows.

1. The prototype firstly presents the user with a generic version of a learning design. Figure 1 represents the screen displayed. The learning design is Predict-Observe-Explain (POE) (Kearney with Wright, 2002). It involves students making a prediction based on a given scenario, observing the outcome of the scenario, and then explaining any differences between their prediction and observation. Learning objects in the form of images and video clips serve an important component of the learning design as they are used to describe the scenario and explain the outcome of the scenario.
2. The prototype then displays a screen (shown in Figure 2) that shows the specific information that needs to be completed by the teacher in order to develop the unit of study. This was developed by examining the contextualized learning design and asking the following two questions:
 - What are the decisions a teacher needs to make to develop a UOS based on a particular generic learning design?
 - What are the elements/items required to build such a UOS?

The screenshot shows a software interface for designing a POE learning design. The window title is "Untitled". It is divided into three numbered sections, each with a question mark icon for help:

- 1. Scenario description**: Contains a "Title:" text field and an "Introduction:" text field with the placeholder text "description to introduce the scenario".
- 2. Scenario demonstration**: Contains three rows, each with a text field and a "Select..." button:
 - "Static image to introduce scenario:" with the placeholder "before image of the scenario".
 - "Additional static image to explain scenario:" with the placeholder "additional image to assist in explaining the scenario".
 - "Multimedia representation of observation:" with the placeholder "image or movie demonstrating the scenario".
- 3. Prediction task**: Contains a "Prediction question:" text field with the placeholder "question asking learner to predict the outcome". Below it are three "Multiple choice" options:
 - (a) multiple choice option 1
 - (b) multiple choice option 2
 - (c) multiple choice option 3

At the bottom right of the interface are two buttons: "Deliver" and "Save..."

Figure 2. Interface for POE learning design

Pedagogical support is available by clicking on the question mark icons. For example, support provided when selecting the question mark buttons shown in Figure 1 is in the form of general information about the POE learning design, that is, what tasks students are required to conduct, what resources are required to help with the tasks and how students should be supported. Pedagogical guidance such as how to construct the task, and what learning objects would be suitable is available by selecting the question marks shown in Figure 2. An example of this support is illustrated in Figure 3. (The pedagogical support supplied is based on the information provided in the Learning Designs web site (Kearney with Wright, 2002).)

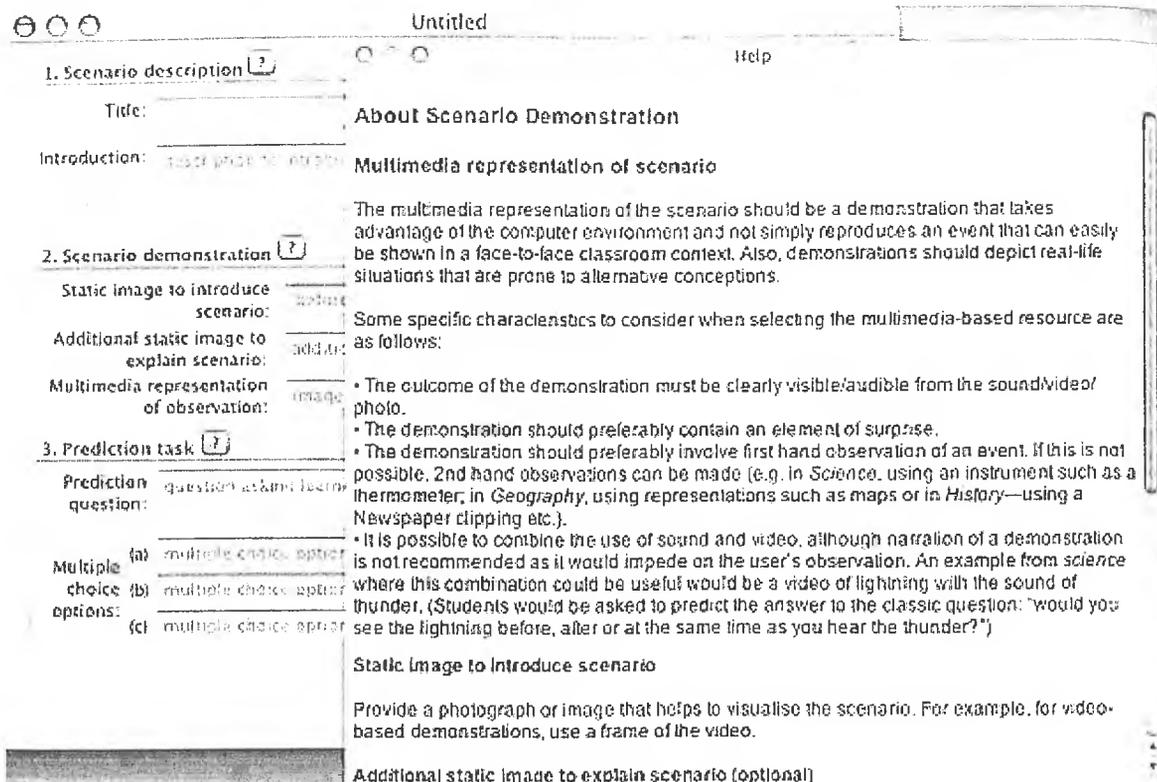


Figure 3. Example of pedagogical support provided when developing a POE unit of study

The prototype also enables the user to generate metadata for the learning objects to be included. A significant feature to be made functional in the prototype is interrogation of the learning object metadata for the purpose of providing advice as to its suitability for inclusion in a learning design. For example, it is envisaged that when a learning object is selected to be included in a UOS, the metadata associated with that learning object is examined and the prototype prompts the user as to whether the selected learning object meets the pedagogical requirements of the learning design. In this way the tool makes meaningful use of the learning object metadata.

3. Finally, the UOS can then be deployed in multiple formats. Figure 4 illustrates how the unit of study can be delivered as a web site, through the use of a web-based template. An advantage is that only a single unit of study need be developed and, via presentation templates, can be delivered to learners in different formats.

(For a more comprehensive explanation of the prototype's functionality refer to Lukasiak, Agostinho, Burnett, et al. (2004); Lukasiak, Agostinho, Bennett, et al., (2005)).

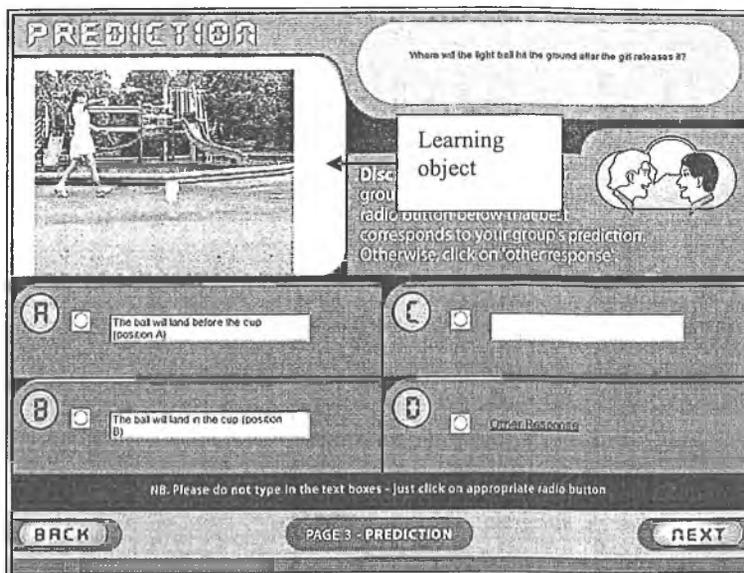


Figure 4. The Unit of Study delivered as a web site (Prediction task details)

4. CONCLUSION

This paper has proposed that a possible way forward in improving teaching in higher education is the provision of software tools that model expert practice in the form of learning designs, thus serving as a scaffold for academics to develop pedagogically sound learning environments. The Smart Learning Design Framework (SLDF) project has allowed the research team to develop a proof-of-concept prototype that explores how learning designs can be used as a support mechanism and how learning objects can be integrated as resources.

The researchers will continue work on the prototype. Next steps include user testing to determine the perceived usefulness and usability of the tool, refinement of the prototype's interface, and extension of the prototype's functionality to enable learning object metadata interrogation when selecting learning objects for inclusion in a unit of study. An ongoing activity is keeping abreast of e-learning developments, particularly the implementation of the IMS LD specification.

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