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Constructing High Quality Learning Environments using Learning Designs and Learning Objects

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Abstract

Designing learning experiences supported by Information and Communication Technology (ICT) is becoming an important skill for all academics in the higher education sector. With a range of "quality" measures being implemented and foreshadowed by government, including "dollars" linked to student learning outcomes, all academics will be increasingly asked to examine their instructional strategies and to offer high quality learning opportunities. Sharing learning resources is seen as one strategy to help academics in this change process. As such, online repositories of learning objects are flourishing to encourage the concept of reuse. However, what is lacking are tools to support academics in designing high quality learning environments that incorporate learning objects. This paper presents a prototype tool that uses the concept of a "learning design" as the framework to assist academics in the design process and demonstrates how learning objects can be incorporated.

1. Introduction

High quality teaching and learning are the staples of effective educational settings. Whilst much of the influential research in learning has been school based, higher education has started to develop 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 [1]. 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 [2].

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 related to poor teaching [3]. Yet despite the recognition that skills in designing and creating high quality learning experiences would be an asset for academics, the scale of the backlog of training necessary to develop these skills across the sector is prohibitive. Some countries have moved strongly toward supporting academics in the teaching process by establishing national bodies and forums encouraging innovation in teaching practice. 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 Australia, the Australian Universities Teaching Committee (http://www.autc.gov.au) and now the The 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 [4].

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. The question then raised is: What is an effective and efficient way forward to improve teaching in higher education and still maintain

the other necessary research activities that are essential in driving national economies? Trends in e-learning may offer opportunities to address this problem by drawing on expertly designed and tested instructional strategies in the form of learning designs and reusing learning resources (learning objects) to construct learning environments that have the potential for high quality student learning. This will not eliminate the need for academics to have an understanding of contemporary learning theories and their applications, but it provides academics with support to design high quality learning environments without investment of excessive amounts of time.

2. Learning Designs and Learning Objects

The concept of learning objects as a mechanism for encouraging reuse of educational material has gained international attention both in the school and higher education sector. Much of the current activity is focused on creating learning object repositories and extensive discussion about learning object metadata [5]. Examples of learning object projects include: eduSource Canada (http://www.edusource.ca/), CeLeBraTe [6], The Le@rning Federation (http://www.thelearningfederation.edu.au/tlf2/) and EdNa Online (http://www.edna.edu.au/).

Despite this activity, there is a realization that work is required to understand how learning objects can be reused. An irony exists in that there is a push to establish learning object repositories to encourage reuse yet not knowing how to reuse learning objects once retrieved is hindering reuse [7]. To address this issue, there is a growing acceptance that in order to incorporate learning objects into a learning experience, they require a pedagogical framework that defines how they are to be used in learning processes [8].

One approach towards this is the use of a learning design construct that serves as a model or template within which learning objects can be included. 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 [9]. For example, a recently completed Australian project (the Learning Designs project http://www.learningdesigns.uow.edu.au) focused on the development of learning designs based on knowledge of best practice, presenting these designs as specific cases or reducing them to a generic design template and description. A formalism that allowed the learning designs to be graphically represented in terms

of the way in which tasks, content resources and support mechanisms are planned and sequenced for students [10] was developed. Figure 1 illustrates a sample generic learning design represented through the formalism developed in the project.
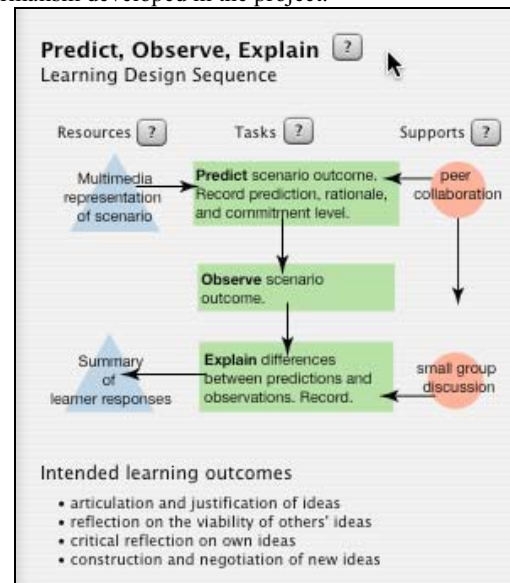

Figure 1. One of the designs formalised in the Learning Designs project

Another approach to the use of the learning design construct has evolved from information systems and is characterized by the current research in learning objects through learning technology standards such as the IMS Learning Design standard [11]. IMS LD attempts to describe learning designs in a machine-readable and consistent way. 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 tools for the implementation of the IMS LD are now being developed with runtime and authoring architectures being investigated by a variety of research and development teams. Recent developments are summarized in Olivier [12] and all the latest information about IMS LD is available from the UNFOLD web site (http://www.unfold-project.net/).

In order for the IMS LD specification to be widely used by educators and instructional designers, effective ways for users to contribute to and access learning designs will be needed. Buzza, Bean, Harrigan and Carey [13] argue that repositories of learning designs will need to be developed and have proposed that the

Learning Designs project, described earlier, is an excellent start because the learning designs described have been proven through evaluation and are useful in that they have been described in "practical and purposeful pedagogical terms" (p. 4). While these learning designs have not yet been translated into IMS LD, these two initiatives may prove to complement each other well.

3. Smart Learning Design Framework

What is recognized as being needed as part of the learning object movement is a tool that provides guidance in the design process and in the selection of suitable learning objects to incorporate within a particular learning design. In a follow-on project from the Learning Designs project a prototype tool, the Smart Learning Design Framework (SLDF), was developed to explore the concept of designing, with wizard support, high quality learning environments for the higher education sector based on proven learning designs and incorporating learning objects. The features of the prototype are summarised as follows. For a comprehensive description refer to [14].

3.1 Guidance and support provided based on learning designs

The prototype presents a learning design in the form of template requiring the user to "fill in the blanks" by adding content and context specific information. In this way, the user is made aware of the essential elements needed (like a checklist) to produce a high quality learning environment based on a particular learning design.

For example, the Predict-Observe-Explain (POE) learning design [15] illustrated in Figure 1, 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 form a crucial part of the learning design as they serve to describe the scenario and explain the outcome of the scenario. The prototype provides general information about the POE learning design, in terms of the tasks, resources and supports required by selecting the question mark icons as shown in Figure 1. Figure 2 displays the fill-in-the-blank type screen the user needs to complete. Advice about suitable learning objects to include and how to complete the context specific information is provided in textual form via the question mark icons.

Figure 2. Interface for POE learning design

3.2 Integration of Learning Objects

The prototype enables the integration of learning objects into the learning design by allowing the user to generate metadata for each learning object and thus selecting the metadata record for each learning object to be included. (See [16] for a detailed discussion about the metadata schema devised.) The advantage of this feature is that the learning object metadata can be interrogated and advice as to its suitability can be provided.

3.3 Interoperable data structure

The output saved from the prototype is referred to as a Unit of Study. It has a data structure in the form of an MPEG-21 Digital Item [17], which enables interoperability due to it being a universal technical specification. Each learning object is also represented as an MPEG-21 digital item. This facilitates the sharing and storage of the learning objects in educational repositories that support the broader MPEG-21 format. The aggregation of learning objects into a unit of study is represented by a hierarchical structure in which learning objects are represented at the lowest level of the hierarchy and a unit of study is represented as a higher level in the hierarchy. A unit of study can also embed another unit of study.

3.4 Customization of content delivery.

Data is separated from presentation, which in turn supports seamless and simple customisation of presentation via templates. The advantage is that the user need only develop a single unit of study and is able, via presentation templates, to deliver it to learners in different formats. Figure 3 demonstrates how the unit of study is delivered as a web site, through the use

of a web-based template. A different template, for example, a text-based handout, which explains the prediction task and lists the multiple choice question, could be used to present the unit of study to students.
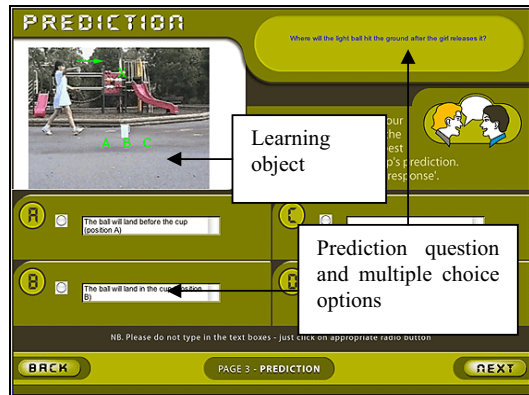

Figure 3. The Unit of Study delivered as a web site (Prediction task details)

4. Conclusions and further work

The Smart Learning Design Framework project reflects a broader trend to design and implementation tools based on the concepts of reusability and interoperability as well as a focus on improving the pedagogical support for academics in designing higher education settings. Specifications such as IMS LD and tools such as The Learning Activity Management System [18] are examining these concepts through different conceptualisations of learning designs. The SLDF however, offers an integrated solution, similar to a "one-stop-shop" because, conceptually learning designs serve as the framework where learning objects can be incorporated; operationally, it offers pedagogical support and technical complexity, which is hidden from the user; and technically an MPEG-21digital item is produced that incorporates learning objects and learning designs in a hierarchical system.

Another advantage of the SLDF system is that it is suited to single author development (that is, a complex design team infrastructure is not required) and the technical complexity is hidden from the user by offering an intuitive, user-friendly interface.

The Smart Learning Design Framework project has allowed the research team to develop a working prototype that incorporates high quality researched learning designs and well-matched learning objects within a wizard supported framework. The researchers will continue work on the prototype with the following features envisaged for inclusion:

• The provision of guidance to select an appropriate learning design. (The current prototype includes only one learning design.)
• The interrogation of learning objects to inform the suitability of the learning object when including it in a unit of study. (The prototype currently provides guidance about the inclusion of learning objects in the form of textual advice.)
• The implementation of different templates. (Currently, only a web-based template is available.)

User testing will inform the usability and usefulness of the prototype thus guiding further developments of the prototype. In addition the research team will continue to examine other developments particularly the implementation of the IMS LD specification.

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