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REUSABLE LEARNING DESIGNS IN UNIVERSITY EDUCATION

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ABSTRACT
This paper discusses the application of reusable learning designs as a support mechanism to guide teachers in designing learning experiences for students. Learning designs, which describe a sequence of learning activities, together with the necessary resources and supports, can serve as a framework which a teacher can then adapt to suit the needs of his or her students. The paper draws on an ongoing study of university teachers using learning designs to design their subjects to highlight reusability issues and outline what further research is necessary..

KEY WORDS
Learning design, reusability, university education, learning objects

1. Introduction

In 2000, the Australian Universities Teaching Committee (AUTC) commissioned a project entitled *Information and Communication Technologies (ICTs) and Their Role in Flexible Learning*. The aim of this project was to "produce generic/reusable learning design resources to assist academics to create high quality, flexible learning experiences for students" (p. 29) [1]. A collection of exemplars, which represented "best practice" in terms of both pedagogy and use of information and communication technologies, were identified and reviewed by a panel of international experts based on the descriptions and research evidence provided by the original designers. A selection of these learning design exemplars were then developed into generic learning design resources. The major outcome of this project was the documentation of 32 exemplary learning design cases and the derivation of five generic learning designs (or guides) and four software tools. These have been disseminated on the Web at http://www.learningdesigns.uow.edu.au. The rationale for this collection is that university teaching staff could use these to inform their practice in the design and implementation of ICT-supported learning.

The sharing of design cases is not new in educational technology. In fact, the literature in the field is replete with descriptions of the application of ICTs to learning. However, the difference is that projects such as the AUTC funded Learning Designs project provide a collection of carefully reviewed cases that are documented in a consistent format and accompanied by a visual representation of the learning design to support interpretation and thus encourage reuse. In this project and in this paper, a distinction is made between a *learning design*, which is essentially a case of a particular contextualised design that has been customised for a particular setting, and a *generic learning design* which attempts to draw out and explain generalisable features of a design and incorporate guidance about how might be adapted to a learning context different from the original. The generic learning designs have been *abstracted* from their original context of application and describe a general pattern of learning the might be applied to an array of appropriate contexts.

The notion of the generic, or reusable, learning design has recently attracted attention because of its apparent compatibility with the concept of reusable learning objects. Reusable learning objects are discrete units of learning material that can be reused within different learning contexts [2] [3]. The idea of integrating learning objects within learning designs is in keeping with Wiley's [4] suggestion that learning objects be thought of as resources to be used within in a broader learning activity. This perspective is also supported by a study of practitioners' use of learning objects which found that teachers regard learning objects as "just another resource that can be called upon to contribute to the development of curricula and to assist in the process of teaching and learning" [5]. Although there is still debate about the exact nature of a reusable learning object in terms of its idea, size and scope to maximise reusability, the idea of integrating learning objects into a coherent sequence using a learning design as a framework is an attractive one for those wishing to promote both high quality educational design and the use of learning objects. To understand how learning designs might facilitate this approach it is important to consider the context in which educational design occurs and the process teachers use to plan and prepare for learning.

2. The context and process of educational design

Most of the time in university education the teacher has sole responsibility for design learning experiences for his or her students. They draw on their content knowledge and their professional experience to plan a logical sequence of activities and create the resources that will enable their students to achieve the desired learning outcomes and meet curriculum requirements. The resultant design is founded on detailed knowledge of particular learners in a particular context. In addition to this preparation, teachers support students as they are undertaking activities by providing guidance to individuals and groups of students based on their own diagnostic reasoning about what learners need at a particular time. When not working alone, teachers are often supported by other teachers either informally or in a team teaching situation. University teachers may also have support from specialist educational designers and technical support staff, or may work with a teaching team in which responsibilities are distributed.

The situation of a university teacher is quite different from the one assumed in some of the learning object literature, particularly in discussions about how automatically customised instruction or intelligent tutoring systems might work [6]. The latter appears to be based on a model in which instruction is pre-prepared by instructional designers who work with subject matter experts and who are not part of the learning context. The materials are often intended for self-paced learners to work through at some time in the future, with or without the support of a tutor or facilitator. In this situation, the tutor or facilitator usually has minimal or no capacity to alter the design. This is often to ensure that uniform materials are delivered to all learners. Though this description may reflect design practice in some learning or training situations, it clearly has little in common with the way design occurs in most of university education. Thus, there is a need for models of learning object and learning designs that are founded on an understanding of the educational design process. Otherwise, use of the instructional design-based model may fundamentally misunderstand and underestimates the role of the teacher in the design process.

Though there has been significant work in developing understanding of the range of pedagogies that can be applied in higher education, there is still much to be learned about the actual practice of educational design by university teachers [7]. Recent work identifying the roles and activities of teachers in a subject as it moved online over five years, indicates however that design occurs throughout the teaching and learning cycle, involving planning and preparation prior to the teaching session; adjustments made during the teaching session based on student queries and progress; and evaluations and reflections on what occurred that feed into the next cycle [8]. Research is needed to understand how learning designs and learning objects might play a role in this cycle.

3. Teachers' use of generic learning designs

A small-scale study begun in 2004 provides some insights into how learning designs might be used by university teachers [9]. The study has followed a team of four teachers who decided to re-design a subject they taught using a problem-based approach. The subject was compulsory for students from four different disciplines in a Bachelor of Education course, including students majoring in early childhood education; primary (elementary) education; secondary physical and health education; and secondary mathematics and science education. Each of these groups needed to develop similar skills in working with technology, designing technology-supported lessons and integrating technology into the curriculum. But, for each discipline there were specific contextual issues they needed to understand. For example, the early childhood and primary students needed to understand how to select and design developmentally-appropriate activities for young children; while the physical and health education teachers needed to understand how they might implement the mandatory part of the junior high school syllabus requiring students to use databases. Despite these different needs it was essential that the structure of the subject and the general nature of the assignments remain the same for all students. Though all four teachers were familiar with problem-based learning in a general sense and felt that it was appropriate to the learning outcomes for this subject, none had prior experience in designing or implementing a problem-based approach. The group decided to use a learning design to assist their design process.

By interviewing and observing these four teachers, the researchers have been able to follow the process as the group deliberated over which learning design was most appropriate and how they would adapt it to suit the needs of their students. Some preliminary findings have been reported in Bennett et al. [9]. The research is ongoing with two of the four subject versions having been implemented in July-November 2004 and the two remaining versions currently being taught at the time of writing. Analysis of the design process and the outcomes for the two subject version offered in 2004 provide some further insights into the process.

The generic learning design chosen by the teachers was Explore, Describe, Apply (EDA) [10]. This generic design was derived from a subject in which students critically examined a multimedia product, developed principles and then applied those to their own design. The key to the design was determining an authentic real world task which would engage students. In the original setting

[11], the learning design encompassed the full subject and was run over the full semester. In the adapted versions it was necessary to alter the duration and the nature of the tasks. The teaching team were concerned that the first year students in their subject did not have the background knowledge and skills needed to tackle the problem. So the first six weeks of the subject retained lectures about general ICT integration and issues specific to the discipline. Students also attended tutorial classes each week in which they undertook a sequence of design tasks based on key software packages to develop skills in presentation, Web page, spreadsheet and database techniques. After week 6 there were no further lectures and the tutorial classes were devoted to supporting the problem-based activities. Thus the EDA tasks were spread over 7 weeks rather than the full 13 week teaching session. Table 1 describes how the design was described in the generic version and then how it was applied in each of the two discipline area.

Table 1: Application of Explore, Describe, Apply generic learning design

	Generic version	**Early childhood**	**Secondary physical and health education**
Explore	Students deconstruct a system/product in which known weaknesses/deficiencies exist. The focus of the deconstruction is to *explore* the system/product and its weaknesses/deficiencies from a practical and conceptual perspective and to articulate the weaknesses/deficiencies as a means of exploring what might constitute a more sound system/product.	Students work in groups to analyse an early childhood learning setting they are familiar with to determine how technology could be used to support the teachers and learners. The students decide whether to focus on a pre-school, child care or kindergarten-year 2 primary setting.	Students work in pairs to choose a lesson plan from a collection of lesson plans developed by local teachers. The original lesson plans do not include any technology-supported activities or technology-based resources. The students use the skills and knowledge they have developed in the first 6 weeks of the subject to decide how they could improve the lesson using technology.
Describe	Students describe the attributes that are consistent with a successful form of the system/product investigated in the first task. The development of a framework describing a successful system/product is intended to enable students to develop an understanding of the elements of a successful entity and how they work in conjunction.	Students' ideas about the attributes of a technology-supported learning environment were developed through tutorial discussions and in the teams. The discussion was used to draw out general principles that could be applied to the learning setting. Students were required to express these explicitly as part of their final report. This task occurred in parallel with the application task.	Students' ideas about appropriate technology-supported activities and resources were developed through discussions in tutorials. These included whole class and team discussion. At various stages students presented their preliminary ideas and these were discussed generally. Students were also required to document their rationale for the application of their ideas in the activities they developed for the next task.
Apply	Students apply the attributes to design a system/product according to derived/given specifications. They do so using the knowledge gained from the previous tasks and its application in a practical setting.	Students were required to design technology support for the learning they had explored. This was expressed in a final report which was accompanied by resources they had developed (eg. presentations or web pages) and concrete examples (eg. for using a particular CD-ROM as part of a learning activity).	Students were required to design two activities which integrated technology into the lesson plan they had chosen to explore. They provided a description of how the activity would be structured and managed. The activity plans were accompanied by support resources they had developed, including content resources, such as Web pages, and modelling of learning tasks that learners had to complete, eg. a model PowerPoint presentation.

The teaching team also decided to add an individual activity which required learners to reflect on what they had learned from the problem task. This again helped learners to draw out some general principles and to link the particular problem activity to the earlier lecture content and tutorial tasks.

The application of the generic learning design in the example demonstrates how the overall integrity of a learning design can be maintained while the specifics of its application can be adapted to suit different learning contexts. For example while both versions included a problem, the nature of the problem was different – although it lead to a similar outcome. Comparing the two versions of the design developed for the early childhood and secondary physical and health education students, it is apparent that the problems are quite different. The secondary physical and health education task required that students work with the syllabus to develop a lesson with accompanying materials, while the early childhood task was more general. This difference in focus was appropriate because it reflected the problem typically encountered in each setting. Early childhood teachers do not often develop their own content resources, but are more likely to use CD-ROMs because of the emphasis on visual and aural stimulus for young learners. It is more common for secondary teachers to develop content resources or have the students do so as part of their lessons. Otherwise the students progressed through the task in a similar fashion, with the same types of supports

and resources provided which were tailored to the nature of the nature of the problem.

Table 1 also shows that the two versions of EDA are consistent with the description provided by the generic learning design. Each focuses on the application of 'design' principles to a practical setting. The exploration and description tasks occur through group activities and class discussion and do not involve an output that is assessed because of the limited timeframe to complete the task and the students were already required to complete other assessment tasks for the subject. This differs from the original learning design from which the generic version was based which required students to develop evaluations and frameworks from these stages [11]. These differences demonstrate how a learning design can be reused/re-purposed in a different context and activities adapted to the capabilities of the students, while still adhering to the underlying rationale.

4. Discussion

From this example we can begin to see some of the potential of using a generic learning design as a model that can be adapted from one context to another. Further analysis of the data collected from the study described above will yield additional insights into the process. However, more work needs to be done to understand this process. Specifically we need to know: what makes a generic learning design reusable; the social and practical factors that affect adaptation; what guidance teachers need to make decisions; and how to express generic learning designs to enable teachers to understand them. Software tools and systems are also needed to enable teachers to:

- search a database for an appropriate generic learning design;
- adapt the learning design within an authoring system, to specify content or to change the overall sequence;
- implement the learning design in whatever learning management system they have access to;
- adapt the design during the learning session in response to learners' queries or difficulties;
- store a copy of the implemented learning design as documentation of the particular learning experience to enable them to reuse it the next time they teach the subject.

Conceptual discussions and research and development work are beginning to address some of these needs. The *Learning Designs project* has offered one format for expressing learning designs. Goodyear [7] presents another idea based on the application of design patterns that "describe a solution to a recurrent problem in a context" that are "written in such a way that they help the reader understand enough about a problem and solution that they can adapt the problem description and solution to meet their own needs" (p. 342). Applied to educational design, these "patterns can work as a method of encapsulating design experience and research-based ideas, rendering them available for re-use in concrete design problems" (p.343). There is, however, significant work to be done to realise this goal.

Other work has begun on the development of tools to support the design process (cf. [12] [13] [14] [15]). These tools provide the ability to create learning materials flexibly by adapting generic learning designs. Other researchers are working to develop and apply a standardised encoding language that can describe these designs (cf. [16])). This is critical to the endeavour as it will allow for learning designs to be presented in any compliant system. The transferability is of great practical importance to educators. The challenge is to develop an encoding standard that is suited to a wide range of pedagogical approaches used in collaborative, generative, dynamic learning environments.

5. Conclusion

This paper has described some of the current thinking and research on the application of generic, or reusable, learning designs in university education. Generic learning designs have the potential to serve as a support for university teachers to develop coherent high quality learning experiences that incorporate learning objects. To further understand how this can be achieved a better understanding of the educational design context and process is needed. Only then can appropriate tools and strategies be developed.

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References:

[1] S. Agostinho, R. Oliver, B. Harper, J. Hedberg, & S. Wills, A tool to evaluate the potential for an ICT-based learning design to foster "high-quality learning". In A. Williamson, C. Gunn, A. Young., & T. Clear (Eds.), *Winds of change in the sea of learning: Proceedings of the 19th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education,*

Auckland, NZ: UNITEC Institute of Technology, 2002, 29-38.

[2] S. Downes, Learning objects: Resources for distance education worldwide. *International Review of Research in Open and Distance Learning, 2*(1), 2001.

[3] D. A. Wiley, Learning objects. In A. Kovalchick & K. Dawson (Eds.) *Educational Technology: An Encyclopaedia* (ABC-CLIO: Santa Barbara, 2003).

[4] D. A. Wiley, Learning objects: Difficulties and opportunities. *Academic ADL Co-Lab News Report: No. 152-030406*, 2003. [Online]. Retrieved April 7, 2003, from http://wiley.ed.usu.edu/docs/lo_do.pdf.

[5] T. Hand, M. Gosper, K. Woo, D. Gibbs, S. Kerr, & D. Rich, Learning objects: User perspective on the conditions surrounding their use. *Proceedings of the ED-MEDIA 2004: World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 21-26 June, Lugano, Switzerland, AACE, 2004, 66-72.

[6] R. Koper, R, Combining reusable learning resources and services with pedagogical purposeful units of learning. In A. Littlejohn (Ed.), *Reusing online resources: A sustainable approach to e-learning* (Kogan Page: London, 2003, 46-59).

[7] P. Goodyear, Patterns, pattern languages and educational design. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* Perth, 5-8 December, 2004, 339-347. http://www.ascilite.org.au/conferences/perth04/procs/goodyear.html

[8] S. Bennett, & L. Lockyer, Becoming an online teacher: Adapting to a changed environment for teaching and learning in higher education, *Educational Media International, 41*(3), 219-231.

[9] S. Bennett, L. Lockyer, & S. Agostinho, Investigating how learning designs can be used as a framework to incorporate learning objects. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* Perth, 5-8 December, 2004, 116-122. http://www.ascilite.org.au/conferences/perth04/procs/bennett.html

[10] R. Oliver, & J. Herrington, *Explore, Describe, Apply: A problem focussed learning design.* Retrieved March 10, 2005, from Learning Designs Web site: http://www.learningdesigns.uow.edu.au/guides/info/G4/index.htm, 2002

[11] J. Herrington, & R. Oliver, *Description of Online teaching and learning (Edith Cowan University Online Unit IMM4141 in Graduate Certificate in Online Learning).* Retrieved March 10, 2005 , from Learning Designs Web site: http://www.learningdesigns.uow.edu.au/exemplars/info/LD20/index.html, 2002.

[12] S. Agostinho, S. Bennett, L. Lockyer, & B. Harper, Integrating learning objects with learning designs. In G. Crisp, D. Thiele, I. Scholten, S. Barker and J. Baron (Eds.), *Interact, Integrate, Impact: Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education,* Adelaide, 7-10 December 2003, 571-575.

[13] J. Dalziel, Implementing learning design: the learning activity management system (LAMS) In G. Crisp, D. Thiele, I. Scholten, S. Barker & J. Baron (Eds.), *Interact, Integrate, Impact: Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education,* Adelaide, 7-10 December 2003, 593-596.

[14] D. Laurillard, & P. McAndrew, P, Reusable educational software: A basis for generic learning activities. In A. Littlejohn (Ed.) Reusing Online Resources: A Sustainable Approach to E-learning (Kogan Page: London, 2003, 81-93).

[15] M. Kang, D. H. Lim, & M. Kim, Learning designer™: An e-learning design and development tool generating SCORM learning objects. *Paper presented at Learning Objects 2003 Symposium*, Honolulu, 24 June 2003. [Online]. Retrieved 30 July, 2003, from http://www.cs.kuleuven.ac.be/~erikd/PRES/ 2003/LO2003/Kang.pdf.

[16] R. Koper, & R. van Es, Modelling units of learning from a pedagogical perspective. In R. McGreal (Ed.) *Online Education Using Learning Objects* (RoutledgeFalmer: London, 2004).