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Implementing generic learning designs based upon quality ICT exemplars

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Abstract

Within the context of an AUTC funded Project: Information and Communication Technologies and Their Role in Flexible Learning, this paper presents an analysis of learning designs using ICTs and how this grounded approach might be a more useful structure to design effective learning environments. The project has developed generic or reusable frameworks for technology-enhanced high quality learning experiences in higher education and this paper will present several examples of the original design and how the key elements were selected and developed for use by others. As this project is currently developing these generic exemplars of learning designs, the final presentation will demonstrate how the designs might be reengineered to become useful templates for other instructors and other knowledge domains.

Introduction

There is growing awareness today of the value of learning environments in higher education that foster knowledge construction. This awareness has coincided with the development and increased uptake of information and communication technologies as supports for learning and increasingly we are seeing examples and instances of the learning settings based on constructivist principles (Harper & Hedberg, 1997). These principles posit that learning is achieved by the active construction of knowledge supported by multiple perspectives within meaningful contexts. In constructivist theories, social interactions among learners are seen to play a critical role in the processes of learning and cognition (eg. Vygotsky, 1978).

In the past, the conventional process of teaching, and that of instructional design, has typically revolved around a teacher planning and leading students through a series of instructional sequences and events to achieve a desired learning outcome (eg. Gagné & Briggs, 1974). Typically these forms of teaching focus upon organised transmission of a body of knowledge followed by some forms of interaction with the material to consolidate the knowledge acquisition. Contemporary learning theory is based upon the notion that learning is an active process of constructing knowledge rather than acquiring knowledge and that instruction is the process by which this knowledge construction is supported rather than a process of knowledge transmission (Duffy & Cunningham, 1996).

Instructional Design

In learning settings that support knowledge construction, the emphasis is placed on learning as a process of personal understanding and the development of meaning in ways which are active and interpretative. In this domain, learning is viewed as the construction of meaning rather than as the memorisation of facts (eg. Lebow, 1993). Technology-based approaches to learning provide many opportunities for constructivist learning through their provision and support for resource-based, student-centred settings and by enabling learning to be related to context and to practice (eg. Berge, 1998; Barron, 1998).

In contemporary learning, we use the concept of a learning environment to describe the setting in which learning takes place. A learning environment typically contains the learner and a space where the learner acts with tools and devices to collect and interpret information through a process of interaction with others. The concept of a learning environment is that of a flexible learning space and quite different to the instructional sequence which has previously characterised instructional design strategies.

The conventional art of instructional design has previously been very well defined and many guidelines and models have been developed to guide instructional designers in the process of developing instructional sequences (eg. Gagné, Briggs & Wager, 1992). Instructional design for learning settings that promote knowledge construction is a far more complex process. There is a distinct shortage of models and explicit frameworks for instructional designers. Jonassen (1994) argues that there cannot really be any firm models guiding the design of constructivist settings since knowledge construction is so context-specific. Lefoe (1998) argues that learning design theory today serves to provide principles and general concepts by which learning environments can be planned. The process is far less rigid and has fewer guidelines than previously and is a very difficult process for many.

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Describing learning environments that support knowledge construction

Many writers have, however, attempted to provide guidance for the design of constructivist learning settings by articulating the underpinning characteristics. For example, Cunningham, Duffy & Knuth (1993) argue that constructivist learning environments are characterised by seven pedagogical goals in that constructivist learning settings are those which concurrently:

- provide experience in the knowledge construction process;
- provide experience in and appreciation for, multiple perspectives;
- embed learning in realistic and relevant contexts;
- encourage ownership and voice in the learning process;
- embed learning in social experience;
- encourage the use of multiple modes of representation; and
- encourage self-awareness in the knowledge construction process.

Others have added extra detail to these goals by suggesting that support and resources should embed the reasons for engagement into the learning activity itself. This approach ensures that the learner can explore options and, in particular, examine errors and failures to ensure they can understand the relatedness and the limits to their conceptual understandings (Lebow, 1993). In particular to support the translation into online forms we have the guidance from Jonassen and Tessmer (1996/7) who have proposed that we need to develop strategies that support:-

- Active learners to engage in interaction with and manipulation of the exploration environments that we construct.
- Learners to explore and strategically search through these environments
- Intentional learners willingly trying to achieve cognitive objectives
- Conversational learners engaged in dialogue with other learners and with instructional systems
- Reflective learners articulating what they have learned and reflecting on the processes and decisions that were included in the process
- Ampliative learners who generate assumptions, attributes and implications of what they learn

The descriptions that writers have provided of the elements required for constructivist learning settings can help designers to understand the forms of learning activity which are required but often fail to provide adequate guidance for the actual learning designs that can encapsulate such principles in cohesive and supportive ways. Hannafin, Hall, Land, and Hill (1994) suggested that appropriate forms of learning settings are open-ended and characterised by learner engagement in cognitively complex tasks involving such activities as problem solving, critical thinking, collaboration and self-regulation.

There is currently little empirical work that can guide the design of learning settings that support knowledge construction. Different authors and different projects have described a range of distinct forms of learning settings that have been designed to encourage learner activities that support knowledge construction. The following examples are presented.

Ip and Naidu (2001) outline a range of experienced-based pedagogical designs suitable for online learning. They argue that one characteristic feature of such experienced-based learning designs is the nature of the learning experience. They distinguish between first-person- experience-based designs and third-person-experienced-based designs. The distinction is based on whether the learning occurs through first-hand experience, for example in a simulation or role play setting, or from a third person information source through such means as resources and content forms.

Jonassen (2000) describes learning designs that support knowledge construction as problem-based learning settings and describes eleven problem-types in a form that suggests a continuum from problem solving based on the application of rules; activities based on incidents and events; through to solutions that require strategic planning and activity; and problem solutions based on learners' performances.

Oliver (1999) and Oliver and Herrington (2001) have synthesised the range of learning designs by developing a framework that identifies the critical elements required in a learning design, particularly when ICT mediated. The critical elements comprise the content or resources learners interact with, the tasks or activities learners are required to perform, and the support mechanisms provided to assist learners to engage with the tasks and resources. This is illustrated in Figure 1.

A Framework for describing learning designs

In our research associated with the AUTC Project: *Information and Communication Technologies and Their Role in Flexible Learning*, we have been exploring strategies by which the nature and scope of the forms of learning designs described above can be formalised. Having formal descriptions will provide the means to more easily guide the instructional design process and will also provide some means for institutions to provide supports and structures for teachers wishing to employ them.

As part of the project the researchers and other project members analysed a wide range of technology-based learning designs to identify its underpinning pedagogies. These designs were collated from a variety of sources including CAUT and CUTSD funded ICT-based projects. The analysis of the learning designs was based on the identification of the three critical elements: learning tasks, learning resources and learning supports (Oliver, 1999). The analysis was conducted by examining the descriptions of all the learning design exemplars to determine emergent clusters. The work by Ip and Naidu (2001) informed this process and the

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various problem types described by Jonassen (2000) were used as a means to develop a framework by which learning designs might be classified and described.

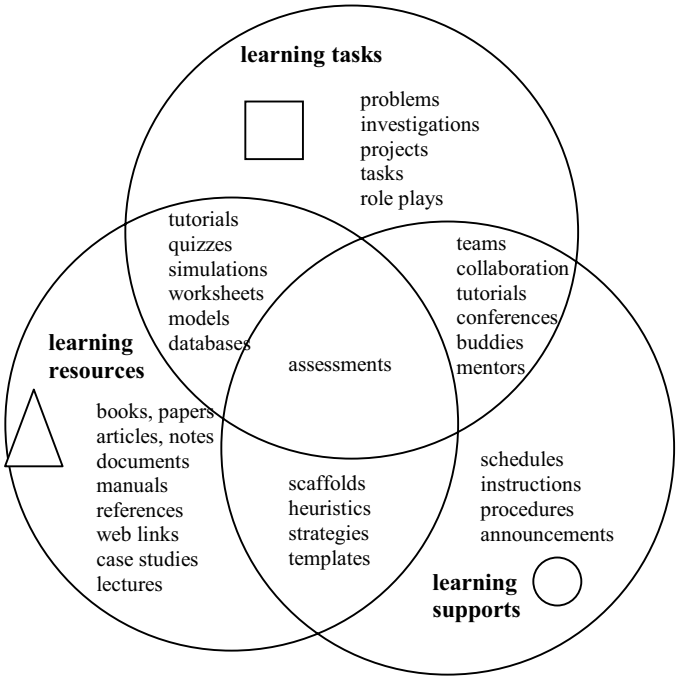

Figure 1: Elements of a learning design. Based on Oliver and Herrington (2001).

Based on the project team's grounded analysis plus further exploration of the Jonassen (2000) problem types, there appear three discrete forms of learning design within the eleven. These discrete forms each encompass a number of the problem types and appear capable of being used to further categorise potential learning designs. The problems encompassed within Jonassen's descriptions are typically either of a rule-focused, an incident-focused, or a strategy-focused form. Our inquiry suggests a fourth type of learning design, that of role-focused and devised two additional problem types that are characteristic of this form. The four types of learning designs that emerge from this form of analysis and development are shown in Table 1. The learning designs are discrete and follow what might be seen as a continuum describing the scope of their complexity and open-ness. Table 1 shows these forms and provides descriptions of each learning activity focus and the forms of learning outcome that are associated with each.

The nature of the various learning designs described in Table 1 can be further demonstrated and exemplified by considering the forms of tasks, supports and learning resources that each would require in a learning setting (Oliver, 1999).

Learning design Focus	Description	Learning Outcomes
Rule focus	The learning task requires learners to apply standard procedures and rules in the solution. Eg the application of given procedures and rules in defined ways to effect a solution.	A capacity to meaningfully and reflectively apply procedures and processes.
Incident focus	The learning activities require learners to reflect and take decisions based on the authentic actions and events.	Disambiguate scenario using an understanding of procedures, roles and the ability to apply knowledge and processes.
Strategy focus	Learning is focussed around the strategies employed to achieve the task goals. Often the strategy options are generated as part of the solution.	A capacity to apply knowledge in meaningful ways in real-life settings often with time and performance constraints.
Role focus	The learning is achieved through learners' participation as a player and participant in a setting that models a real world application.	An understanding of issues, processes and interactions of multi-variable situations with outcomes based on the multiple perspectives of roles taken.

Table 1: A framework for a learning design typology

Describing learning designs in generic forms

In our project, we have a need to be able to articulate clearly the nature and scope of different forms of learning design in ways that will enable that design to be applied across a variety of settings and disciplines. We clearly have a need for some strategy by which the various learning designs can be described and variations and instances can be accommodated. To achieve this goal, we have proposed the use of a temporal sequencing strategy based on the three critical elements of learning environments proposed by Oliver (1999). In the following section, we propose a series of potential generic categorisations based on the four main forms of learning designs using a temporal representation describing the interactions of the tasks, resources and supports. It is our intention to work with the generic descriptions and to refine their elements and components

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through their application to the various forms of learning design that emerge from our investigations and inquiries.

1. Rule-focused learning designs

Figure 2 shows a temporal sequence for the form of learning design we have designated rule-focused. Rule-focused designs are those that are primarily comprised of closed tasks whose completion requires the application of some form of rules, procedures or algorithms. In rule-focused learning designs, the resources which learners use include the procedural and system descriptions needed for the application and the learning environment, together with the necessary supports to enable learners to achieve success in their efforts. The learning is achieved through learners applying standard procedures and rules in developing a solution. For example, algorithmic approaches involve the application of given procedures and rules in defined ways to effect a solution. The task designs need to provide learners with opportunities to meaningfully and reflectively apply procedures and processes to specific closed, logical and bounded tasks.

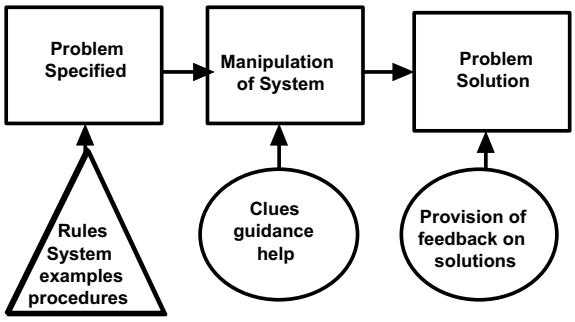

Figure 2: Temporal sequence describing a rule-focused learning design

2. Incident-focused learning designs

In an incident-focused learning design, the learning activity is based around learners' exposure to, and participation in, events or incidents of an authentic and real nature. The learning is focused around activities that require learners to reflect and take decisions about the actions and events. The temporal sequence shows learning processes which begin with a description of the incident, elaboration of that incident through reflection, a group or individual process to find a solution or to come to a decision, declaration of a solution or decision, and provision of feedback on solution or decision.

Incident-focused learning designs can be supported through learner collaboration and through opportunities to articulate and reflect on the learning provided by a teacher acting as a mentor. The learning centres around activities that require learners to reflect and take decisions focused on the incidents and events that are represented. The setting requires a range of resources to provide rich descriptions and information about the incident.

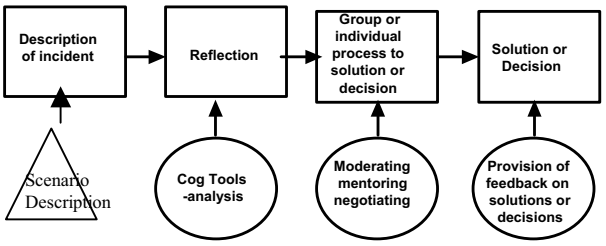

Figure 3: Temporal sequence describing an incident-focused learning design

3. Strategy-focused learning designs

Strategy-focused learning designs are characterised by such activities as complex and ill-defined tasks, decision-making tasks, some trouble shooting tasks, diagnosis solutions and strategic performance tasks. The temporal sequence shown in the example (Figure 5) later in this paper suggests a learning design where learners undertake a series of activities and at the same time interact with a variety of resources and learning supports. The process involves specification of the strategic problem, elaboration of that problem through reflection, a group or individual process to carry out the task, declaration of a solution or outcome from the tasks and reflection on the learning process.

In strategy-focused learning designs, learning is focused around tasks that require strategic planning and activity. The environment requires authentic resources that support multiple perspectives, provide such elaborations as expert judgements and which also provide descriptions of theoretical underpinnings. Typically learners are also provided with sample tasks and solutions, cases, tactics, strategies and treatments. Support is provided through a teacher acting as a coach and facilitator, and often through collaborative learning tasks involving such strategies as peer assessments and the provision of meaningful opportunities and contexts for articulation and reflection.

4. Role-focused learning design

In role-focused learning, learners acquire skills, knowledge and understanding through the assumption of roles within real-life settings. The design typically involves some purposeful and directed preparation and role-playing in scenarios that have been developed to provide the forms of learning opportunities sought in the objectives. The temporal sequence shown in Figure 4 involves the declaration of learner role, on-line dialogue to clarify this role, presentation of a dilemma to resolve, on-line dialogue to resolve the dilemma within the perspective of a role, a possible negotiated resolution to the dilemma and reflection on the process.

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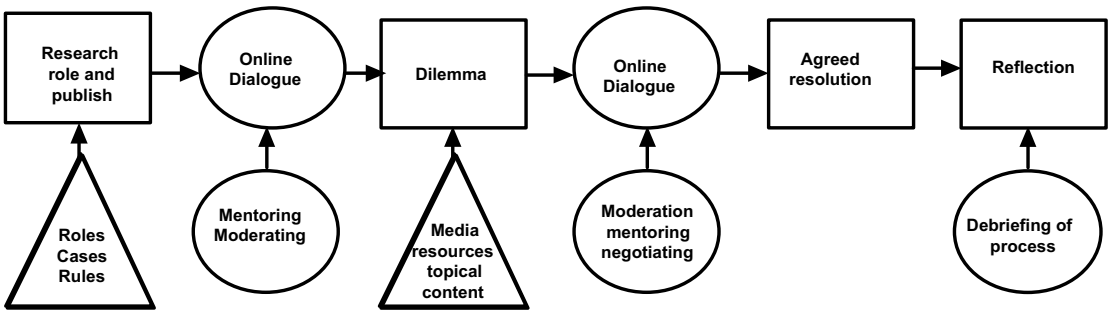

Figure 4: Sequence describing a role-focused learning design

In role-focused settings, learning is achieved through learners' participation as a player and participant in a setting, which models a real world application. Learners apply judgements and make decisions focused on understanding of the setting in real time scenarios. The settings require an array of resources to support the learners' role including procedural descriptions, role definitions, resources to define and guide roles, scenarios, topical content and cases. Typically the role of the teacher is that of a moderator and mentor, who creates opportunities for the learners to articulate and reflect on their learning experiences.

An exemplar — "Interactive Multimedia Design" a strategy-focused learning design

Many of the learning designs evaluated have clever implementations of a pedagogical framework. Many have used standard tools available in learning management systems such as discussion forums or email listservers to establish links and share resources or ideas. Some such as the following design have used the technology to support simple problem solving and reflection. This example is a whole course in which there are a series of learning tasks which build to create the learning experience. The subject aims to:

1. prepare participants to design and develop interactive multimedia in collaborative teams.
2. experience the team design process and reflect on this experience
3. review the process of interactive multimedia development
4. develop specific skills to fulfil their role in the team

The sequence begins with an analysis of a case, moves to a comparison with a second case to identify nuances in design approaches, students then red a set of informational tasks following a textbook structure, which contributes background for the major task. The final project for the course is based around an interactive multimedia design problem which runs parallel to the textbook learning tasks and the whole learning experience is consolidated with a reflective task which compares both cases, the personal experience of design and the theoretical issues raised through the standard textbook. The choice of the cases was to support the transfer of learning of a set of ideas which are loosely transferred from the theory. In design problems, the rules are creatively applied and the strategy might vary considerably from particular one design brief to another.

This design is in fact a compendium of learning designs. Each might be chosen individually but together they make a powerful set of tasks that mutually support the transfer of learning in an ill-structured knowledge domain. The first two tasks are case-study problems, the third is the major design problem and the other tasks are informational and strategic to ensure that the learning outcomes are the focus of the experience rather than these elements being seen as discrete and unrelated pieces (See Figure 5).

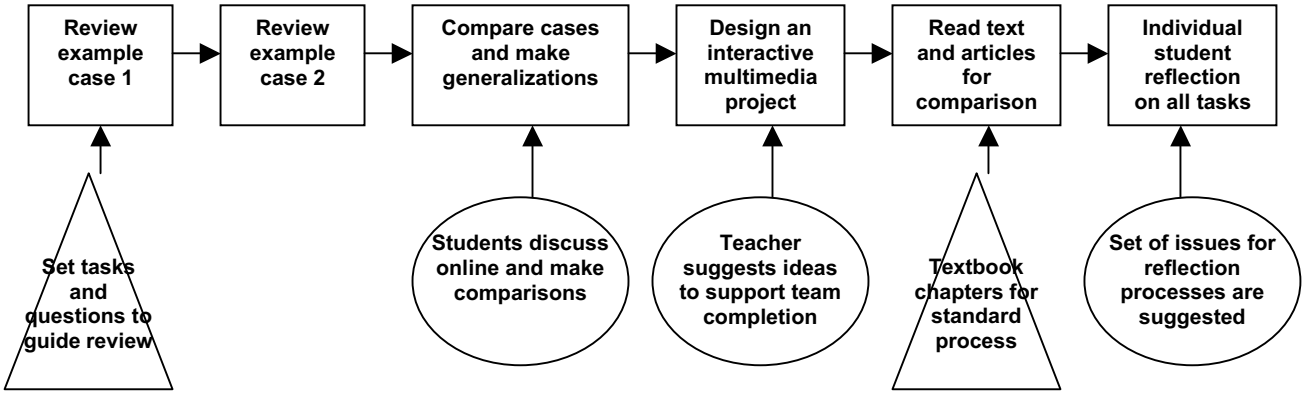

Figure 5: Initial sequence for Interactive Multimedia Design Subject

While the design task includes scaffolds and comparisons with other examples, there are many elements in this particular instance, which might be separated into smaller learning designs to achieve similar

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outcomes in less time with fewer resources. The CD-ROM examples are very complex and were created by a team of experts. Thus the degree of complexity needs to be made explicit and the sets of resources included in each example needs to be constrained to focus upon the main learning outcomes. In the evaluation it was felt that if this is not made explicit in the course it may cause students to have unrealistic expectations of their own individual performance, their team's performance within the course, and what to expect in the field of multimedia development in general, outside the course.

Summary and Conclusions

The project is currently attempting to use these various forms of generic learning design to extend the range of problem-types described by Jonassen (2000) and to create linkages to some additional problem designs which have arisen from the grounded review and re-development of projects. At the same time the project team has been using the generic descriptions to create a comprehensive set of examples of best practice in technology-based learning and to explore the effective pedagogies underpinning these examples.

As the project progresses, it aims to document in very detailed ways, the forms of the learning designs and to provide templates and frameworks that will enable teachers wishing to implement such designs to have some firm guidance and support in the process. The project has developed a Web site that is being used to inform people of the progress and ultimately to provide access to the resources and materials that are developed. (http://www.learningdesigns.uow.edu.au)

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The Interactive Multimedia Design exemplar was derived from a case study research project by Sue Bennett and was based around a course taught on campus and in Hong Kong by Drs Lori Lockyer and John Hedberg at the University of Wollongong.

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