

Developing and Evaluating a Design for Pedagogy Pattern for an Online Forum.

Summary	Addressing the need to investigate how to embed learning theories into the interface, information architecture and content design of e-learning courseware, this research creates a method to develop “design for pedagogy patterns”, a language of design which helps designers place teaching and learning theories at the heart of e-learning design. It does this by developing a pattern-making tool – the “pattern pack” – which aids writers in the task of creating a design for pedagogy pattern. This paper illustrates a case study on the application of the pattern pack to develop a design for pedagogy pattern for an e-learning online forum. An evaluation of the patterns by an expert is included to discuss the quality of the patterns that can be created using this methodology.
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Project	Design for Pedagogy: Patterns for E-Learning

Situation

Embedding pedagogical theories into e-learning

The research and resulting pattern was part of a PhD study project undertaken at the Faculty of Architecture, Design and Planning at the University of Sydney in Australia. The research set out to create a methodology for embedding the principles of teaching and learning (pedagogy) into the design of e-learning courseware. Design in this instance is a broad term, taking into account not only interface design, but also information architecture and content design.

Creating e-learning courseware to make best use of learning theories can add complexity to an already complex design task. Current approaches to e-learning design lack a guiding principle for embedding pedagogical theory into courseware. Designers, content specialists and teachers may be expert in their various fields, but find themselves cognitively burdened when faced with the task of creating e-learning courseware. Mapping classroom learning into the online domain is a complex task (Vrasidas, 2004).

Design pattern languages can facilitate this task. Design patterns create core modules that are composed of smaller elements, but which are linked in an integrated way (Derntl & Motsching-Pitrik, 2004). To date design patterns for computer-mediated interaction, website design and software development have been created, but none have taken into consideration issues to do with pedagogy (Schümmer & Lukosch, 2007; Van Duyne et al, 2003). This research uses two pedagogical theories, constructivism and experiential learning as an overall design philosophy (Goodyear, 2005) and embeds these theories into “design for pedagogy patterns” for e-learning. The “design for pedagogy patterns” cater not only for the designers of e-learning courseware, but also for the tutors or academics that use the resulting courseware.

The research piloted a methodology for the embedding of pedagogy into design patterns and subsequently developed a tool which was designed to facilitate the pattern writing process. The design pattern writing task is for an e-learning forum, the end users of this pattern are the e-learning courseware designers and the tutors/academics who use the resulting forum. The reason that the pattern must cater for both groups is that the courseware design must map onto the teaching practices that it supports. It describes the baseline structure of online communication for the forum.

The tools required in the writing of this forum pattern are the “pattern pack”, a computer and access to the internet. The evaluation of the patterns by the expert was an assessment tool in the form of an online survey.

Task

The task for this case study is broader than simply writing a design pattern for an online forum. In the process of creating “design for pedagogy patterns” for e-learning, this research:

- develops a methodology which embeds pedagogical theories into design patterns,
- creates a tool to formalize the methodology (see Actions),
- tests this methodology through the writing task using eight participants, and
- evaluates the resulting patterns to determine the best “design for pedagogy pattern” (see Results).

The problem was if the Alexandrian pattern structure was used (Alexander et al., 1977) a pattern either became a design pattern OR a pedagogy pattern. The structure was unable to cater for both. “Design for pedagogy patterns” adapt the original Alexandrian pattern language structure to add a pedagogical layer. In order for a design pattern to become a “design for pedagogy pattern” there are certain criteria that a “design for pedagogy pattern” must fulfill.

A design for pedagogy pattern must:

- Show the relationships between pedagogic strategies associated with the design elements and those linked with the general and abstract ways of thinking about education, including the social and the educational context, teaching practices and the tactics for engaging students.
- Make the pedagogy explicit, in how it is articulated through image, text and interaction.
- Refocus the emphasis of e-learning design onto pedagogy and link teaching practices with the resultant courseware.

This research uses the basic theoretical approach that people learn from their experience, using the principles of experiential learning theory (Kolb, 1984). A “trying out” or experience-based approach is at the core of experiential learning theory, and, if encapsulated in a collaborative learning space, provides the real-world context outlined in social constructivist theory. The “what-if” ability available in e-learning is a key attraction, and, according to both experiential and constructivist learning theories, affords additional opportunities in the consolidation of knowledge.

However, the methodology of creating a design for pedagogy pattern is not limited to the two learning theories mentioned. The structure of a design for pedagogy pattern enables the use of alternate and multiple teaching theories as a guiding pedagogical philosophy (Goodyear, 2005).

In creating a design for pedagogy pattern for an e-learning forum, writers need knowledge of the pedagogical philosophies, current research exhibiting best practice and examples of current forums from which to extract the generic design and pedagogical elements. To facilitate this task, a methodology was developed to formalize a process for writing a “design for pedagogy pattern”:

1. *Text search for pattern problem*, by the writer.
2. *Definition of problem*, based on the text search of existing literature and e-learning courseware.
3. *Search for solution, teaching strategies and optional case studies*, which fit constructivist and experiential learning theories (or other pedagogical theories).
4. *Write solution and teaching strategies* in terms of the pedagogical philosophies. (Chatteur, Carvalho & Dong, 2008)

The aim was to refine the method for producing “design for pedagogy patterns”, not just to develop a pattern per se. This methodology was trialled in the early pilot studies with three pattern writers, with a basic set of documents: primers on constructivism and experiential learning theories, and pattern template documents. After each pilot these documents which subsequently formed part of the “pattern pack” were evaluated and updated, based on qualitative feedback.

When the methodology was put into practice, it became apparent that writing a “design for pedagogy pattern” was a complex task in itself. The problem became how to make it easy to identify and extract design solutions and associated teaching strategies based on constructivism and experiential learning from the existing forums and the readings. Two of the pilot pattern writers completed the writing task, but expressed frustration at the complexity of the task, the third failed, after spending many hours trying to decipher the task.

Actions

1) Developing the “Pattern Pack”

The task of associating and embedding the pedagogical theories with the design needed to be made simpler and clearer. A methodology based on an experiential learning approach was developed. Using all four elements of the experiential learning cycle, (Kolb, 1984, p. 42) the writers would be asked to transform their concrete experience of the online forums and peer-reviewed readings through reflective practice using the “pattern pack” to form theories (abstract conceptualization) about the generic structures linking pedagogy with design in e-learning forums. This would then be put to use in writing the design for pedagogy pattern (active experimentation) (Chatteur & Dong, 2008).

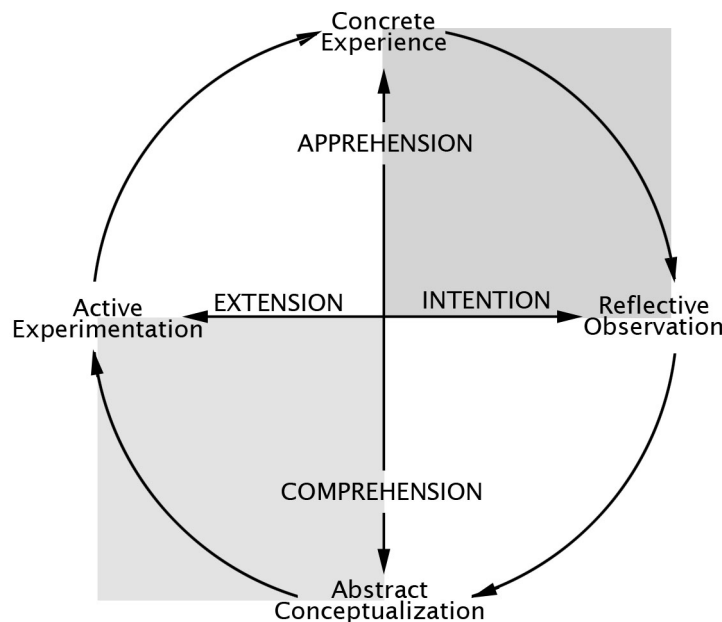


Figure 1. The Experiential Learning Cycle (after Kolb, 1984, p.42)

The first major action in this research was the development of this tool, the “pattern pack”. The “pattern pack” contains instructions, background readings, pattern templates and two sets of cards. One set of cards (white) identifies the generic design elements seen in an e-learning forum, (menu navigation, forum registration page, threaded discussion pages, etc.). Each **design** element was analysed using the Function-Behaviour-Structure framework (Gero, 2002) as an ontology to describe a design work with the focus being on the *structural elements* of the design. The second set of cards (blue) identifies **pedagogical practices** based on experiential learning and constructivism (abstract conceptualization, active experimentation, reflection etc). In this case the pedagogy cards displayed the *function* of the FBS analysis, as the structure (i.e. how the pedagogy is realised on screen) is variable. (Chatteur & Dong, 2008).

The research subjects, (the writers) use the “pattern pack” to help them write a “design for pedagogy pattern” for the online forum. The process is outlined in Figure 2.

the process - using the “pattern pack”

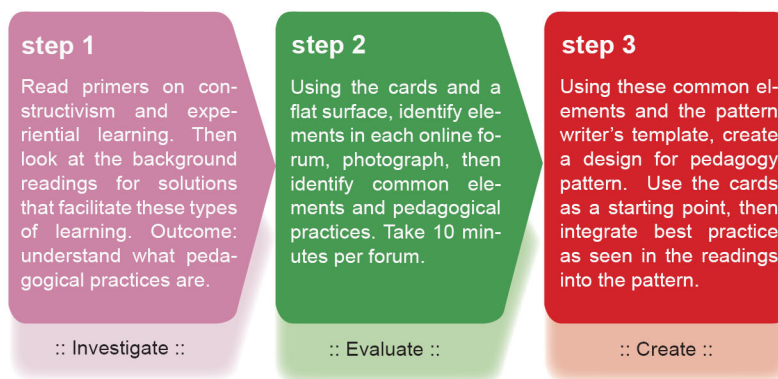


Figure 2. The “pattern pack” process.

The writers firstly read primers on constructivism and experiential learning, so as to gain an understanding of the learning theories. An executive summary of current research on online forums is provided as background reading, outlining best practice. Online e-learning forums are examined and a hierarchy is created using the cards, like a flowchart. The cards enable the organization of the visible design elements (white cards) and allow the writers to link these elements with the supporting pedagogy (blue cards). The hierarchy is photographed for each of the three forum examples and recurring design and pedagogical elements are identified. Using the recurring design and pedagogical elements, the writer creates an “ideal forum” hierarchy. (See Figure 3.) The writers, using an empty pattern template, wrote the pattern with guidance from both the brochure and a document explaining writing style and identifying the possible content for each section. The aim was to give the writers a consistent structure.

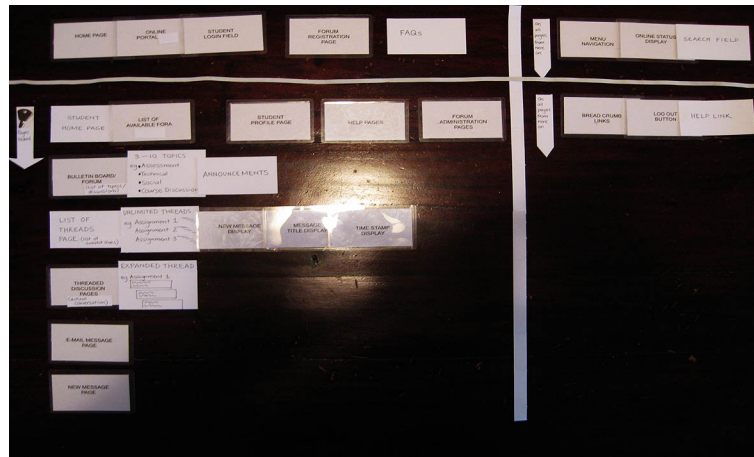


Figure 3. The card hierarchy for the forum pattern.

The “pattern pack” used by all of the writers contains the same pattern problem:

Students need to communicate with each other about the course (subject). How does one design a forum to facilitate and encourage collaborative learning?

By pre-defining the pattern problem and embedding within it pedagogical issues pertaining to social constructivism, it was hoped that the resulting patterns would be consistently on-topic.

2) Writing with the “Pattern Pack”

The “pattern pack” was used with eight writers in the creation of a “design for pedagogy pattern” for an e-learning forum. The eight writers were individuals who fulfilled a selection criteria:

- They were either designers or design educators,
- Were in possession of (or in the process of getting) a design qualification at post-graduate level.
- They were familiar with e-learning and internet technologies.
- They were able to write at an advanced level in the English language.

The test subjects were given four hours to complete the writing task, in two separate sessions of two hours each. This was done on the advice of one of the pilot subjects who was also a cognitive psychologist, who suggested that dividing the task into two sessions would reduce cognitive load. The background readings were given to the subjects in advance.

Session one was the card task, identifying the common design and pedagogical practices for online forums in the form of a hierarchy. These card hierarchies were photographed.

Session two was the writing task, where the card hierarchies were used to aid the writing of the “design for pedagogy pattern”.

Feedback from the writers indicated in the majority of the cases the task was clear, and although difficult, not prohibitively so. Most of the writers requested more time for the writing task, however the card task was completed within the two hour time frame.

3) Developing the Evaluation Tool

In this section the variables used in evaluation will be examined. In the Tasks section (above), the criteria for successful “design for pedagogy patterns” were outlined.

1. The first criteria is to determine a relationship between pedagogic strategies associated with design elements linked with general and abstract ways of thinking about education including the social and the educational context, teaching practices and the tactics for engaging students. (See Table 1).

This pattern outlines how to help students reflect on their learning.
This pattern is likely to result in an e-learning courseware that will stimulate a student's learning experience.
The concepts in this pattern clearly link theory and research with practice.

Table 1: Examples of general questions on ways of thinking about education.

2. The second criteria is to make the pedagogy explicit, through image, text and interaction. Table 2 describes two general questions on learning theory. The third question is specific to the forum pattern.

Constructivist learning theory is incorporated into the writing of this pattern.
Learning theories appear to influence the overall philosophy of this pattern.
Social interaction could be promoted by using this pattern.

Table 2: Examples of learning theory questions.

3. The third criteria for a successful "design for pedagogy pattern" is to link teaching practices with the resultant courseware, while refocusing e-learning design onto pedagogy (See Table 3). The forum specific question is again at the bottom.

I could identify links between the design solution and the teaching strategies.
This pattern contains all of the common elements required for a pattern that links design with pedagogy
This pattern promotes the use of student/teacher communication.

Table 3: Linking design with teaching practices.

If these criteria were to be true of all "design for pedagogy patterns", then logically part of the evaluation tool would contain generalized questions. However, in order to rank the patterns, it was also necessary to determine how these criteria address this particular pattern, the e-learning forum. Some pedagogical and design issues are particular to the type of pattern being developed. It was therefore decided to divide the evaluation into two sections: those that could deal with "design for pedagogy patterns" in general, and those questions that evaluate the forum pattern in particular. In this way part of the evaluation tool could be reused for future patterns, whilst maintaining the granularity required for this particular pattern. The evaluation tool contained nineteen questions that could be applied to "design for pedagogy patterns" in general, and six questions specific to the forum pattern.

A Likert Scale questionnaire was developed as an online tool for the experts to use to evaluate the patterns. This questionnaire also captured information on the experts and to identify which pattern was being evaluated. It also recorded an overall ranking of the pattern, given on a scale of one to eight (where one is the best pattern). This ranking could be triangulated with the Likert Scale, in order to validate the results. The expert evaluation also asked “How would you rank the overall quality of this pattern on a scale of 1 to 5? (Where 5 is excellent)”. This was to gain a perspective of how the study’s “design for pedagogy patterns” compare with design pattern patterns in general.

Results

The study resulted in eight individual “design for pedagogy” patterns, of varying quality. Seven out of the eight patterns addressed the pattern problem statement and discussed the design of an online e-learning forum. Overall there was a consistency in the pattern structure, although not of content. The quality of the study’s patterns appear to follow a bell curve, however, none fell into the “excellent” category.

After the evaluation by an expert in design patterns, the best “design for pedagogy pattern” was determined. Pattern G scored 79/95 in the questions about patterns in general and 25 /30 in the forum specific questions – an average score of 83%. It was ranked first in the scale of 1-8 (where 1 is the best pattern and 8 is not), and a ranking of 4 for out of a possible 5 on the question of overall quality. It ranked 4 out of 5 in the overall quality question.

Future work for this study will further evaluate the patterns with three other design and pattern experts to ensure accuracy of this result.

This pattern succeeded where others did not in clearly addressing the teaching and learning practices that can be applied to an online forum. The links between design and pedagogy are clearly made, as are the pedagogical reasons behind the design choice. In the teaching strategies section it is clear what teaching practices can be put to use in this forum.

In comparison with the other “design for pedagogy patterns” this particular pattern ranks well – but how does it compare with a generic forum design pattern? In their book *Patterns for Computer-Mediated Interaction*, Schümmer and Lukosch (2007) outline a pattern for an online forum. In order to judge the overall quality of the “design for pedagogy pattern” a comparison can be seen in Table 4.

Schümmer and Lukosch	Design for Pedagogy Pattern G
	Summary
Picture of forum in Rome, Italy	(none) (Stonehenge added for this book)
Background <ul style="list-style-type: none"> - Definition of forum - Use as asynchronous communication 	Context <ul style="list-style-type: none"> - Enhancing student learning - Intended use as logical structure in the context of a class of 5- 30 participants. - Assumes use of tutor/moderator - Use as asynchronous communication
Problem statement	Problem statement
Problem background <ul style="list-style-type: none"> - Use cases (when pattern should be used) 	
	Forces (added for this book).
	Process Diagram

<p>Solution Statement</p> <ul style="list-style-type: none"> - Forums list - Use analysis - Danger spots - Email clients/mailling lists - Threaded discussions 	<p>Solution Statement</p> <ul style="list-style-type: none"> - Use analysis (announcements and messages) - Forums list/threaded discussion/multiple threads/multiple messages - Public/Private message modes - Design elements for public/private modes (very detailed) - Admin pages. - Volume analysis (how many pages at each level)
<p>Image of online forum</p> <p>n/a</p>	<p>Structure diagram</p> <p>Teaching strategies</p> <ul style="list-style-type: none"> - Strategies for success - Calm and friendly atmosphere - Don't dominate discussions - Social interaction - Critical thinking - Peer feedback - Ensure each message has a reply - Exploration - Deep enquiry - Positive feedback - Clear discussion objectives - Learner activity goals - Reflection/reflective observation - Scaffolding - Alternate pedagogical solutions
<p>Related patterns</p> <ul style="list-style-type: none"> - Feedback loop - Interaction directory - FAQ - Quality inspection - Threaded discussions - Periodic report - Change indicator - Chat - Messageboard - E-Forum 	<p>Related patterns</p> <ul style="list-style-type: none"> - Moderation settings - Private messages - Social space
<p>Case Study (Yes - about an expert in computer-supported collaborative learning)</p>	<p>Case Study (present in structure but no content)</p>
<p>References (yes)</p>	<p>References (present in structure but no content)</p>

Table 4: Analysis of Forum vs Design for Pedagogy Forum Pattern G.

From the table above it is clear that the “design for pedagogy pattern” addresses the solution statement in much more detail, as well as the teaching methods that accompany the pattern. Although the case study outlines a use case study of an expert in collaborative learning the

Schümmer and Lukosch pattern does not address issues to do with pedagogy and/or user involvement. The “design for pedagogy pattern” details the design solutions for the online forum in much more detail than the Schümmer and Lukosch pattern.

Lessons Learned

By providing a tool that allows writers to clearly identify:

1. The design elements of an e-learning forum;
2. The pedagogical practices used, and
3. The linkages between them,

the process of linking design with pedagogy was made more straightforward for the writers.

By using :

1. Examples of best practices in the background readings,
2. Current online forums for e-learning

the writers were able to address the gap between best and current practices in online forums.

The pattern template when used in conjunction with the cards and card glossary resulted in a generally consistent structure with clearly identified design elements. However, it must be noted that the patterns that have been ranked higher by the expert evaluation were those that were written by people who had experience in design specification documents, use cases and online forums, as well as having a post-graduate design qualification.

The evidence is unclear whether the “pattern pack” is a panacea, but when used by a trained person, it does result in patterns that appear to address the issues of online learning and teaching than the “base line” pattern.

Notes, Links and References

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