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5.01 Incorporating Pedagogical Theories into Pattern Writing – A ‘Wicked’ Task

Two primers were created to inform the pattern writers of the main principles of constructivist and experiential learning theories. These theories inform the choice of learning activities outlined in the design solution (pedagogical strategies) and in the teaching strategies (pedagogical tactics) sections of the design for pedagogy pattern. Constructivist learning theory states that people generate knowledge and meaning from their experiences (Bodner, 1986, p. 873). The purpose of these primers was to provide the pattern writers with concrete experience of the learning theories, so that they could then reflect on the ideas contained within them. Adapting their existing experience of pedagogy, the writers could form new theories about pedagogical practice and apply this new knowledge in the writing of the design pattern (Kolb, 1984, p. 42). Thus the pattern writing method follows the experiential learning model and draws on constructivist learning theory (Figure 5-1).

![Figure 5-1 Pilot Study One methodology. Green indicates pilot pattern writer 1 activities, black is the method and red indicates researcher activities mapping to Kolb’s Learning Cycle. (Chatteur, 2011)](image)

Figure 5-1 shows the method, modes of enquiry and how these map onto Kolb’s experiential learning cycle. By applying the learning cycle to the research process, it was possible to see Kolb’s cycle in action with the participants, and to apply best practice to the research activity.
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It also identified times when evaluation and reflection were required to refine and improve the method.

Although the pattern writers recruited for this study were thought to be competent writers, it would be erroneous to assume that they possessed prior knowledge of the two learning theories, and indeed of design patterns themselves. The aim of providing the primers to the pilot participants was to give guidance and insight into the two learning theories. The primers were the result of textual research into how these pedagogical theories could be applied to the design of e-learning (Appendix Two). The two primers created for the pilot study included not only a background of the learning theories, but also an analysis of the design of e-learning systems and how these two learning theories can be enacted in the interface and information architecture design of e-learning – in other words a set of design principles. As these primers were anticipated to be used in the writing of an entire pattern language, not just one individual pattern, these principles were written without referring to a single pedagogical solution or courseware application in mind (Chatteur, Carvalho, & Dong, 2008).

Pilot Study One involved three participants who were research students studying at a PhD level, with backgrounds in design, architecture and cognitive psychology. At this early stage of the pilot studies, the pattern writers were asked to define the pattern problem, as each of the pilot participants had sufficient background or interest in educational research to tailor the pattern problem/solution topic to suit their interests or research.

After each pilot session the set of documents were evaluated and updated, based on qualitative feedback from a series of unstructured interviews with the participants. This evaluation was based on:

- That the pattern’s problem statement and solution remained focused on design
- Clear linkages between design elements and pedagogy
- Integration of the learning theories into the pattern
- Ease of use of the method
- The time taken by the pattern writers

The desirable outcome was for the participants to be able to create a design pattern that contained a solution which took constructivist and experiential learning approaches, within a reasonable amount of time. Although the time for the pattern writing task was not controlled, based on feedback from the first participant, a reasonable amount of time allocated to the task was deemed to be four hours.
As discussed in the previous chapter, the pilot pattern writers were also provided with:

- A pattern template ‘Pattern Template Explained’ which outlined writing style, use of constructive language, the type of design issues to be addressed in the pattern
- An empty pattern template to be filled in

Many of the issues addressed by the Pattern Language for Pattern Writing were identified and included in the documents that made up the pattern templates. Issues such as using ‘skippable sections’, ‘problem/solution summary’, ‘running examples’ (i.e. case studies), ‘relationship to other patterns’ ‘evocative pattern names’ and so on (Meszaros & Doble, 1997, p. 527). The pedagogical framework (Goodyear, 2005) was explained in the teaching strategies section of the ‘Pattern Template Explained’ document (Appendix Two).

When the method was put into practice, it became apparent that writing a design pattern was a complex task in itself. Although the principles derived from what makes a well-written pattern were outlined in the pattern templates, the pilot pattern writers had difficulty in clarifying the task and found it difficult to create design solutions based on the two pedagogical theories. If writing a pattern language needs a pattern language itself, then the added complexity of embedding pedagogy made it even more ‘wicked’ (Rittel & Webber, 1973).

### 5.02 The First Pilot Study

The first pilot pattern writer was a trained cognitive psychologist and educational researcher who was undertaking PhD studies at the Design Lab at the University of Sydney. The writer was briefed on design patterns and their use, and was given the primers on the learning theories and the template documents to read. The time taken for the reading and writing task was not controlled; the participant was given five days to complete the task in his/her own time. The pilot participant was asked to note any difficulties with the process, to note how long it took, and report it during the unstructured interview. The writer could contact the author for further assistance and advice at any time.

The first pilot participant was researching the sociology of learning within a discipline and it was decided to apply this research to the e-learning domain for the pattern. This meant that the definition of the pattern problem and the text search for the solution (Figure 5-1) was to be based on research that was already in progress, and would reduce the amount of time the writing process would take. This resulted in a design for pedagogy pattern called Exploring Knowledge and Knower Structures (Chatteur, Carvalho, & Dong, 2010).
For the first pilot I was interested to determine whether it was possible to write a design pattern using the method which was able to link design with pedagogy, as this was key to achieving the research aims. The pattern writer was briefed that the pattern was to focus on the design of e-learning courseware and was not to become a purely pedagogical pattern. The resulting pattern proved that the overall strategy produced a pattern that linked design with pedagogy – a welcome result.

However, during the non-structured open-ended interview after the piloting process, the pilot pattern writer expressed that the task of writing the design pattern was extremely difficult and time consuming. This was despite the fact that this pattern writer was familiar with the pattern topic, as it formed part of their own research. This raised the question as to how difficult the process would be when creating design for pedagogy patterns using background readings and research that are not familiar to the research participants.

The first participant also commented that it would be difficult to find participants in the pattern writing if the task was longer than approximately four hours in duration. It was hoped at the onset that the pattern writing process would take approximately three to four hours per pattern. The first pilot study took over eight hours, not including the literature search. This was an unacceptably long time and illustrated that the task required simplification. The participant also questioned some of the wording in the ‘Pattern Template
Explained’ document, and requested that the main points within the document become bullet points. This was to make the key elements clear and unambiguous to the writers.

Being a trained cognitive psychologist, the first participant stated that she felt that the task was overly complex and required clarification and simplification. It was felt that the task would lead to cognitive overload and that some participants would find it impossible to complete. It was specifically stated that more guidance be given over the subject of the pattern itself, defining the pattern problem/solution, as the task was too open-ended.

The first pilot attempt was not seen as a failure, quite the contrary. Although the task was complex, the resulting pattern was well written and researched and clearly demonstrated links between design and pedagogy. The methodology clearly required refinement, but it did demonstrate that the principle of embedding the pedagogical theories within the design of e-learning was possible. However it was felt that it would not be possible to repeat this success with further writing participants unless the process was shortened and clarified.

The next section contains the Exploring Knowledge and Knower Structures pattern to illustrate the pattern structure, method and pilot study result.

5.02.01 Pilot Pattern One: Exploring Knowledge and Knower Structures

Context: This pattern supports students in their investigation and reflection on what counts as ‘relevant practice’ within a disciplinary group or field. The pattern is concerned with how the application design may incorporate a space, with materials and strategies, to stimulate students’ reflection and investigation of the social structuring of a discipline. This pattern complements DISCUSSION GROUPS and INTEGRATED COURSEWARE.

◆◆◆

Problem: When a novice enters a new field he or she is entering a new social group: a group that functions under its own established ‘sociological rules’. These rules regulate the structuring of knowledge within the field: what counts as relevant and the values of its current members. The novice, entering the new field, needs to learn about these rules and how current members go about identifying genuine practices.

How does an e-learning designer build an environment that allows students to investigate / probe / explore / check / learn about the social structuring of knowledge and knowers of a given discipline?

In sociological terms, the student needs to recognise how knowledge and knowers (the people who possess, produce, value, and transmit the knowledge) are specialised within the
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discipline being studied. Whether this is a discipline about learning technical content, skills and procedures, or whether this is a discipline in which characteristics of the person, or who she or he is, is more important.

Maton (2000a, 2000b, 2004, 2006), expanding Basil Bernstein’s theory (1977), proposes the Legitimation Code Theory (LCT) as a framework to analyse the structuring of knowledge within fields. LCT considers that every practice or knowledge claim is made by ‘someone’ and it is about ‘something’. Some disciplines may consider that what professionals know is more important than who they are. Anyone can potentially be a professional in such a discipline, as long as the person learns the theoretical content and skills to do the job. In other disciplines, however, greater emphasis is placed on personal characteristics of the professional, rather than technical content. Here being empathetic, having special sensitivity, an ‘eye for the job’, being from a certain background etc, is more important than what theoretical framework the professional is using. These ‘social rules’ or ‘values’ regulate the practice of professionals and they will influence these professionals’ understanding of what is considered special and genuine in his or her field. A novice entering the field needs to learn how to identify these values.

LCT states that knowledge claims and practices are comprised of two relations: the epistemic relation to the object; and the social relation to the subject, author or actor. Different practices may emphasise these two relations differently, and as a result these relations may be represented as being stronger or weaker within a continuum of strengths. Therefore, knowledge can be seen as specialised by its epistemic relation, by its social relation, by both or neither, depending on its specific structure, which would vary depending on the field or discipline.

Based on these assumptions the e-learning designer may devise a space, with materials and strategies, to support students’ reflection of which relations are being emphasised within a given field. Is this a discipline where what counts is what is known, or is this a discipline that emphasises the experience and background of a person? Every practice will always contain both relations, the epistemic (e.g. technical content, skills) and social relations (e.g. characteristics of the professionals), but may emphasise those differently. Therefore the space, materials and strategies should always encompass both knowledge (based on the strengths of epistemic relations) and knower (based on the strengths of social relations) structures so that learners can probe what type of relations exist for their chosen profession.

Solution: Develop an environment in which students can investigate what is considered relevant within the discipline (the strengths of epistemic and social relations). Populate the environment with real-life examples of how knowledge and knowers are valued within the discipline (e.g. clips of interviews with professionals, photos or examples of genuine work in
the field, links to professional associations, links to conferences and seminars, relevant articles and publications in the field). By allowing a diverse range of materials, students will have an opportunity to explore this topic taking into account various perspectives, and construct their own theory of what is relevant within the discipline. Examples and activities should be supported by course material probing students’ reflection about what is being valued e.g. provide students with a protocol to watch the interview or to read an article, invite a professional guest to contribute in a thematic forum about how one recognises original work in the discipline. Activities should encourage insights into knowledge and knower structuring in the discipline, helping students in identifying the implicit values: is this discipline valuing the application of technical knowledge, or is it valuing how one experiences or feels about the object/product?

Figure 5-3 Interaction between course materials, activities and guests providing insights into knowledge and knower structuring. (Chatteur after Carvalho)

Teaching Strategies:

1) Social interaction via moderated discussion (with invited guests/speakers)

Moderated discussions may benefit from a guest ‘appearance’. Warm the students up for the guest appearance by suggesting students research the topic beforehand (e.g. visiting websites of professional associations, or reading interviews with professionals). Organise initial discussions among the students, in which they can exchange their early theories about what counts as important within the discipline. Formulate a process that allows students access to a number of resources so that the discussion may be enriched with different views and perspectives.

Organise a professional guest who will present his or her views of how a particular field recognises original work. The invited guest will provide a real-life aspect to students’ construction of what is considered special within the discipline.

The exercise will provide students with opportunities to deepen their knowledge construction of the values of the discipline by exploring the topic in varied instances, as well as interaction with students and professionals and their perspectives of the topic.
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2) Comprehension strategies

Use comprehension strategies (e.g. reading protocol, enquiry chart) to accompany reading material or watching of interview clips. Reading protocols are documents in which subjects are asked to record what they think and do as they work (Sanders, 2012). Enquiry charts use a chart grid to allow students to enquire deeper into a given topic. By using a planning phase which allows topic identification, question formation and gathering of materials, along with an interaction phase for exploring a topic by sharing and recording facts and an evaluation phase, students are able to critically analyse texts (Hoffman, 1992). Provide students with material that supports and scaffolds students’ inquiry into what is considered important within a discipline.

For example, a reading protocol should prompt students with strategies they may use when trying to identify how the discipline is specialised (e.g. How does the professional describe genuine work in the discipline? Is there emphasis on the object per se? Is there emphasis on how one applies knowledge or techniques? Is there an emphasis on how one experiences the object? Is there any personal characteristics that are essential in this job?).

Use a general enquiry chart to aggregate the various sources (interviews, publications, websites from associations, etc). Generate questions whose answers will come from converging data obtained from the various sources. This may then be used as input in a discussion forum about the topic.

Consider these other patterns:

THE ROLE OF TUTOR, MODERATION and LINKING PATTERN

References:


5.02.02 Defining the Pilot Study’s Pattern Problem

Feedback from Pilot Study One indicated that a number of issues needed to be addressed in the method.

- The task was seen to be too open-ended.
- There should be guidance on what the overall pattern topic and problem statement should be.
- It was not sufficient to allow the writers to do their own literature search, as this caused the task to be ill-defined and was time consuming.

The undefined pattern topic raised another issue - the laboratory experiment. This research was to create the method for writing a design for pedagogy pattern, and then to test this with a set of designers against a standard design pattern that dealt with the same e-learning application in a non-pedagogical way. It would not be possible to do a comparison between the Exploring Knowledge and Knower Structures pattern and another published pattern on the same subject, as the standard published design pattern did not exist on this subject matter.

For the second pilot exercise, it was decided to guide the writers to define the pattern problem to be that of a forum for e-learning. This was done by providing peer-reviewed literature which addressed interpersonal communications on e-learning forums (Berge, 1995; McLoughlin & Luca, 1999; Oren, Moiduser, & Nachmias, 2002; Sargeant et al., 2006). The second and third pilot pattern writers were also briefed as part of the writing exercise in that the pattern was to address an e-learning forum. The problem statement was left to be defined and written by each participant, but the background research dealt exclusively with e-learning forums. By providing this literature it was hoped that the pattern writers would be able to define the pattern problem within the desired domain. This allowed an existing non-pedagogically based forum to be used as a comparison in the subsequent study with designers (Schümmer & Lukosch, 2007).

5.02.03 Piloting the Forum Pattern

The second pilot study participant was a PhD student at the Design Lab at the University of Sydney. This participant held a Bachelor of Design Computing and was interested in the use of virtual reality in the realm of e-learning. Research publications included papers on the usefulness of computer-aided design tools (CAD) in the early stages of designing. The set of documents given to the second pilot subject was expanded to include:

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- Pattern Writer Instructions (which included links to two online communities, one social and one from an online course)
- Primer on constructivism and design principles derived from constructivist theory
- Primer on experiential learning and design principles derived from this theory
- Pattern Template Explained – outlining the different sections of the pattern and what they do as well as outlining the use of constructive language
- An Empty Template in which to write
- Peer-reviewed academic papers on e-learning forums

The provision of the peer-reviewed academic papers was supposed to reduce the time needed by the writer and at the same time to provide examples of current research and best practice to embed within the design for pedagogy pattern. By providing the literature, the pattern writer was no longer required to do a literature search on e-learning forums. In this instance, four peer-reviewed papers were provided in the second pilot study for the writer to read.

Included in the peer-reviewed readings were examples of recent research that could be used as case study examples in the pattern. The participant was also given a fully worked example pattern and a set of two forums, one an e-learning forum and the other a social forum as a contrast. These forums were provided for two reasons:

- As an example of a current e-learning forum to demonstrate current practice
- An example of a forum containing an active social community to illustrate a thriving community which could provide a context for best practice for social constructivism - as this was not evident in the e-learning forum

As before, the second pilot participant was given a briefing on design patterns and their use before commencing the task. The second participant was videotaped and used a ‘think aloud’ approach as he wrote the pattern. This ‘think aloud’ video, along with an unstructured interview, as well as the pattern, formed the materials that were used in the evaluation.

The instructions, particularly in the ‘Pattern Template Explained’ document, were not focused enough to result in consistent results (i.e. in a design for pedagogy pattern for an e-learning forum). The participant struggled with the task, being unsure as to the requirements. The peer-reviewed readings that focused on the pedagogy associated with e-learning forums took several hours to complete and made the task unclear. The second pattern writer also found that embedding constructivist and experiential learning theories into the pattern was extremely difficult. This was due to the participant’s lack of experience with the learning theories and how they were enacted in e-learning.
Confusion arose in the use of similar terminology in the ‘Pattern Template Explained’ and the primer documents. Background research undertaken on design patterns for information technology outlined that they should be written using a ‘constructive approach’ (Clancy & Linn, 1999). The template documents were written using a constructive approach. This was outlined in the ‘Pattern Template Explained’ document:

The writing style of the pattern should be constructive, explaining how the pattern can be used in context. (Participant 2, 2008)

The use of the terminology ‘constructive’ in the same context as documentation on ‘constructivism’ led to a great deal of confusion. The writer was unable to clarify what was meant by the two terms, and used them interchangeably. ‘Constructive’ writing for the pattern means that the pattern is written explaining how it can be used, rather than simply describing what it does. ‘Constructivism’ is a learning theory that states that knowledge is constructed: either through the personal experience of the learner or through collaboration with others. These two concepts are very different in their use, even though the terminology is very similar.

Finally the comment was made:

I’m using constructive and experiential ideas in creating design patterns. Somebody to create e-learning software. So the person creating the e-learning courseware is the person I’m writing this for... they are not looking at constructive or experiential, what I’m doing is using constructive and experiential learning ideas to create a design pattern to help them create the e-learning courseware. (Participant 2, 2008)

It took nearly forty minutes for the research participant to come to this understanding, and it was clear that the instructions and methodology needed to be adjusted.

One useful comment that helped focus the next stage of the research was this one:

These instructions make a lot of sense, but I’d like a more general overview of what’s going to happen. These are like do this do this [sic], it would be nice to feel if you're in control of what you're doing. So – in this task you will be working towards creating your own study pattern to do with e-learning. First of all you will have to familiarise yourself with the background literature. Then you will be guided through a template to create your own study pattern, this should take approximately three hours. Yeah that kind of stuff, make you feel more oriented in it. (Participant 2, 2008)

This comment was illustrative on many levels. Firstly that the instructions were not operating effectively on a constructivist level. The learner, in this case the second pattern writer, was finding it very difficult to make links through the learning in order to construct new knowledge on writing of design patterns using pedagogical theories. The background readings and online forums provided were not providing enough concrete experience for the
learner to reflect upon in order to conceive new theories in order to enact them. So the instructions were failing both in constructing new knowledge effectively, and were not structured enough to provide cohesive experience upon which to build new theories.

This comment subsequently allowed the author to reflect upon the set of documentation provided and to focus on the constructivist learning principles as enacted in the ‘pattern pack’. For the next pilot participant the set of instructions was rewritten, which ultimately resulted in the production of an illustrated brochure outlining the design for pedagogy pattern writing task, the problem and the methodology for the next stage of the piloting process. The comments by pilot pattern writer two were the motivation to focus on using the two learning principles effectively within the pattern documentation and within the pattern writing method itself.

The resulting pattern from the second pilot focused on the development of e-learning courseware, entitled *Creating and Administering e-Learning Courseware*, it addressed the broader issue of involving students in an online community rather than specifically investigating an internet e-learning forum. This pattern used the pre-defined problem domain (i.e. forums), but its solution posited the forum as one possible solution, embedding it in a broader community strategy. In order to create greater consistency, further refinement of the instructions and clarification was necessary.

The writer gave the task four hours, but was unable to complete it within the required time constraints. The last three sections of the pattern were left incomplete.

At this stage the ‘Pattern Template Explained’ document had been designed to be a generic document that could be used for all design for pedagogy patterns. It neither described the pattern problem, nor did it state specifically that the pattern should be about e-learning forums. It was written in this way with an entire pattern language in mind, a document that could be used for all of the necessary patterns. It was not written with a specific pattern in mind. Determining which pattern to write was supposed to be apparent from the readings, a detail that was missed by the pilot pattern writer two. Ironically by describing how the pattern is used in the template documentation rather than giving examples of how it could be used in the context of an e-learning forum is essentially using a descriptive approach in the writing, rather than a constructive one. The research had indicated that using a descriptive approach in the writing of design patterns was not an effective method. It appears that this also holds true of other documentation, not necessarily a pattern language. This was my oversight, and needed to be addressed in further versions of the documentation.

The third pattern writer was a research assistant and teacher at the Design Lab at the Faculty of Architecture, Design and Planning at the University of Sydney. This participant held a
Master’s degree (Hons) which included a dissertation on creating a framework for representing virtual worlds. This participant was a computer programmer with experience in using design patterns. The set of documentation was given to a third pattern writer, with major revisions to the ‘Pattern Writer Instruction Sheet’, and the rewriting and removal of the word ‘constructive’ in the ‘Pattern Template Explained’. This participant completed the background readings, but felt that the task was so ill-defined that it was impossible to achieve. Being someone who was previously familiar with information technology design patterns, several usefully critical comments were made that led to the further development of the ‘pattern pack’. The participant firstly stated that design patterns are usually more modular, in that elements are slotted in to the overall design to create the final pattern. It was also stated that the readings made it unclear that the task was to design a pattern for a forum specifically. The subject of the proposed pattern was a topic that was the participant’s area of specialised instruction. However after spending five hours on the readings the writer did not understand the task and abandoned the pilot.

The failure of the third pilot led to much reflection on the pattern writing process and on the research process in general. Based on the experience formed by the pattern writers struggling with the task, it became necessary to reflect on the process in order to form theories about how to aid the writers in their task, based on what had been learned. Distilling generic design and pedagogical elements from literature and media examples alone was a complex task, and the linking of pedagogy with the design elements was proving prohibitively difficult. The pattern subject and problem were unclear, which was leading to inconsistent results from the participants. Clearly a tool was required to make the process easier and clearer.

Comments from the writers posited two approaches:

1. A document that provides an overview of the pattern writing process and the task of embedding the learning theories within the pattern
2. A modular approach to pattern creation – using elements that could be ‘plugged in’ which in future work could form the basis for the additional patterns that make up the language

The third approach was based on the research hypothesis:

3. Embedding pedagogical theories into design for pedagogy patterns, which are subsequently used in the design and development of e-learning courseware, increases the awareness of pedagogy during the e-learning design process over generic design patterns.
5.03 Using an Experiential Learning Approach for the Pattern Writing Process

The task of associating and embedding the pedagogical theories with the design needed to be made simpler and clearer. The method outlined in Figure 5-1 was failing at the second and third stages – the textual analysis (reflective observation) at stage two was insufficient to support the interpretation (abstract conceptualisation) of the forum topic, and of the appropriate design solution.

Using all four elements of the Kolb 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 a tool to form theories (abstract conceptualisation) about the generic structures linking pedagogy with design in e-learning forums. This tool needed to take a ‘hands on’ approach so that writers could actively form relationships between design and pedagogy, identify these areas and put this new knowledge to use in writing the design for pedagogy pattern (active experimentation).

Experiential learning theory therefore informed a change in method to teach the participants how to write a pattern. An additional step that defines the structure of the pattern and identifies commonly used elements that should be included in the pattern was inserted into the method. The new method is outlined in Table 5-1.

Table 5-1 Pilot 4 revised pattern writing method

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Step 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text search for problem</td>
<td>Problem definition</td>
<td>Text search for solution</td>
<td>Linking design with pedagogy, identify generic design and pedagogical elements</td>
<td>Write solution in terms of constructivist and experiential learning theories.</td>
</tr>
<tr>
<td>Based on mapping of Alexander’s structure onto e-learning (Figure 2.2) Working from larger to smaller components, and incorporating pedagogical issues (after Goodyear)</td>
<td>Definition of design problem based on research. In this research, steps 1 &amp; 2, i.e. the problem will be pre-defined for the pattern writers to avoid confusion as to the task.</td>
<td>Writers review existing online media and peer-reviewed papers. In researching solution also find case-studies and teaching strategies for incorporation into design pattern.</td>
<td>Development of a hierarchical structure based on common elements found in existing media, using two sets of cards. Incorporate ideas from peer-reviewed research for final solution.</td>
<td>Defining solution in terms of pedagogical philosophy, using the generic elements defined in step 4.</td>
</tr>
</tbody>
</table>
For this stage of the research:

- The problem has been pre-defined (Steps 1 and 2)
- The peer reviewed research has been supplied (Step 3)
- Common design and pedagogical elements for the pattern solution and teaching strategies sections have been identified (Step 4)

By predefining the pattern problem and giving the pattern the title 'Forum' confusion as to the aim of the task should have been overcome. The pattern problem was also explained in detail in the information sheet, which was rewritten with additional flow diagrams to become the brochure. The addition of step-by-step instructions, the predefinition of the pattern problem and a detailed outline of the task and expected outcomes would make the task clearer for the pattern writers.

The next ingredient for developing the 'pattern pack' was based on experiential learning theory and constructivist techniques. My aim is to embed constructivist and experiential learning techniques into the design patterns, which in turn informs the e-learning design process (Figure 5-4). The theories are then embedded into the design solutions created by the designers – realised in the e-learning courseware. This realisation (the courseware) in turn enacts the learning cycles for the end users of the e-learning – the students. The interaction between the learning and design is therefore iterative and cyclical. The design patterns sit at the heart of this complex system. There are two major components of this cycle – the pedagogy and the design elements. Based on this cycle, and after textual research investigating three online e-learning forums, (Murty, 2009; The Open University, 2011; Vande Moere, 2009/2010) two sets of cards were developed.

These cards were developed to aid in the identification of generic design and pedagogic elements for the e-learning forum. Once identified, the generic elements (i.e. user interface, information architecture/navigation and content layout design elements and pedagogical practices as seen in the different instances of the online forums) would in turn be used in writing the forum design for pedagogy pattern. For the first set of cards, the focus was on the design of an e-learning forum. The elements outlined on the design cards were firstly identified by examining the three e-learning forums and capturing what was seen. Each design element (e.g. menu navigation, threaded discussion, student login, bread crumb links etc.) was analysed using the Function-Behaviour-Structure Framework (FBS) (Gero & Kannengiesser, 2002) as an ontology to describe a design work with the focus being on the structural elements of the design.
Figure 5-4 The interaction between Kolb’s experiential learning cycle (Kolb, 1984, p. 42), constructivist teaching approaches (as mentioned by Chee, 2004) and the design process with the design for pedagogy patterns. (Diagram by Chatteur, 2010)

The FBS framework was used over an approach such as Unified Modelling Language (UML) (Roff, 2003) because although UML is useful for e-learning that is authored using object-oriented programming (such as C++, Java etc.), and can be used for deconstructing existing software for analysis, it takes an approach that is too detailed for the purposes of this research. UML is useful in object-oriented-programming, but it models software with the
emphasis on programming, from a programmer's perspective. What this research required was an analysis of interface elements and navigation structures linked to pedagogy, and for this a simple approach such as the FBS framework enabled a linking of function (both interface design interaction and pedagogical) with structure (visible screen interface elements, content layout and examples of pedagogical practice). The focus in this case is not on programming, but on design, teaching and learning. The FBS ontology describes the relation between the function of a design element, (i.e. the interaction and pedagogic functions), with the courseware’s behaviour (i.e. how it performs a function) with the structural element (i.e. the visible elements seen on screen). Each of these functions may serve a dual purpose: interaction purely in the contact with the online courseware, but it may also serve a pedagogic function in how it aids learning. This analysis was helpful in defining which design and pedagogical elements should be included in the cards (Figure 5-5). The fronts of the design cards display the structural elements of an e-learning forum (Table 5-2).

Table 5-2 Design card analysis using the FBS framework

<table>
<thead>
<tr>
<th>Function – both interaction and pedagogic function</th>
<th>Behaviour - how it performs a function</th>
<th>Structure – visual realisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows users to communicate and get to know each other independent of time constraints. Also contains moderator/administration tools.</td>
<td>Users post messages, query other users’ details, post rich media and links, know who is online, etc. Allows moderator/administrator to organise and manage discussions.</td>
<td>Bulletin Board/Forum</td>
</tr>
<tr>
<td>Allows users to see their path from the main login page</td>
<td>Display site hierarchy.</td>
<td>Bread crumb links</td>
</tr>
<tr>
<td>Allows users to email each other within the forum.</td>
<td>Field with text entry and mailto address using user’s login email.</td>
<td>Email message page</td>
</tr>
<tr>
<td>Logging into forum</td>
<td>Enter login details and password, accesses registered details from database.</td>
<td>Forum Login Page</td>
</tr>
<tr>
<td>Registering a username</td>
<td>Entering your own username and password, enters into database.</td>
<td>Forum Registration Page</td>
</tr>
<tr>
<td>Instructions as to how to use forum</td>
<td>Displays textual information and images.</td>
<td>Help Pages</td>
</tr>
<tr>
<td>Allows users to instant chat privately with each other</td>
<td>Online chat</td>
<td>Instant message page</td>
</tr>
<tr>
<td>Allows user to log out of the forum.</td>
<td>Takes the user off the active user list and disconnects from the database.</td>
<td>Log out button</td>
</tr>
<tr>
<td>Allows user to navigate to different available forum.</td>
<td>Displays a list of available forums.</td>
<td>List of available forums page</td>
</tr>
<tr>
<td>Displays links to main areas of course site</td>
<td>Methods to navigate to the main site areas, such as hyperlinks and</td>
<td>Menu navigation</td>
</tr>
</tbody>
</table>
What resulted was a set of 22 design cards. The next stage was to create cards that described the pedagogy in a forum (Table 5-3).

Table 5-3 Pedagogy card analysis using the FBS framework

<table>
<thead>
<tr>
<th>Function – both interaction and pedagogic function</th>
<th>Behaviour - how performs a function.</th>
<th>Structure – visual realisation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abstract conceptualisation.</strong></td>
<td>Forming new theories based on what has been observed.</td>
<td>Articulation of theories.</td>
</tr>
<tr>
<td><strong>Active experimentation.</strong></td>
<td>Putting new theories into practice.</td>
<td>Evidence of students experimenting with newly formed theories.</td>
</tr>
<tr>
<td><strong>Articulation</strong></td>
<td>Expressing learning.</td>
<td>Teachers encourage students to articulate about the task in hand.</td>
</tr>
<tr>
<td><strong>Ask open ended questions.</strong></td>
<td>Allowing student articulation</td>
<td>Moderator posts questions that must be elaborated.</td>
</tr>
<tr>
<td><strong>Be flexible – guide discussion while going with the flow.</strong></td>
<td>Moderator provides guidance while allowing discussion to follow its natural course.</td>
<td>Evidence of moderator giving direction, guiding the conversation’s course but not dominating.</td>
</tr>
<tr>
<td><strong>Coaching</strong></td>
<td>Supporting learners as they put new skills into practice by reinforcing learning.</td>
<td>Students are encouraged to practise the techniques that will aid them in the learning task.</td>
</tr>
</tbody>
</table>
Concrete experience. | Experiencing learning situation through real world examples | Learners first experience the new theories in action.  
Create a calm and friendly atmosphere. | Encouraging trust. | Diffuses conflict and is a calming influence.  
Don’t dominate discussions support student-to-student interaction. | Encouraging social learning. | Encourage students to respond to each other’s questions.  
Encourage peer feedback. | Allowing students to comment on others’ work. | Encourage students to post about other students’ work.  
Encourage social interaction. | Allowing social learning. | Moderator allows and encourages off-topic social posts.  
Encourage students to critically analyse their own views and maybe rethink them. | Encouraging remodelling of existing theories. | Challenge the students’ views – play devil’s advocate.  
Exploration | Allowing learner autonomy and problem formulation | Evidence of students examining the learning subject and beginning to form new theories.  
Formulate a process for deeper enquiry into subject. | Encouraging knowledge assimilation. | Ask leading questions sequentially that encourages students to dig deeper into the subject.  
Give positive feedback. | Identifying correct learning and reinforcing this. | Encouraging students when they form a correct result or process.  
Make discussion objectives clear. | Avoiding confusion as to discussion task. | Moderator posts an initial outline of discussion objectives.  
Modelling | Creating the framework for student learning. | Giving examples of practice (usually part of learning activities – not included in cards).  
Outline learner activity goals | Allows students to evaluate the learning goals for each activity. | Tell the students the aim of exercises so they can judge how much effort to involve for each activity.  
Scaffolding | Creating a support structure surrounding the learning: setting boundaries. | Task definition, direct or indirect instruction, specification and sequencing of activities by tutor.  
Reflection | Thinking about problem solving. | Students reflect on their own experience from different perspectives.  
Reflective observation | Thinking about problem solving based on observations. | Students articulate how a problem may be solved, based on the examples given.  
Reply to each message. | Encouraging trust and helps students overcome problems. | Ensure that each message has a reply (not necessarily from yourself).  

Using principles taken from the primers on the two pedagogical theories, along with teaching practices and best practice outlined in the peer-reviewed literature, an additional set of 20 pedagogy cards for a forum was developed, using the FBS analysis. The pedagogy cards
Chapter 5: Creating the ‘Pattern Pack’

describe elements based on experiential learning theory, e.g. ‘Reflection/reflective observation’, ‘Abstract Conceptualisation’ etc. and elements based on constructivism, e.g. ‘Scaffolding’, ‘Modelling’, ‘Articulation’, etc. (Figure 5-4) as well as forum-specific pedagogies such as ‘Ensure each message has a reply’, ‘Create a calm and friendly atmosphere’ and so forth. Example cards can be seen in Figure 5-5.

This time when an FBS framework was used, the focus was on the function of the interaction design elements as pedagogical elements (Table 5-3). 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.

5.03.01 Using the Cards

The pattern writers were asked to examine an e-learning forum. From examining only what they could see in the forum, and using the design cards, they were to create a hierarchy describing the information architecture and design elements of that forum. Once a hierarchy is created with the design cards, the pattern writer finds areas in the example e-learning forum where they see pedagogy taking place. The pedagogy cards help identify and clarify some the types of teaching and learning that are used by tutors and moderators, based on the two learning theories. The writer then places the appropriate pedagogy card in the corresponding area in the design card hierarchy.

A hierarchy linking design with pedagogy is thereby developed for each of three online e-learning forums. The final structure is photographed/recorded using a digital camera. Using these images as references, the pattern writer reflects on the hierarchies and develops a single hierarchy based on design and pedagogical elements that are generic – those that are seen again and again in a forum. The process allows the writer to apply the knowledge gained from the real e-learning forum examples into a model that only uses generic elements. This
final conceptual hierarchy is subsequently used to help the writer to create the design for pedagogy pattern (see Figure 5-6 and Figure 5-7).

Figure 5-6 Photograph of the design and pedagogy cards in use. (Chatteur, 2009)

Figure 5-7 The hierarchy shown in Figure 5-6. (Chatteur, 2009)
The design cards in the final hierarchy are used in the ‘Solution’ area of the pattern. The pedagogy cards are used in the ‘Teaching Strategies’ section. In this way the teaching strategies are linked with the design. As the cards represent the design of an internet e-learning forum in a modular fashion, each design element card could be distilled into a design for pedagogy pattern. In this way an entire design for pedagogy pattern language for e-learning could be developed in future work.

The use of the ‘pattern pack’ follows an experiential learning model. The primers, peer-reviewed literature and forum examples provide the concrete experience for pattern writers. Analysis of each of the three e-learning forum examples, and the creation of the hierarchies linking pedagogy with design, encourage reflective observation. The process of creating a unique conceptual hierarchy of frequently seen design and pedagogical elements, and then using these elements to write the pattern, completes the cycle. These employ abstract conceptualisation, or the formulation of new theories, and then put those theories into practice.

5.03.02 Modifications
The ‘Pattern Template’ document was changed to incorporate the pattern name and problem statement, so as to make the task unambiguous. Examples of related patterns were also included, as design patterns are difficult to evaluate on their own, and should be encapsulated in a pattern language (Alexander et al., 1977). As this pattern language is not complete, examples of smaller and larger design for pedagogy pattern titles were included, as an indication of future work.

The cards, brochure and a compact disc (CD) containing peer-reviewed literature, primers, internet forums to be examined and a glossary were placed in a custom-made briefcase. Initially the cards were given magnetic backs so that they could be used on a whiteboard, along with a set of whiteboard markers, so the writers could create lines between the design elements to link them together.

5.04 Piloting the ‘Pattern Pack’
The ‘pattern pack’ was then piloted by the first pilot study pattern writer, the cognitive psychologist, so as to compare it with the previous method. The feedback was very positive. The writer reported that the writing task, including the process of extracting the pedagogical and design principles for inclusion into the pattern was much easier and clearer. The resulting pattern was on topic and focused on an e-learning forum, the ‘pattern pack’ was eliciting the desired results (Figure 5-8).
The writer did state, however, that reading the peer-reviewed literature was very time consuming and was continuing to confuse the task. Reading the literature consumed approximately three and a half hours of the research time. The participant suggested that the important elements of the literature should be distilled into an executive summary. Summarizing would reduce the time required to complete the entire task. It would also focus the readings and keep them on-topic. The entire process took over eight hours at this pilot stage. The magnetic strips on the cards were not deemed necessary, as the adhesive was not effective and it was easier just to lay the cards out on a table, or on the floor.

The participant also stated that the entire process was tiring and suggested that it be broken down into two sessions: one that involved completing the readings and the card hierarchies and one writing the pattern. Being a trained cognitive psychologist, the participant stated that this would reduce the cognitive load on the pattern writers.

Taking these comments into account, an executive summary was written, distilling out the relevant main points of the peer-reviewed literature, the brochure was updated to encourage a two-stage process, and the fifth pilot study was undertaken.

The fifth pattern writing pilot was completed by a participant who was also the moderator of an online e-learning forum. The task was completed in less than four hours, in two separate sessions - a halving of the time of the previous pilot. The participant enjoyed using the ‘pattern pack’ and found the process clear and easy to use. This writer also suggested that the magnetic strips were unnecessary and that the individual card glossaries could be
reproduced on the back of each card. The pattern produced was on topic and clearly linked the design elements for an e-learning forum with the teaching and learning solutions.

![Pattern writer using 'pattern pack' (Chatteur, 2009)](image)

By using a tool that took an experiential approach in the development of design for pedagogy patterns for e-learning, the cognitive load for the pattern writers appeared to have been alleviated. The ‘pattern pack’ reduced the complexity of the task and allowed the research participants to quickly learn how to write the pattern. The tool allowed the writers to link pedagogical theories with the design of an e-learning forum in a clear and unambiguous way and was producing the consistent results required for the study.

On reflection, the process of developing the ‘pattern pack’ followed an experiential learning approach. The three early pilots formed concrete experience (in this case a failure) upon which to reflect. This reflection on the process and the participants’ feedback led to the development of the ‘pattern pack’ – forming theories on how to facilitate the task of pattern writing – abstract conceptualisation. The design of the ‘pattern pack’ was continually modified based on the feedback of the final pilot participants. This modification formed the experiential/experimental part of the process and thus completed the Kolbian cycle.

It became apparent during the development of the ‘pattern pack’ that it was not sufficient simply to give the participants background information in the form of peer-reviewed research and the primers on experiential learning and constructivism and expect the writers to be able to write pattern solutions based on them, or to understand how the ‘best practice’ examples contained in the peer-reviewed research could be applied and incorporated into the resulting patterns. The lack of direction made the task obscure and unachievable. The writers needed to be given clear instruction as to how to complete the task, not only verbally,
but this initial guidance needed to be reinforced with a brochure containing step-by-step instructions. Once a clear methodology was developed, the task of writing the design for pedagogy pattern became easier for the pilot participants, and subsequently the pattern writers.


