

# **THEORETICAL APPROACH TO DISTILLATION OF PEDAGOGICAL PATTERNS FROM PRACTICE TO ENABLE TRANSFER AND REUSE OF GOOD TEACHING**

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## **Abstract**

The promise of the learning design pattern approach to resolve the problem of adequate support to practitioners has not materialised. Our contention is that this is due to the lack of a pedagogically grounded model of approach. We made use of the Conversational Framework (Laurillard, 2002) to guide us in analytical scoping of the problem space and to enable strong focus on the pedagogical properties of a learning design. Our assumption is that successful support for the learning design process can only be erected on top of the model that gives prominence to critical pedagogical properties of the Learning Design.

To this end, the work we are engaged with, has two aims: i) understanding the critical factors in what makes good Teaching and Learning Activity design, so that it can be foregrounded in the representational format, and, ii) arriving at a computational model for representing the pedagogy inside the learning design.

Our approach is introduced by positioning it in relation to similar work so far, most notably the work on learning design patterns. The paper begins with a critique of the current approach to the design pattern paradigm in the field of learning technology. Our methodological approach is explained and a prototype pedagogical pattern representation based on the Conversational Framework is presented, to illustrate how this might work in practice.

## **1. Introduction**

The work presented in this paper represents a key strand of the EPSRC/ESRC funded three-year interdisciplinary project titled Learning Design Support Environment (LDSE [www.ldse.org.uk](http://www.ldse.org.uk)), with the primary concern of providing support to teachers. The rationale is straightforward: supporting teachers in designing for learning increases the potential of achieving the improvements in learning. The support in this sense is addressing the issue at the heart of educational practice - ‘how to identify and provide what it takes to learn’ (Laurillard 2008). Supporting teachers in doing this is necessarily subject to understanding what it takes to learn and providing teachers with access to that understanding in the form of tools. One of the principal strategies adopted by LDSE is to enable teachers to build on the

work of others. Operationalising that strategy requires a way of representing the theory and practice of learning design so that the analytical links are exposed and offered to practitioners as support.

To this end, the work we are engaged with, has two aims: i) understanding the critical factors in what makes good Teaching and Learning Activity design, so that it can be foregrounded in the formal representation, and, ii) arriving at a computational model for representing the pedagogy that is characteristic of a particular learning design.

The LDSE project ethos is emphasized in focusing on the ‘Teaching and Learning Activity’ (TLA), as opposed to the ‘Learning Activity’ in an attempt to emphasise the teacher’s control and responsibility over the learning process in the context of formal education. Far too often the control and responsibility over the educational dynamic is surrendered to institutional dictates, and teachers are seen as operators, or as mechanistic mediators between an institutionally approved curriculum and student learning. When the TLA design is understood as teachers designing ‘themselves into the dynamic’, as an integral part of the teaching-learning discourse, then the thinking parameters are likely to change.

## **2. Background**

The need to address teacher’s needs in the face of significant game change in HE in the UK has been well documented (HEFCE 2005, 2006) - see Laurillard and Masterman (2009) for a recent and comprehensive review of the problems, factors, and potential solutions to the problem. Our work is concerned with instrumentalising that change, in the manner of ‘if you build it they will come[1]’. Certainly, the provisions that we are designing need to be informed by the genuine practitioners’ needs if they are to adopt them in their practice. So, the work we are pursuing within this strand of the LDSE project is solely concerned with designing the tools that are, strictly speaking, of high pedagogical relevance to the teaching practitioners. With this in mind the review of the literature in this section is aimed at examining the research and tools concerned with operationalising pedagogical support to teachers.

Historically, the dominant trend of providing support to teachers as learning designers has been the technological one. The IMS LD specification (2003) has been developed as the basis for tools to offer practitioners the means to increase the use of technology in their existing practice, by means of making it computer interpretable. Initially, logistical gains brought on by the use of VLEs encouraged the trend of teching-up the existing practice and

produced a number of offshoots, such as IMS LD-inspired LAMS[2] and IMS LD-based Graphical Learning Modeler (Neumann and Oberhuemer 2009).

As it has been noted (Sitthisak and Gilbert 2009: 1), “IMS LD allows it to model a business process such as a mortgage application just as well as it can model a tutorial”, the pedagogically agnostic model behind IMS LD does not itself offer the opportunity for the teachers to think about the pedagogy behind learning design. But to expect this from a specification that was never intended to support pedagogical decision making in the first place would be wrong. IMS LD models the consequential aspects of learning design, once the pedagogy is decided, it does not adequately support thinking about the pedagogical design.

The driving force behind the learning design should be the pedagogy, the how and why of learning design, thereafter the mechanisms and resources for realising that pedagogy should be considered. The intent behind the IMS LD specification was to enable the technologists to build applications that would provide learning design support, including pedagogical support, to end-users – teachers; in this way the teachers can only indirectly engage with IMS LD. This notion of IMS LD as the learning design interoperability solution is echoed recently by Dalziel (Dalziel 2009):

By finding a shared language for describing educational activity structures, we lay the foundations for the most important promise of Learning Design – sharing of good teaching and learning ideas among educators.

Dalziel’s (2009) analogising of the development of Learning Design notation with the development of music notation highlights the monopoly of interoperability concerns over the research and development work in the field of learning technology. The focus on notation for interoperability obscures an important and crucial consideration, to use the music analogy, the would-be-composer’s understanding of music notation is a necessary but not a sufficient pre-condition for composing (designing) good quality music – music composed to a brief. This consideration features in Dalziel’s thinking, but as an afterthought:

There are many topics ahead of us for research on Learning Design, including:  
theoretical/ontological questions about the most useful framework we could adopt...

The ‘notation first’ principle of approach does give away the research intuition behind IMS LD inspired/based systems. This approach can be summarised as follows - allow the practice

to be expressed and exchanged, and it will evolve naturally. For all its simplicity, that has not happened. Even in developing notation, the question – is the notation easily adoptable by the practitioners? – needs answering; our contention is, it is not, and partly because it lacks pedagogically informed foundation. To make it more adoption friendly we need to provide more meaningful benefit to practitioners, in terms of their practice. To understand not only ‘how’ but ‘why’ a pedagogical design works is a precondition to having teachers innovate, and to being able to offer some substantive, informative, and overall immediately relevant guidance to the practitioners.

In analysing the work so far our primary focus has been on the way these tools that support learning design process, and the models that underpin them, define and enable thinking about the pedagogical properties of learning design. By pedagogical properties we mean those properties of a particular learning design instance that are critical to promoting its intended learning outcomes. The following section looks at the derivation principles of pedagogical detail for the purpose of informing the design of the pedagogical support to learning designers.

### **2.1. Informing the informants – where should the pedagogical support be coming from**

Generally, the approaches to arriving at ‘good learning design rules’ (Koper and Tattersall 2005), to support learning design process, can be categorised by their derivative source, from either theory, practice, or patterns of learning design. Each of the sources has its benefits and drawbacks. For example, “the theoretical approach is intended to be of general purpose because it excludes conditions as much as possible, the example-based approach is so highly contingent on conditions that the chance of finding a matching example is relatively small” (Koper and Tattersall 2005). Furthermore, approaches can be examined in the way they discriminate between a variety of contributing design elements of a learning design, such as: epistemological (coming to know detail), curricular (how to prepare/decompose the material), and, what can be termed as ‘logistical’ (student-grouping strategies).

The term ‘theory’ in learning design literature is commonly indiscriminately used to cover two quite distinct categories of analytical engagement (Reigeluth 1999): a Theory of Learning as a set of empirically validated explanations of learning as a natural process, and Instructional Design Theory (IDT) as a set of prescriptions of probabilistic instructional methods that are likely to effect specific type of learning in specific conditions. This distinction is a very important one, and has been described elsewhere as the distinction between ‘natural sciences’ and ‘the sciences of artificial’ (Simon 1969).

Therefore, descriptive theories are also useful to practitioners, because they provide an understanding of why a design theory works and because they can help practitioners to generate their own design theories for those many situations for which no adequate ones exist. (Reigeluth 1999)

There is a sense that an attempt to operationalise theory for its easier application (the aim behind IDT) produced a significant gap between ‘the pedagogical why’ and ‘the instructional how’ of learning design. Our work aims to fill this gap. To enable teachers to innovate there necessarily has to be a way for them to go back to the first principles of derivation of a given learning design they are thinking of using (Laurillard and Ljubojevic in print); moreover these principles need to be expressed in practitioner’s terms, with strong links to the learning design instance in practice.

The more recent, widespread adoption of the approach to the derivation of ‘good learning design rules’ that are the basis of any learning design support mechanism, is the design patterns approach. The design patterns approach has its origins in architecture and it is based on an assumption:

Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice. (Alexander 1977)

It is easy to see the appeal, and understand the widespread adoption of the design patterns approach. It is neither theory nor practice driven; it simply entails the search for, and documenting the recurrence of design problems and related design solutions in the environment. Koper and Tattersall (2005) differentiate between two ways of going about such an approach, inductive and deductive, which do in effect exhibit respectively practice and theory emphasis. Inductive is about analysing the regularities in a common set of learning design methods, and deductive is drawing upon experiences of the learning designers to identify recurrent problems and the generic models for solutions.

Several patterns collection projects (ICOPER, TELL, Learning Designs, PLANET)[3] have followed the inductive/deductive route: collect instances of teaching practice, evaluate/theoretically analyse and re-describe the patterns using the patterns collection-specific template.

The question is, given the purpose, what aspects of learning design methods and/or educational problems should this pattern-derivation process focus on, and what should be ignored? The danger is that once everything that constitutes the formal educational context is seen as the focus for this spot-the-recurrence exercise, the approach quickly runs aground. To avoid this there is the requirement for delineating the critical from non-critical pedagogical properties of a learning design that promotes a specific learning outcome. This delineation guidance on “how to identify and provide what it takes to learn” (Laurillard 2008) should in effect act as an analytical scoping framework that would not only inform the endeavor but serve as the basis for developing the theoretical/ontological framework for pedagogical patterns, of the kind that Dalziel (2009) writes about (see above quote). The next section outlines a way of systematising the thinking about the pedagogical design patterns.

## **2.2. The Conversational Framework**

The design pattern approach has not so far found a systematic, and theoretically informed means for describing the pedagogy inside the learning designs. This leads to unsystematic, text-based, and anecdotal representations of the pedagogy that characterises the learning design instance, which is hard to interpret and is prone to misinterpretation (Laurillard and Ljubojevic in print).

To help systematise the pedagogical descriptions, and to provide the analytical scoping guidance to practitioners, we have tried using the theoretically informed Conversational Framework, or CF (Laurillard 2002), which set out to be a theoretically comprehensive framework for capturing what it takes to learn. The CF consists of the most minimal set of activities by teachers and learners that captures the complete teaching-learning process. Different orderings of these processes can be linked to different pedagogies (Laurillard 2009), so that when ordered inside a particular teaching-learning episode they exhibit a form that we define as a pedagogical pattern. Thus conceptualised, the pedagogical pattern can be systematically described in a way that can be interpreted in terms of learning theory, opening up the potential for an objective, theoretically informed interpretation of its potential against the learning outcome it is designed to promote.

The CF specifies 14 types of cognitive activity by teacher and learner that together define the pedagogy of the teaching-learning process. These activities have a clear pedagogically purposeful role, such as: share ideas with peers, share practice with peers, act to achieve goal, reflect on practice feedback etc. Using this set of activities as an interpretative vocabulary of pedagogical ‘moves’ we analysed a set of learning designs from

disparate collections and subject disciplines. The way the CF was used to inform our approach to, and the representations of, pedagogical patterns is presented in the following sections.

### **3. Methodology**

The LDSE approach to understanding what is and what is not a pedagogical pattern and how to represent it, coupled with the aspiration to build on the work of others, resulted in a methodological approach presented in Figure 1.

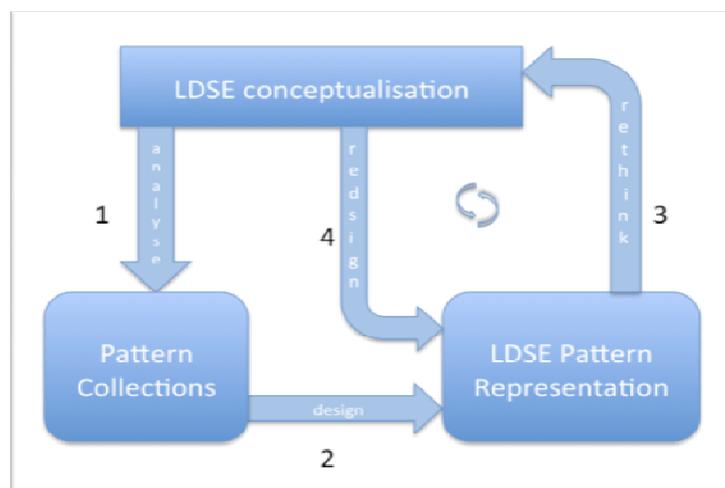


Figure 1. Approach Cycle.

We started with a set of assumptions that were then tried and tested on a data set, composed of five learning design patterns from disparate sources. The consequent findings informed our rethinking of the departing assumptions and led to re-representation. The following sections describe our methodology in more detail.

#### *Data Sampling Rationale*

The choice of data for analysis was guided by ensuring a balanced variety of the sources, subject disciplines, time duration, and, level of study (postgraduate and undergraduate). This varied data set helps to ensure that our approach is tested on all fronts and in all ways, and consequently has the potential to further validate our findings. Two patterns in the data set were chosen from our team members' teaching practice (unpublished), which are well described, well used, and have been evaluated as successful. One pattern comes from the empirical study on transfer to prediction (Schwartz and Bransford 1998). Finally, two patterns

come from the Learning Pattern Collection projects (ICOPER and Learning Designs)[4] as these represent the work of our colleagues and are the natural choice in terms of assessing the compatibility of our approach with the work of others.

#### *Common Description Template*

Table 1 shows comparison between excerpts from three patterns collection templates devised to enable practitioners to describe their practice in a systematic way. The shaded cells in Table 1 present the pedagogically critical descriptors. The remainder of the descriptors do affect the design but are not critical. What is the most striking feature of this approach is that the crucial design detail, in *Sequence of Activities* (ICOPER) and *Solution* (in Planet and TELL), is provided for in the form of text-based accounts of the activities that address, respectively, the *Learning Outcomes* (ICOPER), and the *Problem* (Planet and TELL). This type of provision offers little generalisable guidance for teachers about how to link the pedagogical aims with the pedagogical means. Moreover, it invites the unsystematic and unstructured text-based accounts that would be hard to interpret computationally in order to inform computer-based design support.

Table 1. Pedagogical pattern in LD collections.

<i>ICOPER</i>	<i>Planet</i>	<i>TELL</i>
Author & Copyright		Credits
Summary/ Thumbnail		Context
<i>Rationale</i>	<i>Rationale</i>	<i>Rationale</i>
Subject/ Discipline	Context	
<i>Learning outcomes</i>	<i>Problem</i>	<i>Problem</i>
		Forces
Group size		
Duration (part)		
Learner Characteristics		Audience
<i>Sequence of Activities</i>	<i>Solution</i>	Diagram
		<i>Solution</i>
<i>Roles</i>		
<i>Type of Assessment</i>		

We define the pedagogical pattern (PP) as the structured set of core properties of a learning design (LD) that are critical to facilitating the student in achieving the intended learning outcome. The template we used for our analysis (Table 2) reflects this strict focus on the core pedagogical properties.

Table 2. Pedagogical pattern in LD collections.

<b>Title</b>	Usually the working title for the pattern
<b>Summary</b>	Structured summary of the following form: <u>To what End</u> by <u>What Means</u> ; this will potentially be used by the search engine to make inferences about the functional orientation and character of the pattern.
<b>Rationale</b>	Pedagogical rationale providing learning theory justification that links learning outcome with the pedagogical method
<b>Learning outcomes:</b>	Higher Cognitive Skill learning outcome(s), most commonly of the following form: To Be Able To Perform/Apply/Resolve etc.
<b>Sequence of Activities:</b>	Ordered and timed sequence of Teaching and Learning Activities, each interpreted for the type of Conversational Framework activity it represents
<b>Type of Assessment:</b>	How can we prove that the learning outcome is achieved
<b>Time</b>	Duration of the TLAs sequence that executes this pattern

Armed with this strongly focused outlook on the pedagogically critical properties of learning design we present our approach to pedagogical pattern representation in the next section.

*Pedagogical Pattern Representation*

In order to foreground the pedagogy in the learning design representation without compromising clarity we decided to use the representation metaphor of a *score*. In part this choice was inspired by the analogy between the maturation of LD notation and that of history of development of musical notation, put forward by Dalziel (Dalziel 2009). The metaphor of a *musical score*, embodied in our representation of a *learning score*, that unravels over time seemed appropriate as it offers designers the clarity (by virtue of familiarity) on which the overlay of pedagogically structured ‘moves’ can be imposed. We made sure that the representation format’s structure was not too rigid, so that practitioners can still use their own language and labels to denote the activities and processes, but these are slotted inside the formalised structural whole. Figure 2 presents the representation of a fragment of one pedagogical pattern we investigated.

Contributing Patterns		Jigsaw pattern for grouping; Table-top Concept Mapping - forming plans pattern (PLANET)	Pattern - Three hats (PLANET)	Consensus building towards one (set) proposition, student grouping pattern... from TELL collection	Core student feedback
CF processes	Setup environment and methodology	Plan activity	Data collection	Task-group analysis of data to form team interpretation	What data
	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	
1 Present concepts	Introduce task Arrange teaching practice environment- Record key teaching points from your teaching practice to illustrate your approach			Set up website - Post to the website images of your teaching points, with captions and notes explaining what you did and what happened	prepares
2 Set Task goal					
3 Feedback					
4 Offer Guidance					
5 Questions					
6 Action on task					
7 Share practice					
8 Discuss					
9 Revise actions					
10 Present conception					
Period in mins	prep	30	60	60	All critical data to note the
	Define task and principle(s) of practice to focus on in practical	Students are grouped into pairs or small teams and plan a teaching activity, to practice principle, and to define focus of recording	The lesson is conducted with one or members of the team taking photos during the session. The plan is adjusted according to the class situations that arise, this is noted in a set of paper notes accompanying the recordings.	The pairs/teams select the best images from the set taken and share them online using image sharing software, providing an explanatory caption for each, and, where available the notes explaining in more detail the links with theory.	

Figure 2. Pedagogical pattern representation.

The far left column in Figure 2 contains an inventory of teaching-learning activities as defined by the Conversational Framework and stands in as a *Y-axis* against which each of the activities in the pattern are mapped. The top four teaching-learning activities belong to Teacher, and the remaining 6 to Student. The covert activities (adaptation and reflection) from

the CF process-set were discarded, as these can only be assumed, so the list contains ten overt teaching-learning processes. Moving to the right, in Figure 2, there is a series of *segments*, each numbered by a Roman numeral (there are four segments shown in Figure 2, I - IV), which tend to correspond to the structure of the original narrative description of the pattern (in blue). Each *segment* contains, starting from the top:

1. A set of recommended design patterns (these could inform the grouping, curricular and/or epistemological decisions) suitable for the Teaching-Learning Activity (TLA) contained in the segment,
2. Formal, abbreviated functional purpose behind a segment,
3. Number of the segment in the sequence, using Roman numeral,
4. A set of interlinked Teacher-Learner Activities, each juxtaposed against a single related CF pedagogical activity type, with abbreviated, informally described label,
5. The duration of the segment in time,
6. The user's original description of the activities, and the purpose behind them, inside the segment.

The flow of the TLAs is from left to right and is further specified with the use of arrows. The arrows denote intra and inter segment cohesion between the activities. The arrows are especially important when there is a need to represent a cycle of activities that the learning process needs to run through for ensuring that learning takes place. The *segments* representation reinforces visually the idea of the parts of a pattern being resolved by lower level patterns. The TLA composites normally occurring in a *segment* have so far proven to be the lowermost unit of analysis for pedagogical consideration. Below the level of TLA composites (contained in a *segment*) the inquiry into 'what makes it work' is possible but it belongs to the discipline of Cognitive Psychology; and it can be linked with the pattern representation and offered as support to designers in a read-through manner, but it cannot be represented using the representation format in Figure 2.

The representation allows for mapping the practitioner's intent onto the structure and that in turn enables a theoretically informed interpretation of the pedagogical design and consequent theoretically informed evaluation of its quality. It is important to emphasise that the representation in Figure 2 is an early form of representation enabling the computational system to access the design details. More work needs to be done on the way it will be presented in the user interface. It is also important to emphasise that at this stage of the work the mapping of a pre-existing pattern narrative has to be done 'by hand'. If we can demonstrate that we have a mapping of sufficient generality to be able to express all the

learning design patterns we attempt to map, then it becomes possible to collect an increasing set of standard pedagogical patterns, whose general pedagogical properties can be instantiated in all the particular activities we collect.

#### **4. Findings**

The findings are presently informative about the methodology of approach and cannot be yet offered as guidelines for practical use. Internally, within the project team, the early tests show great potential behind the approach.

We are presently testing in the prototype an approach that makes use of five types of learning, representable in the Conversational Framework as learning through: *acquisition*, *inquiry*, *production*, *discussion*, and, *practice*. The approach sees each Teaching-Learning Activity (TLA) as defined by its *epistemic character*, and, its *epistemic orientation*. The former asks the question ‘in what way?’ and the latter ‘to what end?’ of the TLA structure. Then the TLA can be presented as a point in the coordinate system defined by its *epistemic character* (CF activities) and its *epistemic orientation* (learning outcome).

We have designed a plan to test empirically the representation presented in this paper as part of a workshop. The testing would first elicit users’ responses to the *learning score* representation, and then prompt the users to use the same format to represent three textually described example patterns. Finally, it will be tested by asking the user to represent a pedagogical pattern of their own.

#### **5. Discussion**

If this methodology is successful in finding a robust representation of learning design patterns, then it will be possible to use it for the discovery, categorisation, representation, and evaluation of learning designs, as intended. This will form part of the knowledge and intelligence built into the LDSE.

In addition, the process will generate a pattern language, by finding the terminology that defines the most generic form of a learning design pattern description that preserves the richness of its pedagogy. These terms will form the main terms (concepts) used in the LDSE. However, since they are derived from an (ever increasing) collection of existing patterns, there is the potential to develop a thesaurus of terms that are cognate with the LDSE generic terms (concepts).

The next stage of this methodology will be to test (i) the learning design pattern representations described in this paper, (ii) the intelligibility of the LDSE concepts and their

definitions, and (iii) the comprehensiveness of the collection of terms as synonyms for the LDSE concepts.

### Notes

1. Often misquoted original quote - 'if you build it he will come' – from the book *Shoeless Joe* (W. P. Kinsella, 1982). Reference is to building a baseball pitch on a farm to offer a redeeming chance to a fallen baseball hero. Allusion here is that the change cannot be forced it can be attracted.

2. <http://lamsfoundation.org/>.

3. ICOPER <http://www.icoper.org/>

Learning Designs <http://www.learningdesigns.uow.edu.au/>

TELL [http://www.elearningeuropa.info/directory/index.php?page=doc&doc\\_id=4729&doclng=6](http://www.elearningeuropa.info/directory/index.php?page=doc&doc_id=4729&doclng=6)

PLANET <http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Main/>

4. ICOPER <http://www.icoper.org/>

Learning Designs <http://www.learningdesigns.uow.edu.au/>

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### Note

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