

# PEDAGOGICAL PATTERNS FOR ONLINE LEARNING

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**Abstract.** This paper describes the use of a new representation language E2ML to denote pedagogical patterns. With E2ML you can create visual illustrations to communicate of sound pedagogical applications of technology. The language is so intuitive that it provides the means to construct templates, and the possibility to be translated into XML and then use in a compliant platform.

## Introduction

“Each pattern describes a problem that 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, Ishikawa & Silverstein 1977).

Patterns are predefined potential solutions to recurrent design problems in different contexts. “In teaching we have many problems such as motivating students, choosing and sequencing materials, evaluating students, and the like.” (Pedagogical Pattern Project 2003). Recently, design patterns have attracted the attention of the Instructional Design and Education community. Basically, design patterns could be applied to instructional design at two different levels:

1. For learning materials and multimedia production, such as defining patterns for Learning Management Systems. These are actually a subset of Web design patterns (Avgeriou, Papasalouros, Retalis, & Skordalakis 2003)
2. For instructional activities of different scale – from the organization of a whole semester course to specific activities (Bergin 2003)

The design of educational activity could actually benefit from the definition of specific reusable solutions on both levels as they could provide inspiration to designers and enhance and quicken the design process.

This paper has a threefold goal: (a) introduce a new representation application of E<sup>2</sup>ML – Educational Environment Modeling Language for describing pedagogical patterns; (b) presenting one pattern captured from the work of DE&T; and (c) discuss the way a pattern can be translated into an organizational template for an effective implementation of educational technologies

## Pedagogical Pattern Languages and E<sup>2</sup>ML

The possibility of defining patterns depends on the existence of a pattern language that allows the synthetic and clear expression of the pattern idea. A pattern is the abstract gist of a solution, and should be the origin of an insight of the instance problem the designer is concerned with – thus opening an original solution fit to *that* specific problem.

Common pattern languages usually define a set of descriptors (i.e. text paragraphs) summarizing the pattern, namely specifying the problem addressed, then describing the solution and eventually providing examples or other additional materials, such as in (Hypermedia Design Pattern 2003). The same structure is used for the definition of a pedagogical pattern (such as in Bergin 2003). Other pattern languages add the specification of what particular materials are needed for the implementation (e.g. a course Web site or an online forum, etc.).

### E<sup>2</sup>ML for Expressing Patterns

The quality of a pattern is its adequacy to the problem and its straightforwardness. E<sup>2</sup>ML – Educational Environment Modeling Language (Botturi 2003) can play an interesting role in the definition of pedagogical patterns. Its visual orientation may actually provide an important added value in making the pattern language easier to understand, and patterns more affordable to use, adapt and implement. This section will provide a short introduction to the language, leaving examples and some additional detail to the pattern presentation.

### Goal Mapping

In order to enhance the communication within the design and development team, learning goals can be expressed visually, by mapping them on a visual grid or representation. E<sup>2</sup>ML suggests the use of a visual tool as a communication

device, called the QUAIL model, which can be used for expressing the goals, or the types of objectives a pattern aims at. Given the limitations of space, we will not use such diagrams here.

#### Action diagrams

An action is the performance of a set of acts with a unity of purpose by defined acting subjects. Unity of purpose means that the action is aiming at one thing, e.g., producing a report, completing an exercise, achieving the understanding of a set of concepts, etc.

#### The Dependencies Diagram

The dependencies diagram represents the relationships existing among all the actions in one instruction. The represented relationships are the following three types:

1. *Learning prerequisite* (dot-ended arrow), which indicates that the first action builds on a learning outcome that is the prerequisite for the second action (e.g., a lecture provides concepts for the following analysis work).
2. *Product* (simple arrow), which indicates that the first action produces as material output some artifact that is required as material input for the second action (e.g., a group-work activity produces a presentation which is shown during the following class discussion). Product arrows may be tagged with an indicator of the product (e.g., report).
3. *Aggregation* (nested box), which indicates that an activity is part of another activity (it is a sub-activity).

Moreover, actions can be grouped into *trails*, or logical groups of actions, e.g., all lectures, or all the actions that form a specific activity in a course, etc.

#### The Activity Flow

The activity flow is a visualization of the instruction calendar, and provides an overview of the flow of educational activities during the course time span. It is similar to a flowchart diagram, where the flow represents each learner's path through the instruction. Splits (branches) are added to the action flow as advanced elements in order to make it more flexible and respondent to the actual instruction.

#### **The Online Read & Discuss Pattern**

This section presents one pattern for online learning developed at DE&T, expressed with E<sup>2</sup>ML. Since we are describing patterns to describe Instructional Design we needed to adapt some of the descriptors provided in Alexander's patterns.

This pattern is a simple structure that may be used for online courses where individual work on specific documents and critical discussion are the main features of the approach. This method properly applies to almost all Humanities, such as Literature, Law or History, where written documents (as different from data or theorems) represent the primary object of study. At the same time, the tenet below this pattern in that group discussion may enhance the understanding of documents and the construction of meaning about them.

TITLE	Online Read & Discuss (Version E <sup>2</sup> ML, July 2003)
SUMMARY	Students need the time to approach personally important documents, read, analyse and understand them. Critical discussion with peer and with the instructor may refine their understanding and motivate them.
PROBLEM/ ISSUE	Depending on the type and content of documents, this pattern may address different types of goal. Generally speaking though, it addresses the <i>understanding</i> and <i>judgment</i> levels concerning the documents. Special attention should be paid to the development of interpersonal skills through discussion, and to the acquisition of meta-cognitive skills by comparing one's understanding with the group.
AUDIENCE/ CONTEXT	This pattern applies to any subject area where the review of relevant documents is of primary importance. Learners should be skilled in reading the kind of proposed documents, and should not have language or comprehension problems. Moreover, they should have basic online communication skills.
FORCES	Students can take the time for personally approaching relevant documents, still maintaining deadlines and group comparison Critical understanding of documents is enhanced by discussion

SOLUTION	<p>The activity starts with the reading of introductory materials (presenting the topic and the activity structure), and then proceeds with the reading of the documents. Online group discussion proceeds at the same time, engaging students in collaboratively understanding the documents. After the discussion is over, some revision questions are proposed. Students that experience difficulties in answering them may request support in the forum.</p> <p>The dependencies diagram, reported bottom-right, indicates the flow-like activity of this pattern. Although simple, details are provided in the action diagrams below.</p>
DISCUSSION & IMPLEMENTATION	The implementation of this pattern requires a structured forum with group support. Notice that students may be given particular roles in the discussion.
EXAMPLE INSTANCES	History course at UBC; SWISSLING modules in Lugano.
RECOMMENDATIONS	Provide learners with clear expectations and guidelines of how to use the discussion forums to deepen their learning. Reference the Action diagrams for this pattern to for further detail of the pattern's application.

Table 1 – E<sup>2</sup>ML version of the read and discuss learning pattern

This pattern was extensively used in a History course at UBC about *Slavery in the Americas*. The basic course module was indeed modeled on the read & discuss pattern – documents were primary sources that students had to read after the introduction provided by the instructor's notes. Personal assignments were to be submitted, concerning the work done in the modules. Finally, a final exam concluded the evaluation. The whole course was accompanied by the instructor's scaffolding activity. This was done through the forum, and was more intense in the beginning of the course, then declining in proportion to the students' acquired autonomy.

The general course structure was as follows (M indicates the modules and A the assignments):

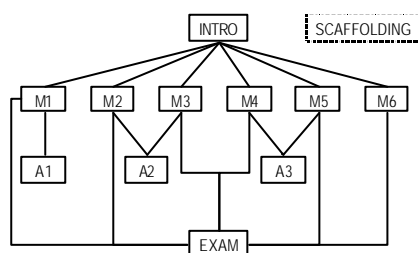


Figure 1 - Slavery in the Americas: dependencies diagram

Each M action (module) was then inner structured according to the pattern, with readings, discussion and revision. Notice that although for A2 and A3 students could chose between two different topics, presented in different modules (M2 and M3 for A2; M4 and M5 for A3), the problems to be discussed in the assignments implied knowledge also of the other module.

The activity flow is perfectly linear: it assigns two week to each module, and one assignment every fourth week. Notice the continuous scaffolding activity accompanying the course.

The online read & discuss pattern is a tool for designing online courses with a Computer Mediated Communication (CMC) approach. Moreover, it offers a structured representation or *one possible* implementation of CMC principles. This shows how the availability of a standard and semi-formal pattern language may improve critical discussion between researchers and practitioners.

## Implementing a Pattern System

Most instructors are willing to try sound pedagogical strategies in their classes that allow their learners to be successful. But many are confounded by a lack of time and a need for specific and clear step-by-step guidelines that they can use or adapt to their own practice without a significant investment of time.

The patterns offer variety, and provide a broader framework to assist the instructor in developing and delivering a successful and engaging learning experience with a sound educational foundation. The use of the E<sup>2</sup>ML to support the definition of a pattern, provide instructors with visual tools, tables and diagrams that can be used as a whole, or in parts. Each of the tools provided can be converted into a digital template where instructors add and edit the goals, actions and dependencies.

The language offers different levels of representation from a very detail approach (very specific criteria for each activity), to a higher-level approach (sequencing of activities). Therefore, instructors could easily move from a top level to a lower level description and manipulate the graphics to represent what they want to do.

At an institutional level, it would be easier to develop, maintain, and support courses using around five to six different patterns, instead of what is now the common “lone ranger approach”, in which each instructor develops a course following his intuition, interest and previous face-to-face experiences.

There is also the possibility to write the XML description of the pattern and then use in a compliant platform. On this point: E<sup>2</sup>ML has also an advanced version, which is compliant with IMS Learning Design: if you describe some activity with E<sup>2</sup>ML advanced version you *could* then have a program translating it automatically into the corresponding XML description.

## Concluding Remarks

We believe that E<sup>2</sup>ML may improve the definition of pedagogical patterns thanks to its visual and semi-formal features, thus fostering the creating of shared patterns repository and enhancing critical discussion and professional cross-development.

Some may notice that we introduced the QUAIL model, i.e. the goal mapping, in the *problem/issue* descriptor. This may seem inappropriate, as the goal mapping is *not* a description of a problem. Nevertheless, we believe that patterns become useful only when an accurate requirements analysis is conducted – designers have the problem of selecting patterns only when they know what goals their design aims at. Moreover, the definition of pattern problems – or *scope*, we suggest – in a formal way, such as with the QUAIL model, may offer a chance to compare patterns, systematically classify them, and finally search and retrieve them by querying a specific goal definition.

Patterns can be used not only in design, but as well for teaching instructional design to prospective designers, describing learning activity tasks and processes to faculty and students, and as a common language between a development group; under this respect, a partially visual representation of patterns acquires a great importance. Moreover, if expressed with a common language, patterns developed by different design communities may provide a way to compare different understandings and implementations of the same instructional principles and theories – and the use of visuals may improve the process.

## References

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