Chapter 1.11
Using Design Patterns to Support E-Learning Design

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ABSTRACT

Design patterns have received considerable attention for their potential as a means of capturing and sharing design knowledge. This chapter provides a review of design pattern research and usage within education and other disciplines, summarizes the reported benefits of the approach, and examines design patterns in relation to other approaches to supporting design. Building upon this work, it argues that design patterns can capture learning design knowledge from theories and best practices to support novices in effective e-learning design. This chapter describes the authors' work on the development of designs patterns for e-learning. It concludes with a discussion of future research for educational uses of design patterns.

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INTRODUCTION

The instructional design of e-learning course materials directly affects student learning outcomes, but research suggests that many of the instructors developing online courses have not received training in interaction or instructional design (Braxton, 2000; Clark, 1994; Tennyson & Elmore, 1995). Hirumi (2002) found that novice course designers find it difficult to incorporate the types of meaningful interactions needed in online courses. Also, inexperienced educators can have difficulties in the application of learning theories to course design. According to Wilson (1997), theories are written as hard science, and novices require a different type of representation to support their initial learning needs. As further stated in Wilson (1999), "the plurality and multiplicity of models and theories can be daunting to both

researcher and practitioner." As a result, making the transition from this wealth of information to actual design practice can be difficult for all but experienced educators and instructional designers.

Design patterns have emerged as an approach for capturing design knowledge from theories and best practices in a form that is understandable and useful for novices (Alexander, Ishikawa, Silverstein, Jacobson, Fiksdhl-King, & Angel, 1977). Design patterns and their use in the development of effective learning designs are currently important areas of research.

The purpose of this chapter is to introduce design patterns as a strategy for representing and disseminating instructional design and learning theory research. First, a review of the literature provides a definition for a design pattern and gives the history of design patterns usage and reported benefits in other disciplines. We then examine how design patterns can be used in education to represent and disseminate learning theory research and educator best practices in the context of e-learning design. We discuss our current research with design patterns for e-learning design, which advocates the development of an underlying design framework and support environment for design pattern development and use. Examples of design patterns developed from this work are provided. Finally, we conclude with areas of future research.

BACKGROUND

What Is a Design Pattern?

Design patterns have been defined in the literature in a number of ways. As provided in one of the earliest definitions from the field of architecture, a design 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 et al., 1977). They further describe a design pattern as "a three part rule, which expresses a relation between a certain context, a problem and a solution" (Alexander, 1979). In a definition almost 20 years later from the field of software engineering, a design pattern is described as a "particular prose form of recording design information such that designs which have worked well in the past can be applied again in similar situations in the future" (Beck, Coplien, Crocker, Dominick, Meszaros, Paulissch, & Vlissides, 1996).

Originating in the field of architecture, design patterns have been used to capture expert knowledge, experiences, and design best practices within many different domains (Alur, Crupi, & Malks, 2001; Borchers, 2001; Gamma, Helm, Johnson, & Vlissides, 1995; Graham, 2003; Tidwell, 2005). A large part of their value is attributed to their ability to serve as a design aid to disseminate this knowledge to a novice designer. Although many formats and templates exist for formulating a design pattern, four elements are typically present:

1. The *pattern name* identifies the pattern and provides a way to communicate about the pattern. Choosing a good name is considered vital as it becomes a part of the design vocabulary (Gamma et al., 1995).
2. The *problem* section describes when to apply the pattern explaining both the design problem that is addressed and the context surrounding it.
3. The *solution* section describes the elements that make up the design to solve the problem. References to other design patterns that support the solution are also typically provided.
4. An *example* section provides specific implementations of the solution. Depending on the discipline, the examples may be textual descriptions or pictures.

Formulating design knowledge in terms of problems and solutions is regarded by some to provide designers with more concrete design

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