Chapter XVII
Design and Evaluation of Web-Based Learning Environments using Information Foraging Models

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ABSTRACT

In this chapter, methods and tools for effective design and evaluation of Web-based learning environments are presented. The main aspect addressed by this proposal is that of increasing findability of information in large Web sites of learning information content by applying methods and tools based on the information foraging model. It is argued that through this approach, issues of learning content structure and usability may be also addressed. In particular, we propose four different ways to have information foraging theory informing the design. Directives, to ensure proper learning content structuring and cues with strong scent, tools based on LSA to automate the design and evaluation process, methods to construct archetypal learner's profiles from user data and added functions to realize collaborative information filtering and personal information patch creation, thus allowing learners to organize their reference materials in a meaningful and constructive way.

INTRODUCTION

During the last years, there has been a growing demand for adopting innovative approaches to the design and delivery of Web based education. The benefits of interactive hypermedia and the increasing popularity of the Web open a new paradigm for the authoring, design and delivery of learning material, and has carved the path for the so called **Web-based learning environments (WBLE)**. It has been widely accepted that the hyper-medial structure of the Web could promote learning. Some researchers characterize the Web as an active learning environment that supports creativity (Becker & Dwyer, 1994). According to Thuring, Mannemann and Haake (1995), the Web encourages exploration of knowledge and browsing behaviors that are strongly related to learning.

Theories of learning standing on theoretical bases of *objectivism* and *constructivism* (Jonassen, 1992; Vrasidas, 2000), can inspire the design and usage of WBLEs. The aspects that each theoretical standpoint puts more emphasis in, can transcribe the design and development of certain WBLEs and the associated learning activities that are followed. One of the most promising constructivism-based models, which emphasizes the role of social interactions and cultural artifacts in triggering cognitive elaboration and resulting in co-construction of knowledge among the members of communities of practice (Lave & Wenger, 1991), for designing WBLEs is the one proposed by Duffy and Kirkley (2004). The basic pedagogical goals of the model are to engage students in inquiry, provide structure, support collaborative inquiry, conduct performance-based assessment and promote reflection and transfer.

Apart from the pedagogical design aspects that have to be followed, the interaction design of the WBLE plays a significant role in how these principals come into real practice. According to Duffy and Kirkley (2004), effective design of such systems should encompass two basic entities. The learning content management system (LCMS), and a separate, although tightly interconnected by means of hyperlinks, learning management system (LMS). Despite the fact that in the second module exists an important body of design knowledge as well as good practices and plethora of useful tools (forum, calendars, assignments, etc.); this is rarely the case for the first one.

For example, concerning the links of learning content that lists the learning resources on a single screen lead to a linear reading strategy by the students. In a WBLE realized according to the aforementioned model, when the designers developed a new interface where the resources were linked to the task, the students found it more beneficial, and there were few students that reported that they read everything first (Gunawardena, 2004). In addition, from a psychological perspective, the learner needs to consult links with high-quality residues, in order to proceed seamlessly, establish a *flow state* and not get overly frustrated while she is involved in the task (Csikszentmihalyi, 1990). Therefore, apart from the disposition of links of learning content, the *proximal cues* of such links (i.e the hyperlinks' descriptions), that give the learner a sense of the access path of the desired information sources, are crucial for the success of the learning task.

As a result, the process of design and adaptation of appropriate learning content with respect to the needs and particularities of the medium, could serve efficiently even pedagogically neutral WBLEs, since the effective separation of learning content from learning tools greatly enhances its organization, reusability and maintainability. This is a critical point, since one of the most common pitfalls in WBLEs is the use of existing course materials without adapting them to the online delivery method. Thus, often learners are unable to find, evaluate, and use materials relevant to their studies, which renders learning activity problematic. Although the key requirement still remains the quality of the instructional design itself, this should not be treated as an excuse

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