Layers of Navigation for Hypermedia Environments: Designing Instructional Web Sites

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As an instructional medium, computer-based hypermedia environments (e.g., Web sites or CD-ROM materials) enable distinct and enriched activities that facilitate learning. With the pressure on educators to produce Web-based courseware and other distance educational materials, more and more instructional Web sites have been developed. However, simple access to the World Wide Web (WWW) in any course does not guarantee that learning takes place: “No computer technology in and of itself can be made to affect thinking” (Salomon, Perkins, & Globerson, 1991, p. 3).

Too often, Web sites are developed for instructional uses without the aid of sound instructional design principles. Content is presented as static, verbal information pages linked to other information pages that may or may not include obvious or intuitive navigational cues for making the cognitive connections necessary for knowledge construction. That is, critical information is delivered in a potentially rich learning environment but the format of the presentation confuses or “loses” the novice learner. Such environments are most often the result of an educator’s first few attempts at Web site development.

Even with the use of Web site builders and intranet templates, designing instruction for instructional hypermedia requires thoughtful attention to certain aspects of learning. Over-simplification of the complexities of an ill-structured or even a well-defined domain encourages novices to reduce the “solutions” of domain-specific problems to simplified or cookbook answers, which is known as reductive bias (Spiro, Feltovich, & Coulson, 1992). Thus what is learned from some Web sites is often not what the designer or educator intended. A deliberate instructional design strategy for educational hypermedia environments is needed.

This chapter focuses chiefly on the development of deliberate navigation cues and describes strategies for three blended levels or “layers” of navigation that support knowl-
edge construction. Characteristics of hypermedia learning environments (learner and site specific elements) and cognitive flexibility theory are discussed in relation to navigation strategies. Recommendations for application of the navigation strategies to hypermedia environments conclude the chapter.

Specifically, the objectives of this chapter are:

- to identify and define learner and site elements present in hypermedia environments,
- to introduce cognitive flexibility theory in relation to higher order learning in hypermedia environments, and
- to examine strategies for navigating in hypermedia environments (based on learner and site elements) that facilitate higher order learning.

**HYPERMEDIA AND LEARNING**

Successful educational hypermedia environments are more than the information presented. That is, in successful educational Web sites, there appears to be a synergistic relationship between the information at the site, the authors of the site, and the users of the site. Several articles have identified elements of this synergy (Barrett, 1992; Carlson, 1991; Corry, Frick, & Hansen, 1997; Hill & Hannafin, 1997; Jonassen, 1991; Jonassen & Wang, 1993; Locatis, Charuhias, & Banvard, 1990; Schroeder, 1994; Spiro et al., 1992; Spiro, Feltovich, Jacobson, & Coulson, 1991), but few have presented them as a unified whole. Table 1 is an attempt at illustrating the learner and site characteristics designers consider when developing successful educational Web sites.

**Learner Elements**

*Computer skills.* The ability to use the computer and by implication a WWW browser, is described by Hill and Hannafin (1997) as “system knowledge” (p. 39). Word processing, e-mail, and basic WWW familiarity are competencies most graduating high school students have upon entering post-secondary institutions. In fact, the prevalence of computer skills among K-12 students is increasing. Even as far back as 1993, “…more than two-thirds of all students in grades 1–12 used a computer either at home or at school, with a majority, 66 percent, using a computer at school” (National Center for Education Statistics, 1995). Currently, that number is predicted to be much higher, though current national data is not yet available.

*Content knowledge.* Content knowledge is the understanding of certain domain-specific building blocks of information. As learners add to their building blocks (i.e., learn new things), new knowledge is linked to prior knowledge. Such prior knowledge is critical

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Managing Cognitive Load in Verbal and Pictorial Representations


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