

Chapter 6

Diagnosis, Supporting, and Fading: A Scaffolding Design Framework for Adaptive E-Learning Systems

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ABSTRACT

This chapter presents a design framework of scaffolding that can be applied in designing adaptive e-learning systems. The framework is primarily grounded in socio-cultural theory and built on a critical analysis of literature on scaffolding. It addresses three key processes in scaffolding (i.e., diagnosis, supporting, and fading) and four conditions for designing scaffolding (i.e., who, what, how, and when). From the historical perspective, this chapter also provides a literature review of adaptive systems. The characteristics of adaptive systems from different paradigms are specifically examined through the lens of scaffolding. To illustrate the application of the scaffolding framework in system adaptation, four web-based e-learning systems are described to demonstrate how various scaffolding strategies are implemented through the design of the systems. In conclusion, issues related to designing scaffolds for adaptive e-learning systems are discussed, and research gaps are identified for future investigation.

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INTRODUCTION

With the rapid advancement of information and communication technology, the word “interactivity” has been taken for granted as a key characteristic of and an essential requirement for e-learning. Yet, interactivity has been defined or interpreted differently in different contexts and from different perspectives, ranging from the human-computer perspective to the communication and media view. The former perspective views interactivity as the capability to allow a human being to act on the computer screen, such as a mouse click (e.g., Betrancourt, 2005), and the latter views interactivity as personal communications (verbal & non-verbal) over different media (FtF or CMC) (Burgoon et al., 2002). Tung and Deng (2006) argued that interactivity is a means of developing sociable technology that enhances social presence in an e-learning environment. In the e-learning environment we contend that interactivity is a dynamic process that allows exchanges not only between human and computer, but also among people through computer systems, involving control or ability to act.

An important aspect of interactivity is system adaptation. System adaptation, in its broad sense, refers to “an artificial organism that alters its behavior according to the environment” (Shute & Zapata-Rivera, 2008, p. 278). In the context of e-learning, system adaptation refers to the capability of a technology system to monitor individuals’ learning processes and consequently provide optimal dynamic adaptations according to the needs and characteristics of individual learners (Leutner, 2004; Shute & Zapata-Rivera, 2008). In this chapter, we are particularly interested in examining system adaptation that facilitates learners’ deep cognitive and metacognitive processes.

The concept scaffolding originated from Vygotsky’s (1978) socio-cultural theory. When a child is being assisted by an adult or a more capable peer in a social context, he or she is capable of carrying out a task that would have been otherwise too

difficult to accomplish alone. The assistance that a learner receives in this situation is described as scaffolding. This kind of support, or scaffolding, is “temporary and adjustable” (Palincsar, 1986, p. 75), which means that scaffolding will be gradually withdrawn as learners gain competence in performing a task. Conventionally, scaffolds are described in the form of instructional strategies or procedures (e.g., Palincsar, 1986; Palincsar & A. Brown, 1984; Scardamalia & Bereiter, 1985; Scardamalia, Bereiter, & Steinbach, 1984); however, the use of scaffolding began to find its way in the context of computer-supported learning environments in the 80s. For example, Salomon, Globerson, and Guterman (1989) proposed using computers as Reading and Writing Partners to scaffold learners’ metacognitive activities and assist learners to complete their reading and writing tasks. Scardamalia and her colleagues (1989) embedded procedural prompts in a computer-supported collaborative learning environment as a form of scaffolding to guide learners through their writing tasks.

In the context of computer-supported learning environments, Lajoie (2005) defined scaffolding as “a temporary framework to support learners when assistance is needed and is removed when no longer needed” (p. 542). In such environments, adaptive instruction can be considered a method of scaffolding because instructional approaches, strategies and techniques are geared to accommodate individuals’ needs and abilities within their zone of proximal development (ZPD) (Vygotsky, 1978). As learners develop their skills over time and no longer depend on the assistance, scaffolding can be withdrawn gradually (Corno & Snow, 1986).

PURPOSE

In the past three decades, there is a myriad of research and practice on developing scaffolds for computer-supported learning environments

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