Chapter 2.12
Individualized Web–Based Instructional Design

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ABSTRACT

Adaptive (individualized) Web-based instruction provides mechanisms to individualize instruction for learners based on their individual needs. This chapter will discuss adaptive Web-based instruction, paying particular attention to (1) the implications of individual differences to Web-based instruction, (2) the adaptive methods that are available to designers and developers, and (3) the considerations for instruction design and development with adaptive Web-based instruction. The primary purpose of this chapter is to provide a framework to shape the development of future individualized Web-based instruction.

INTRODUCTION: STRATEGIES AND GUIDELINES FOR INSTRUCTIONAL DESIGNERS

Web-based learning environments have unlimited opportunities for educational uses, but there are numerous implementation challenges. Significantly, Web-based learning systems' content presentations, navigational methods, and instructional strategies may not be suited to all users (Brusilovsky, 1998; Song, 2002). Most Web-based instruction provides what the designers/developers consider to be the optimal interface and content presentation, expecting learners to fit into the system (Brusilovsky, 2001; Chen, Czerwinski, & Macredie, 2000; McLoughlin, 1999). Since Web-based learners typically work

alone and asynchronously, instructors/trainers are unable to provide the just-in-time modifications afforded in face-to-face sessions. If the user is not comfortable with the Web-based learning system, many instructional advantages can be lost (Metros & Hedberg, 2002; Oliver & Herrington, 1995).

While many challenges affect all learners, there is also a need for physically and visually challenged students to be appropriately accommodated and successfully integrated into the learning environment. Web-based instructional applications often neglect impaired learners. Through the use of assistive and adaptive technologies, impaired students could leave their isolation and become an important part of the learning community (Cavanaugh, 2002; Fink, Kobsa, & Nill, 1998). To overcome these barriers, an online learning system should be designed such that each individual's needs are identified, and appropriate guidance and support are provided during the learning process (De Bra, Brusilovsky, & Houben, 1999; Papanikolaou & Grigoriadou, 2004; Triantafillou, Pomportsis, & Demetriadis, 2003).

ADAPTIVE WEB-BASED INSTRUCTION AND INDIVIDUAL CHARACTERISTICS

Adaptive instruction means creating a learning environment and finding instructional approaches and techniques that conform to meet students' individual needs (Park & Lee, 2003). Adaptive Web-based learning environments (A-WBLEs) are one form of adaptive instruction that tailor individual differences in the online environment (Inan & Grant, 2004, 2005). In A-WBLEs, the fundamental focus is the individual differences of learners, because individual differences such as gender, prior knowledge, and learning styles have demonstrated significant effects on student learning (e.g., Chen & Paul, 2003). To provide a guiding framework, A-WBLEs (1) gather a learner's information and preferences, (2) build an individual model based on the learner's preferences and knowledge, (3) apply adaptive methods to accommodate the learner based on the developed model, and (4) monitor the learner's actions and learning processes to provide new information to update the learner's model, granting a more effective and efficient system (Inan & Grant, 2004).

Although researchers agree on the influential effects of individual differences during learning, the question remains as to which variables should be considered when designing an A-WBLE. Many researchers consider learning style and cognitive style to be important characteristics to take into consideration when developing adaptive web-based instruction (Gilbert & Han, 1999; Magoulas, Chen, & Dimakopoulos, 2004; Papanikolaou, Grigoriadou, Kornilakis, & Magoulas, 2003). Brickell (1993) suggested the more enriched learning experiences occurred when the materials developed considered students' learning styles. Furthermore, Triantafillou et al. (2003) reported the majority of students were satisfied with the adaptations of learning strategies in relationship to their cognitive styles.

Another trait, students' prior knowledge and experiences, is also popular in designing adaptive systems (Brusilovsky, 2003; Foster & Lin, 2003; Weber & Brusilovsky, 2001). Students' prior knowledge contains their previous understanding of the content area and level of readiness for learning new content. Many studies have considered prior knowledge in Web-based instruction (e.g., Chen & Paul, 2003; Milne, Cook, Shiu, & McFadyen, 1997). Foster and Lin (2003) found students' acquisition of knowledge and skills were not just related to the presentation of the instructional tasks, but their prior knowledge and cultural background also played an important role. Similarly, Far and Hashimoto (2000) found a student's background knowledge and motivational state had a strong influence on learning outcomes. Moreover, prior technical knowledge may have an effect as well. Learners have different degrees of familiarity with Web browsers and communication tools,

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