Chapter 7
How Does Prior Knowledge Impact Students' Online Learning Behaviors?

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ABSTRACT

This study explored the impact of prior domain knowledge on students' strategies and use of digital resources during a Web-based learning task. Domain knowledge was measured using pre- and posttests of factual knowledge and knowledge application. Students utilized an age- and topic-relevant collection of 796 Web resources drawn from an existing educational digital library to revise essays that they had written prior to the online learning task. Following essay revision, participants self-reported their strategies for improving their essays. Screen-capture software was used to record all student interactions with Web-based resources and all modifications to their essays. Analyses examined the relationship between different levels of students' prior knowledge and online learning behaviors, self-reported strategies, and learning outcomes. Findings demonstrated that higher levels of factual prior knowledge were associated with deeper learning and stronger use of digital resources, but that higher levels of deep prior knowledge were associated with less frequent use of online content and fewer deep revisions. These results suggest that factual knowledge can serve as a useful knowledge base during self-directed, online learning tasks, but deeper prior knowledge may lead novice learners to adopt suboptimal processes and behaviors.

INTRODUCTION

Increasingly, individual educational experiences have a significant online component. Students frequently use Web-based materials as their primary, and often only, informational sources for educational tasks (e.g., Graham & Metaxas, 2003). Although students are enthusiastic about using online materials, research evidence suggests that even college students perceive themselves as more capable of using technology than they actually are (Stone & Madigan, 2007). When using the Internet to find answers to questions, Graham and Metaxas (2003) found that students had difficulty identifying trustworthy sources, were not consistently able to differentiate between advertising and fact, and failed to confirm online information by checking multiple sources.

The problem may be especially serious when one considers not just finding information online, but learning from such information. For individuals engaged in self-directed learning tasks (e.g., using online resources to write a scientific essay), effective use of online resources requires students to deploy a series of complex behaviors. Students must decide on search terms relevant to their information needs, conduct searches using their search terms and options from online search engines, evaluate lists of potential resources to decide what to explore, choose how long to explore an online resource, and decide when enough information has been gathered. From a cognitive perspective, learners must identify and encode relevant information from potentially large amounts of online content and continuously integrate the new information that they find into an accurate, overall understanding of domain content. Overall, these challenges are central to complex cognitive processes such as sensemaking (Russell, Jeffries, & Irani, 2008) and self-regulated learning (Azevedo, Guthrie, & Seibert, 2004; Azevedo, Moos, Greene, Winters, & Cromley, 2008). They also highlight the interplay between cognitive processes and online learning behaviors. Understanding more about how known cognitive variables impact students' online learning behaviors can support the design and development of educational technologies and interventions designed to improve the quality of students' Web-based learning experiences.

PRIOR KNOWLEDGE AND COMPREHENSION

In this research, we explored how prior knowledge influenced students' online learning behaviors and analyzed the relationship between these behaviors and students' eventual knowledge outcomes. We chose to examine prior knowledge as a predictor of online learning behaviors because prior knowledge repeatedly has been shown to be a key factor in predicting learning with text (e.g., Adams, Bell, & Perfetti, 1995; McNamara, Kintsch, Songer, & Kintsch, 1996; McNamara & Kintsch, 1996; Recht & Leslie, 1988; Schneider, Körkel, & Weinert, 1989) and multimedia materials (e.g., Kalyuga, 2005; Kalyuga, Ayres, Chandler, & Sweller, 2003).

The rationale for why prior knowledge plays a strong role in learning can be drawn from research and theory in cognitive psychology. Relevant prior knowledge forms a framework for incoming information (Chi, Glaser, & Rees, 1982), allowing new materials to be integrated into a flexible knowledge representation that can be transferred to new situations (Kintsch, 1988, 1998). Without a conceptual framework of prior knowledge into which incoming information can be integrated, learners typically focus on memorizing isolated facts that can be recalled but cannot be applied outside of the context in which it was learned. This type of knowledge long has been referred to as "inert knowledge" (Whitehead, 1932).

Prior knowledge not only can facilitate the development of more integrated knowledge during learning tasks, but it also plays a strong role in determining the types of learning materials that will be best suited to an individual learner. Research has found that creating instructional materials or sce-

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