Chapter 8.16
New Forms of Deep Learning on the Web:
Meeting the Challenge of Cognitive Load in Conditions of Unfettered Exploration in Online Multimedia Environments

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ABSTRACT

We claim that the Web has the potential to be a quintessential multimedia environment for complex learning, particularly in ill-structured domains. This chapter explores the cognitive load considerations associated with several aspects of deep and extended learning on the Web. We also propose the need for a reconceptualization of Cognitive Load Theory for comprehension and learning in more ill-structured conceptual arenas. This reconceptualization emphasizes the need for learning approaches that promote flexible knowledge assembly through processes of organic, reciprocal, and deep Web learning.

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INTRODUCTION

The Web has the potential to become a quintessential multimedia learning environment. Both formal and informal learners are increasingly turning to the search engine as their primary source of information. For example, college students regularly use the Internet and commercial search engines (e.g., Google) before, or in lieu of, local library resources (Griffiths & Brophy, 2005; Jones, 2002; Thompson, 2003; Van Scoyoc, 2006). At the same time, the content provided to them on the Web is presented in multimedia form, often comprising various combinations of text, data, pictures, animation, audio, and video, of differing levels of interactivity. These

myriad forms of information all battle for learner attention and consideration.

The second author argued that this migration away from traditional information resources to Web mediated multimedia learning environments is ushering in a revolution in thought, a New Gutenberg Revolution (2006a, b, c, d, e). He outlined how, given the dramatic increases in the speed with which information can be accessed, the increasing well directedness of search (due to more advanced search algorithms, data organization, and searcher skill), and the *de facto* assumption of "ambient findability" (Morville, 2005), the Web is becoming a more fertile knowledge landscape than man has ever known. Consequently, the Web is particularly well suited to support *deep* learning for subjects and concepts that are complex and ill-structured; the kind that we seem to be finding more and more of in the world everyday. These ill-structured domains of knowledge demonstrate an inherent *irregularity* of conceptual application across instances and contexts (for discussion of the special qualities of learning in ill-structured domains, see Spiro & DeSchryver, in press; Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger, 1987; Spiro, Feltovich & Coulson, 1996).

In order to harvest information from this landscape in the most effective and meaningful ways, learners will need to explore the Web with a Post-Gutenberg Mind. This involves searching with *advanced Web exploration* techniques and an *opening mindset* that together result in advanced knowledge acquisition that goes well beyond the cursory and fact based searches most common to learning on the Web (Kuiper, Volman & Terwl, 2005). The knowledge structures acquired by a Post-Gutenberg Mind will be tailored assemblages that are contextualized, interconnected, and flexible, enabling the everyday creativity necessary to succeed in a world increasingly driven by complex and rapidly changing information.

Sounds great, doesn't it? Well, as it turns out, not everyone is prepared to use the Web to learn like this right now. In fact, we do not really know precisely how deep learning on the Web occurs. As such, it is imperative that we begin to thoroughly examine the phenomenon. We need to better understand the specific ways that Post-Gutenberg learning will manifest itself. What specific affordances and aspects will enable deep Web learning of ill-structured concepts? How will they differ from the characteristics of traditional learning? How will we best prepare learners to maximize the benefits of deep learning on the Web? What will be the cognitive load considerations for learning that is of such depth and complexity?

With these questions in mind, we recently embarked on an inquiry to investigate the emergent aspects of Post-Gutenberg learning for an advanced Web learner in an ill-structured domain. In this study, we documented the decision-making, knowledge construction, and general learning reflections of an advanced Web searcher who examined the subject of climate change through deep and extended Web learning. The data were collected from a baseline mind-map of existing knowledge, extensive notes taken by the learner during each session, the parallel use of Clipmarks (an online tool that allows for portions of Web resources to be saved, tagged, annotated, updated, and retrieved in multiple ways), and corresponding updates to the mind-map. A detailed analysis of the data collected from this study has provided a better picture of what Post-Gutenberg learning may look like. And, while we do not claim any generalizability from the results of this demonstration case study (i.e., we sought to demonstrate what *is possible* not *what is*), several interesting phenomena emerged that are worthy of continued scholarly examination. (For a more detailed presentation of the theoretical implications of this study, see Spiro and DeSchryver, in preparation; for a more detailed accounting of a full list of deep Web learning aspects and their derivation, see DeSchryver and Spiro, in preparation.)

One of the primary considerations that surfaced was whether this form of advanced knowledge acquisition would be, in general, too challenging for