

# Chapter XI

## The Cognitive Demands of Student-Centered, Web-Based Multimedia: Current and Emerging Perspectives

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### ABSTRACT

*This chapter examines the cognitive demands of student-centered learning from, and with, Web-based multimedia. In contrast to externally-structured directed learning, during the student-centered learning, the individual assumes responsibility for determining learning goals, monitoring progress toward meeting goals, adjusting or adapting approaches as warranted, and determining when individual goals have been adequately addressed. These tasks can be particularly challenging in learning from the World Wide Web, where billions of resources address a variety of needs. The individual, in effect, must identify which tools and resources are available and appropriate, how to assemble them, and how to manage the process to support unique learning goals. We briefly analyze the applicability of current cognitive principles to learning from Web-based multimedia, review and critically analyze research and practice specific to student-centered learning from Web-based multimedia, and describe implications for research.*

## INTRODUCTION

Several time-tested cognitive principles are applicable to both face-to-face and print-based learning environments. Indeed, the research summarized throughout this text supports several principles and constructs relevant to multimedia. However, much of this research is rooted in objectivist epistemology, where the individual selects, organizes, and integrates knowledge in an effort to acquire and demonstrate externally prescribed, canonical meaning. While the effectiveness of didactic, directed methods have been demonstrated using multimedia (see, for example, Azevedo, Moss, Greene, Winters, & Cromley, 2008; Gerjets, Scheiter, & Schuh, 2008), significant growth has been evident in user-centered, Web-based multimedia applications that are individually rather than externally directed and managed.

This chapter focuses on student-centered learning in Web-based multimedia environments wherein the individual assumes primacy in determining goals, selecting or devising approaches to address these goals, and responsibility for interpreting and constructing unique meaning. We examine the applicability of research related to Web-based multimedia and address both similarities and differences in cognitive demands between ill-structured and externally-structured multimedia learning environments. The purposes of the chapter are to briefly review selected principles of human cognition that are applicable to Web-based multimedia, to review cognitive perspectives, research, and practice specific to student-centered learning from Web-based multimedia, and to describe implications for research, theory, and practice.

## BACKGROUND

### **Cognitive Roots of Technology-Enhanced Learning**

During the past two decades, researchers have studied technology-enhanced learning from several perspectives. Initially, for example, we examined the applicability of cognitive theories to computer-based instruction (Hannafin & Rieber, 1989; Hooper & Hannafin, 1991). It became apparent that while many research-based learning and cognition principles were readily applicable, epistemological shifts and advances in technologies raised important questions about the nature of computer-assisted learning. Constructivists suggested basic shifts in both beliefs as to the locus of knowledge and educational practices (Jonassen, 1991). Concurrently, technologies emerged that extended, augmented, and/or supplanted individual cognitive processes, reflecting a shift from delivery to tools that supported and enhanced thinking (Iiyoshi, Hannafin, & Wang, 2005). Thus, the focus on technology and constructivist, student-centered approaches has become increasingly evident in the efforts of cognition and multimedia theorists, researchers, and practitioners.

Hannafin, Land and Oliver (1999) described student-centered activity during “open learning” where the locus of activity and control shifts from external to individual responsibility for establishing learning goals and/or determining learning means. As a result, the cognitive demands shift from selecting and processing externally-provided stimuli to anticipating and seeking based on individual needs and learning goals. In many cases, the associated cognitive shifts have proven problematic. Researchers have noted that students failed to develop theories or explanations and retained initial misconceptions (de Jong & Van

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