Chapter XV
Designing Multimedia to Trace Goal Setting in Studying

Mingming Zhou
Simon Fraser University, Canada

Philip H. Winne
Simon Fraser University, Canada

ABSTRACT

We suggest that multimedia environments can benefit from learning as well as offer significant capacity to serve as research purposes. Because motivational processes can support or inhibit complex learning, we first review current hypermedia learning models by specifically focusing on how they integrate motivational elements into their frameworks. Following our observation of a gap in the way motivational constructs (e.g., achievement goal orientation) are operationally defined, we suggest alternative methods, called traces, which make these latent constructs visible and measurable. The goal-tracing methodology we describe draws on achievement goal theory and extensive empirical studies in various settings. Using it, we treat learners' use of cognitive tools as traces that express their goal orientations. By applying data mining techniques to these data, we show how it is possible to identify goal patterns together with study tactic patterns. We propose that future research can benefit substantially by merging trace methodologies with other methods for gathering data about motivation and learning.

INTRODUCTION

Technological advances have stimulated educational researchers and educators to expand designs for learning environments as well as conceptions of multimedia learning. Along with descriptions of the latest features of new learning systems have come newer theoretical accounts about how those features scaffold learning and teaching.

Validating learning theories in this context has proven challenging. Research in the last decade has demonstrated that multiple and contingent

factors affect learning in highly complex knowledge systems; examples include the layout of multimedia information, learning dynamics, and multiple forms of cognitive processing (Astleitner & Wiesner, 2004). As well, additional attention has begun to be paid to motivation in software-supported multimedia learning. Motivation is one of the most important factors that affects learning in any educational environment (Maehr, 1984), accounting for approximately 20% of the variance in achievement and about 29% of the variance in transfer of knowledge (Colquitt, LePine, & Noe, 2000). We agree with Hidi and Harackiewicz (2000) that motivating learning, particularly the academically unmotivated student, represents a critical issue in establishing a viable platform for life-long learning that increasingly involves multimedia-based content.

In this wider view that includes motivational factors in modeling learning from multimedia, the main targets have been to: (a) investigate how motivation moderates achievement when learning multimedia content, (b) explain discordant empirical evidence about achievement by augmenting models that omitted motivational variables; and (c) improve designs for multimedia systems to improve learning. But merely observing a gain in achievement as a function of adding motivational scaffolds is insufficient for constructing a valid account about how knowledge is constructed through motivated goal seeking activities (Borsboom, Mellenbergh, & van Heerden, 2004; Winne, 2006a). Gaining knowledge of processes learners engage in *as* they study multimedia content is essential to advancing theory and informing designs for learning environments.

Measures of motivational factors that play a role in goal-directed learning have typically been narrowly operationalized as learners' responses to questions posed on paper and answered outside the envelope of time when learners actually study. Such data, as we discuss later, may not be sufficient to capture motivation fully, accurately, and its effects on learning "on the fly." We describe how this gap affects research on the roles of motivation in multimedia learning, and we propose alternative ways to track motivational constructs, such as achievement goal orientation, *during* learners' engagement with content.

Our presentation has four parts. The next section overviews major multimedia learning theories from a motivational perspective. The second section discusses issues in empirical investigations of motivational factors during multimedia learning processes when motivational constructs are operationally defined in traditional forms, i.e., self-reports gathered outside the learning episode. The following section examines how motivation can be operationally defined as traces that are logged within a multimedia system as learners learn. We make a case for the value of using tracing methodology to investigate motivation during learning. The last section considers implications of trace methodology for motivational research.

BACKGROUND

New technologies are rapidly being introduced into schools and other learning settings, and multimedia is an increasingly common format for learning. This offers new possibilities to structure, represent, adapt and integrate various learning content and materials as multimedia learning environments implement the latest technological features. Rarely, however, have these implementations been grounded in research-based principles (Kozma, 1991; Moore, Burton, & Myers, 1996). Further, a great opportunity has gone unfulfilled because too little attention has been paid to significant and almost cost-free capabilities to log extensive, detailed data about learning processes without much intrusion into learners' activities (Winne, 2006a). However, before capitalizing on this opportunity, it is first necessary to know what data should be gathered to describe learning as a process. Guidance on this front comes from models and theories.

Related Content

Modeling Verbal Judgements
Luca Iandoliand Giuseppe Zollo (2007). *Organizational Cognition and Learning: Building Systems for the
Learning Organization (pp. 178-194).*
www.irma-international.org/chapter/modeling-verbal-judgements/27896

Human Cognitive Processes
Slava Kalyuga (2009). *Managing Cognitive Load in Adaptive Multimedia Learning (pp. 1-33).*
www.irma-international.org/chapter/human-cognitive-processes/25730

The Potential of Affective Computing in E-Learning: The Journey from Theory to Practice in the
"Myself" Project
Fabrizia Mantovani, Linda Confalonieri, Marcello Mortillaro, Olivia Realdon, Valentino Zurloniand Luigi
Anolli (2010). *Affective, Interactive and Cognitive Methods for E-Learning Design: Creating an Optimal
Education Experience (pp. 260-274).*
www.irma-international.org/chapter/potential-affective-computing-learning/40562

The Cognitive Demands of Student-Centered, Web-Based Multimedia: Current and Emerging
Perspectives
Michael J. Hannafin, Richard E. Westand Craig E. Shepherd (2009). *Cognitive Effects of Multimedia
Learning (pp. 194-216).*
www.irma-international.org/chapter/cognitive-demands-student-centered-web/6612

A Ten-Level Web Integration Continuum for Higher Education
Curtis J. Bonk, Jack A. Cummings, Norika Hara, Robert B. Fischlerand Sun Myung Lee (2000).
Instructional and Cognitive Impacts of Web-Based Education (pp. 56-77).
www.irma-international.org/chapter/ten-level-web-integration-continuum/23899