Chapter 89
Personalization With Digital Technology:
A Deep Cognitive Processing Perspective

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ABSTRACT

How to personalize learners' learning with digital technology so that learners derive optimal experiences in learning is a key question facing learning scientists, cognitive psychologists, teachers, and professional instructional designers. One of the challenges surrounding personalization and digital technology is how to promote learners' cognitive processes at a deeper level so that they become optimally engaged in critical and creative thinking, making inferences in learning, transferring knowledge to new learning situations, and constructing new knowledge during innovative learning process. This chapter examines the literature relating to deep cognitive processes and the idiosyncratic features of digital technology that support learners' deep cognitive processes in learning. Guidelines pertaining to personalization with digital technology in regard to deep cognitive processing are proposed, followed by the discussions on future research with a focus on verifying the theoretical constructs proposed in the guidelines.

INTRODUCTION

Digital technology has increasingly played a critical role in learners' learning in terms of their cognitive, metacognitive and affective processes. With its unique features that support a wide range of learning experiences including interactive engagement (e.g., multimedia), immersive learning (e.g., virtual reality), ubiquitous information access (e.g., mobile learning), data driven individualized learning (e.g., learning analytics), digital technology is poised to redefine the educational landscape with tremendous opportunities for personalized learning and development of skills and abilities necessary to meet the challenges in 21st century (Arnab et al., 2012; Echeverri & Sadler, 2011). Digital technology has shown promises in multiple areas in education including assessment (Beggrow, Ha, & Nehm, 2014; Gierl, Bulut, & Zhang, 2018, Chapter 5; Nehm, Ha, & Mayfield, 2012), intelligent tutoring and natural language

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processing (Kerr, Mousavi, & Iseli, 2013; Nakamura, Murphy, & Christel, 2016), expertise acquisition (LaVoie, Streeter, & Lochbaum, 2010), educational gamification (Conrad, Clarke-Midura, & Klopfer, 2014; Gibson & Clarke-Midura, 2013), learner interaction and participation (Hamilton & Owens, 2018, Chapter 9; Sural & Yazici, 2018, Chapter 3; Schneider & Blikstein, 2015), and curricular integration and online learning (Georgiopoulos, DeMara, & Gonzalez, 2009; Oliveira & Pombo, 2018, Chapter 10; Svenningsen, Bottomley, & Pear, 2018 Chapter 8). The use of digital technology in education has led to the investigation of what and how digital technology may influence and change learners' behavior in personalized learning. Some researchers (e.g., Hacker, 2017; Zhou & Winne, 2009) examine the relationship between self-regulated learning and digital technology in support of self-paced, goal-oriented, reflective learning. Others (e.g., Lee & Liu, 2017; Liu, Toprac, & Yuen, 2009) focus on motivational aspects by examining the impact of digital technology on learners' motivation in learning such as intrinsic and extrinsic motivation and the locus of control. Still others are interested in understanding the phenomena of digital technology from the perspective of social learning by focusing on the influence of digital technology on learners' social behavior such as collaboration, participation, and collective knowledge sharing and creation (Agosto, Copeland, & Zach, 2013; Vickers, Field, & Melakoski, 2015).

In spite of the advances in the knowledge of the role of digital technology and its relation to self-regulated learning, motivation, and social learning, much remains unknown in terms of how digital technology contributing to personalized learning in the context of deeper cognitive processing, engagement in critical and analytical thinking, inference making, and knowledge construction and transfer. A search in ERIC, PsychInfo, and PsychArticle databases with the search words "personalization" and "cognitive learning" generated only 42 search results. Within forty-two available publications, only six cover the areas of cognitive learning, digital technology and personalization. Even within six publications none of them focuses on deep cognitive processes related to personalization and digital technology. Given the scarcity of research in deep cognitive processes in personalization with digital technology, it is warranted that research be conducted to understand deep cognitive processing with digital technology in personalized learning.

The main aim of the book chapter is to examine the characteristics of deep cognitive processing in personalized learning and digital technology and how they affect learner learning. To do this a number of key objectives are outlined:

1. To identify deep processing in cognitive learning
2. To identify the role of digital technology in personalization
3. To examine the relationship between personalized learning and digital technology in deep cognitive processing.

DEEP PROCESSING: A THEORETICAL PERSPECTIVE

Marton and Säljö's Framework of Surface and Deep Learning

Studies have shown that human information process can be divided into two types: deep- and surface-level processing (Case & Marshall, 2004; Marton & Säljö, 1976). According to Marton and Säljö (1976), learners approach learning content differently depending on the perceived objectives of the course they are studying. When processing a complex content, some students could take an understanding approach