Chapter 12
Leveraging Computer Interface to Support Creative Thinking

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ABSTRACT

How to design computer interface that facilitates learners' creative thinking can be challenging. This chapter discusses the cognitive processes, the types of divergent thinking, visualization, and brain-functions in relation to human learning. Informed by the research in previous areas, the authors examine the features of computer interface that aligns with brain-functions to support various types of creative thinking. An example is included to demonstrate, at the conceptual level, how computer interface can be leveraged to support learners' creativity, imagination, originality, and expressiveness in learning. Discussions are made with respect to the implication and limitation of the chapter. The chapter concludes with suggestions for future research and studies.

INTRODUCTION

Creative thinking is perhaps one of the most important outcomes in education. It accounts for learners' cognitive abilities in making connections between concepts and information across domains and disciplines, exploring novel approaches in problem solving, and generating solutions pertaining to complex social and environmental issues (Goldschmidt, 2016; Lince, 2016). Research has shown a significant correlation between learners' academic achievement and creative thinking, suggesting that creative thinking can enhance learners' academic performance in terms of deep understanding, multi-level problem solving, and far knowledge transfer within and outside academic domains and disciplines (Birgili, 2015). Substantial efforts have been made in the past to develop learners' creative thinking skills in language acquisition (Sehic, 2017), science education (Widiana & Jampel, 2016), mathematical thinking (Vale, Bragg, Widjaja, Herbert, & Loong, 2017), and so forth. With the advancement of digital technology, new ways of teaching creative thinking skills have been introduced. For example, the Internet is considered to

be a viable platform to promote learners' creative thinking skills (DeSchryver, 2017; Lin & Wu, 2016). Recent emerging technologies like Artificial Intelligence (AI), 3D virtual reality, simulation, and video games have found their ways into classrooms and other educational settings to facilitate learners' creative thinking (Lin, Wang, & Kuo, 2017; Moffat, Crombie, & Shabalina, 2017; Neo & Neo, 2013). However, there are challenges associated with digital technologies in teaching creative thinking skills due to (a) a lack of proper knowledge in understanding the complexity of creative thinking processes and (b) an absence of sufficient pedagogical supporting system that facilitates individuals' creative behaviors and activities when engaged in technology-support creative thinking processes. The purpose of this chapter aims to explore the unique cognitive processes associated with creative thinking and examine the pedagogical role of digital technology in supporting creative thinking.

THEORETICAL BACKGROUND

Creative thinking is a cognitive process that often results in novel approaches to learning and production. According to Merrian-Webster Dictionary, *create* means "to produce through imaginative skill" (Merrian-Webster Dictionary, 2018). Within the literature of creative thinking research, the term is defined as originality, expressiveness, and imagination (Goldschmidt, 2016; Lopez-Ortega, 2013; Widiana & Jampel, 2016). There are two aspects of creative thinking, divergent thinking, which is defined as generating many ideas, and convergent thinking that is developing a plausible solution to a problem (Colzato, Ozturk, & Hommel, 2012). The reductionist approach which typically employs convergent thinking in reasoning, researchers in creative thinking advocate divergent thinking as a vehicle to achieve innovation, expressiveness and resourcefulness (Boden, 1998; Lopez-Ortega, 2013; Smith & Kosslyn, 2007).

This chapter focuses on divergent creative thinking, as digit technology can provide a great aid to this aspect of creativity. There are several types of divergent thinking: spontaneous, deliberate, and constructive thinking. Spontaneous divergent thinking refers to the process of on-going idea generation. Deliberate divergent thinking refers to the deliberating process in creative thinking. Finally, constructive divergent thinking is marked by a process in the genesis of knowledge. A discussion of each type of divergent creative thinking follows.

Types of Divergent Thinking

Spontaneous Divergent Thinking

Idea generation is considered a critical part of creative thinking process. Spontaneous Divergent Thinking (SDT) reflects an on-going thinking process in which the individuals generate novel ideas while working on projects. According to Lopez-Ortega (2013), SDT activities are associated with the central and posterior cortical areas of brain which are not guided by conscious planning or preconceived mental paradigms. In other words, SDT is an automatic process that is neither initiated nor operated deliberately. Examples of SDT include spontaneous brain-storming, non-linear idea generation, and free association in solution seeking. There are several cognitive benefits associated with SDT. For example, SDT which takes a goal-free approach reduces learners' cognitive load as they seek solutions to the goal-free problems (Sweller, 1988; Sweller & Chandler, 1991). Other benefits include allowing for expressiveness and

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