

Does the Format of Pretraining Matter?

A Study on the Effects of Different Pretraining Approaches on Prior Knowledge Construction in an Online Learning Environment

Robert Z. Zheng, University of Utah, USA

Udita Gupta, University of Utah, USA

Aaron Dewald, University of Utah, USA

ABSTRACT

The current study investigated an important issue pertinent to pretraining and prior knowledge construction. It examined whether different formats of pretraining, namely, concept map and two-phase, isolated-interactive elements learning would influence the way prior knowledge was constructed. In addition, it looked into the influence of spatial ability on pretraining and prior knowledge construction. Results showed that spatial ability did not play a significant role in learners' prior knowledge construction. The findings suggest that effective learning is marked by a relevant existing prior knowledge (i.e., schema). The successful construction of the relevant prior knowledge, irrespective of the format, is what makes learning meaningful and effective.

Keywords: Concept Mapping, Information Processing, Pretraining, Prior Knowledge, Schema

INTRODUCTION

Pretraining has been widely considered to be an important instructional strategy in helping learners learn complex materials that require significant prior knowledge (Lee, Plass, & Homer, 2006; Mehta & Russell, 2009). Researchers (e.g., Butcher & Sumner, 2011; Kalyuga, 2005;

McNamara & Kintsch, 1996) suggest that prior knowledge can significantly influence learners' behaviors and their consequent learning performance. They found that meaningful learning, especially learning at a deeper level, is closely related to learners' existing structure of prior knowledge often called schema. Because of the important role of prior knowledge played in deep learning such as deeper level comprehension, knowledge application and transfer, complex

DOI: 10.4018/ijcbpl.2012040103

problem solving, etc., researchers have been focused on the instructional strategies that facilitate the construction of prior knowledge. Examples include using concept map to facilitate learners' prior knowledge construction (Chang, Sung, & Chen, 2002; Gurlitt & Renkl, 2008; Hilbert & Renkl, 2008) or using a two-phase, isolated-interacting elements learning approach to help learners build their prior knowledge before they are exposed to more advanced content (Lee et al., 2006; Pollock, Chandler, & Sweller, 2002). Other pretraining approaches include using visual and sound methods (Janssen, 1972), systematic vs. unsystematic pretraining (White, 1972), and so forth. However, the first two types of pretraining, that is, concept map and two-phase, isolated-interacting elements learning approach have been heavily studied and applied to a variety of instructional situations. Results have shown positive effects for both approaches in terms of prior knowledge construction and outcome performance. Yet, the aforementioned forms of pretraining seem to be effective only in instructional situations in which the specific pretraining (i.e., concept map or two-phase, isolated-interacting elements learning) was carried out. Therefore, it is unknown if both approaches would be equally effective in one particular instructional situation. In other words, does the format of pretraining matter if the learner is to learn some complex content where either concept mapping or two-phase, isolated-interacting elements learning pretraining is applied? The goal of this article is to examine the effects of different types of pretraining on learners' prior knowledge construction. The study helps researchers identify the relationship between pretraining and prior knowledge acquisition on the one hand, and inform instructional designers of the functionality of various pretraining formats in learning on the other; both of which have significant theoretical and practical implications for the field.

LITERATURE REVIEW

Like other types of learning, complex learning poses considerable challenges to learners due to

its high demands on cognitive resources, prior knowledge and information processing (Grice, 1987; Schwartz & Bransford, 1998; Zheng, McAlack, Wilmes, Kohler-Evans, & Williamson, 2009). For many, prior knowledge activation resonates with meaningful learning (Surber & Schroeder, 2007; Winberg & Hedman, 2008). Schwartz and Bransford (1998) pointed out that learning becomes "problematic if students do not have the relevant prior knowledge to begin with" (p. 475). Thus, how to effectively develop learners' prior knowledge becomes a focal point for many researchers who explore the issues from the perspectives of cognitive structures (Kinchin, Hay, & Adams, 2000) and memory related instructional strategies (Lee, Plass, & Homer, 2006; Miller, Geng, Zheng, & Dewald, 2012).

Concept Map as a Pretraining Tool

Among the efforts to improve learners' abilities in complex learning, concept map is applicable in prior knowledge construction and activation during deep learning. For example, Puntambekar and Goldstein (2007) used concept maps in science learning and found that learners who learned with concept maps were able to navigate better through the content and engage in better deep learning. In a separate study, Roberts and Joiner (2007) used the concept map as an educational strategy to help a group of autistic students learn science. Results showed that students with concept mapping condition outperformed those without. The benefits of concept maps have been well documented. In a meta-analysis study Nesbit and Adesope (2006) found that studies comparing learning from concept maps to learning from text passages showed that learning with concept maps offers significant learning gains with an average effect size of 0.4. Moreover, significant effect sizes were found for concept maps that facilitated retention and knowledge transfer in learning. The authors ascribed the success of concept maps in learning to the unique instructional benefits that concept mapping has brought to its learners, namely, information retention, load

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