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Examining preservice teachers' decision behaviors and individual differences in three online case-based approaches

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ABSTRACT

This study compared the impact of three types of case-based methods (case-based reasoning, worked example, and faded worked example) on preservice teachers' ($n = 71$) interaction with decision tasks and whether decision related measures (task difficulty, mental effort, decision making performance) were associated with the differences in student characteristics (decision making styles, self-efficacy, confidence). Participants in this study received a short-term implementation of one of these three major approaches to case-based instruction. The results showed that while students' perceptions of task difficulty and mental effort did not change as a function of treatment, the worked example group, compared to the case-based reasoning and faded worked example groups, performed better on making reason-based decisions related to classroom management. Furthermore, some of the relationships between individual differences and decision related measures were inconsistent with the existing literature.

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1. Introduction

In the field of education, decision making research, specifically understanding complex cognitive processes underlying teachers' thinking and decision making, has received considerable interest. An important area of research that has provided valuable insights regarding teachers' cognitive processes in decision making constitutes studies of teaching expertise, which "mostly took the form of expert–novice comparisons" (Tsui, 2003, p. 22). A number of research studies in this tradition have shown evidence that expert teachers apply more complex and elaborated knowledge structures, derived from their prior experiences, to interpret or make decisions about different teaching and learning events. Novices, with limited experience, practical, or pedagogical content knowledge, focus more on the surface characteristics of classroom events (Berliner, 1994, 2001; Westerman, 1991), fail to deal with unexpected classroom situations (Martin, 2004; Vancı Osam & Balbay, 2004), and use their often incomplete and shallow knowledge structures about teaching as a lens to justify their decisions (Calderhead & Robson, 1991; Stuart & Thurlow, 2000).

The research on expert–novice differences has suggested preservice teachers be empowered to develop robust conceptual and practical knowledge that are essential for learning to solve or make reasoned decisions about critical teaching situations in different teaching contexts (Jonassen & Kim, 2010; VanEs & Sherin, 2002). One method that has been widely used in teacher education to help preservice teachers learn how to teach and experiment in making teaching decisions is the case-based method (Merseth, 1996; Shulman, 1992; Sykes & Bird, 1992). There is an extensive body of

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research evidence demonstrating positive impacts of case methods on preservice teachers' understanding of complex classroom situations, their ability to analyze these situations from multiple perspectives, their competence in using evidence to support their interpretations and decisions, and their skills to reflect on what they learned from cases (Beck, King, & Marshall, 2002; Bruning et al., 2008; Choi & Lee, 2009; Rich & Hannafin, 2008).

The popularity of the case method has resulted in multiple interpretations of how best to use cases to promote learning. Different forms of case use have been described in the literature (Jonassen, 2006; Merseth, 1996). Two general approaches to teaching complex decision making or problem solving skills, currently being investigated in educational research, are case-based reasoning (CBR) and worked examples. Both the worked examples and CBR research traditions have yielded successful results on improving learners', especially novices', problem solving performances. Additionally, studies in cognitive psychology and education have indicated the benefits of using the CBR method to facilitate decision making process (Hernandez-Serrano & Jonassen, 2003; Wang, Moore, & Wedman, 2003). Despite the considerable amount of interest in the explanation and improvement of teacher decision making, no study has compared the relative impact of each method on students' interaction with decision tasks.

Current trends in the psychological theory of judgment and decision making, however, (JDM) have emphasized the importance of understanding and describing the influences of the decision environment and the decision maker's characteristics on their cognitive and affective processes (Newell & Broder, 2008; Weber & Johnson, 2009). Weber and Johnson (2009) describe a group of internal and external influences that guide a decision maker's attention. External influences were comprised of task characteristics (e.g. difficulty) and situational factors (e.g. time pressure). Internal or endogenous influences, on the other hand, are related to the decision maker's prior knowledge, cognitive capacity, goals, motivations, beliefs, and emotions. Similar to the lack of focus on students' interaction with decision tasks in different case environments, few, if any, studies have examined the relationships between individual differences and decision features. Therefore, there is a need for additional research to compare how different case methods (i.e. CBR and worked examples) affect preservice teachers' decision making behaviors and their perceptions of the features of decision tasks (i.e. task difficulty, mental effort), and how decision task features are related to individual differences (i.e. self-efficacy). This paper compares preservice teachers' interaction with decision tasks related to classroom management in three online learning environments designed based on one of the three approaches to the use of cases in education. These three approaches include (a) case-based reasoning, (b) worked examples, and (c) faded worked examples, which is a variant of worked examples approach. Additionally, this study is also aimed at exploring the relationships among individual differences and decision related measures in the context of students' working on complex decision tasks in these three online case-based environments.

In the following sections of the paper, we first provide a comparative description of the three approaches to using cases in education. Next, we describe task difficulty and mental effort as decision-related factors and individual differences as mediating factors of individuals' decision making processes. Then, we present a research study in which we examined the relative impact of each case method on students' interaction with decision tasks and whether decision related measures were associated with the differences in student characteristics.

1.1. Three instructional methods: case-based reasoning, worked examples, and faded worked examples

Kolodner (1991) defined case-based reasoning (CBR) as "reasoning from old cases or experiences in an effort to solve problems, critique solutions, explain anomalous situations, or interpret situations" (p. 53). The theory underlying CBR is Schank's (1999) theory of dynamic memory. Schank (1999) argued that human reasoning and learning is case-based, that is, humans solve problems by reusing or modifying previous experiences stored in an evolving memory structure in which cases having similar properties are dynamically organized around a more general structure. The goal of CBR approach thus is to provide learners with real world cases, similar to the current problem situation they are engaged in, to facilitate their understanding of how similar problems were solved before and to help them apply previously utilized case solutions or experiences to the current problem. Case-based learning thus is learning by experiencing. A number of researchers have claimed that cases describing previously used solutions, the contexts in which those solutions were used, the circumstances under which those solutions were successful, and the lessons learned from previous experiences can be used as cognitive scaffolds to help students to identify critical issues on which to focus in problem analysis, generate solution alternatives, and make reasoned judgments and decisions about selecting the most appropriate solution/s to the problem (Jonassen & Hernandez-Serrano, 2002; Kolodner, 1991, 2006; Kolodner et al., 2003). CBR's implications to designing instruction are similar to those entailed by constructivist approaches to teaching and learning (Jonassen, 1999; Kolodner, 2006). Accordingly, CBR implies that for effective learning, learners should be asked to make decisions about complex cases drawn from authentic situations. Cases in CBR often include detailed and rich descriptions of real-life situations to help students experience the complexity of the learning domain (Hernandez-Serrano & Jonassen, 2003; Kolodner, 2006; Kolodner, Owensby, & Guzdial, 2004).

Worked examples refer to an instructional method based on the cognitive load theory (CLT) as developed by Sweller (1988). The basic assumption of the CLT is that learning activities should be designed in a way that minimize cognitive load that is not relevant for learning to avoid straining the limited capacity of working memory (Sweller, van Merriënboer, & Paas, 1998). The initial approach to using worked examples for instruction assumed that novices should receive a number of worked examples before solving problems by themselves. Sweller (1988) argues that novices generally do not have

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