Chapter 94
Self-Regulated Learning in Online Mathematical Problem-Solving Discussion Forums

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ABSTRACT

Online discussion forums have created both opportunities and challenges in the instruction of mathematics. They provide a variety of tools for sharing knowledge during the solution process, which can enhance students' mathematical problem solving. However, research also indicates that students have difficulty engaging in the processes involved in using discussion forums, which require the ability to coordinate knowledge with solution strategies and control behaviors (i.e., monitoring). This ability is the essence of self-regulated learning (SRL). This article presents how one may stimulate students' online SRL in mathematical problem-solving discussion forums by using support techniques. An overview of four research fields, along with the leading experts in each field, presents the complexity of mathematical problem-solving online discussion forum tools, SRL models and self-questioning support techniques using the IMPROVE model. Future directions are suggested.

INTRODUCTION

Research shows that although mathematical problem solving has been a central focus in mathematics education for several decades, it is still the most difficult topic for school students (National Council of Teachers of Mathematics-NCTM, 2000). Leading mathematics educators (Alan Schoenfeld of UC Berkeley; Frank Lester of Indiana University; Edward Silver of University of Michigan**;** Jinfa Cai of University of Delaware; and Lieven Verschaffel from University of Leuven) argue that these difficulties may stem from three

DOI: 10.4018/978-1-4666-0315-8.ch094

sources. First, there are differing interpretations of what mathematical problem solving is and how it can be used. For example, Lester and Kehle (2003) characterize mathematical problem solving as an activity involving students' engagement in a variety of cognitive actions and experiences. According to Silver and Cai (1996), mathematical problem solving should include opportunities for students to pose questions and formulate reasoning. According to Schoenfeld (1992), successful problem solving involves coordinating previous experiences, obtained knowledge, familiar representations and patterns of inference, and intuition in an effort to generate new representations and related patterns that prompted the original problem-solving activity. Second, there is a hierarchy of skills to be acquired using various problem-solving tasks. Distinctions are made between solving routine and non-routine tasks, familiar and unfamiliar (novel) tasks, and basic and complex tasks. Complex tasks often (1) include a background story; (2) incorporate mathematical data in different representations; (3) may be approached in different ways; (4) are based on a wide range of mathematical knowledge and skills; and (5) often require solvers to provide justifications for their reasoning (NCTM, 2000). Finally, mathematical problem solving requires the integration of several cognitive and metacognitive processes. For example, when solving a word problem, children need to (1) understand the language and information in the problem; (2) translate the problem using relevant information to form an adequate mental representation; (3) devise and monitor a solution plan; and (4) execute adequate procedural calculations. This complexity is difficult for many students to handle, particularly for low-achieving students who lack an adequate knowledge base (Verschaffel, Greerm, & De Corte, 2000).

To cope with this complexity of problem-solving features, Schoenfeld (1992) claims that educators should consider problem solving that fosters the ability to coordinate *knowledge* (e.g., facts, definitions, procedures), *strategies* (e.g., analysis), *behaviors* (i.e., feedback), *metacognition* (i.e., monitoring) and *beliefs* (i.e., motivation, self-efficacy) by using practice in adequate learning environments and with appropriate instructional methods. This ability is the essence of self-regulated learning (SRL).

Following the reform standards (NCTM, 2000) that suggest using technology as a way to introduce students to using SRL for problem solving, let us examine SRL practice using online mathematical problem-solving discussion forums.

OVERVIEW

The entry provides an overview of four research fields, along with the leading experts in each field. (a) Online mathematical problem-solving discussion forums. The experts in field include Alan Schoenfeld of UC Berkeley regarding mathematical problem solving, Roger Azevedo of McGill University regarding technology, Bracha Kramarski of Bar-Ilan University regarding mathematical problem solving in online forums, Robert Slavin of Johns Hopkins University regarding the collaborative aspect, and Jean Lave Wenger of UC Berkeley regarding communities of practice. (b) SRL models. The experts in the field include Barry J. Zimmerman of the graduate center of CUNY and Paul Pintrich (1953-2003) of the University of Michigan. (c) SRL self-questioning support. The experts in the field include Alison King of San Marcos University and Alan Schoenfeld of UC Berkeley regarding generic self-questioning. (d) IMPROVE self-questioning prompts. The experts in the field include Bracha Kramarski and Zemira Mevarech of Bar-Ilan University.