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The Effects of Self-Explanations of Correct and Incorrect Solutions on Algebra Problem-Solving Performance

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Various strategies such as self-explanation (Chi, 2000), collaborative problem solving (Ellis, Klahr, & Siegler, 1993), scaffolding (Vygotsky, 1978), reciprocal teaching (Brown & Palinscar, 1989), and learning from worked-out examples (Mwangi & Sweller, 1998), have been used successfully to facilitate learning and understanding. Psychologists are particularly interested in the cognitive processes underlying and affected by these methods, the varying effectiveness of each across different domains, and the mechanisms that are associated with the learning that results from the utilization of each. Although these techniques are different in form, each one encourages the student to engage in learning during which knowledge is actively processed, and mental models and schema are constructed and reconstructed. The goal of this study was to extend our knowledge of the mechanisms by which students acquire knowledge and the strategies that could be used to facilitate these processes.

The effects of feedback and self-explanation have been examined under various conditions, and within various domains (Chi, de Leeuw, Chiu, & LaVancher, 1994; Mwangi & Sweller, 1998; Tudge, Winterhoff, & Hogan, 1996). Because both have shown to have advantageous effects under many circumstances, they were used together in this study of algebra problem solving. To extend prior research, both the self-explanation of correct and incorrect solutions was elicited and compared to the condition in which only the correct answer was self-explained. It was hypothesized that students who received feedback and were asked to explain both correct and incorrect solutions would demonstrate the most improvement in solving algebra word problems.

Method

Participants included 80 college students (60 females, mean age = 19.73 years, SD = 2.05), including 50 Caucasians, 12 African Americans, 10 Hispanics, 6 Asians, and 2 “Others”.

An algebra pretest consisting of 14 multiple-choice compare word problems (4 simple-direct, 5 simple-indirect, and 5 complex) was used to assess algebra problem-solving abilities. Participants then participated in a directed practice session during which they were randomly assigned to one of four experimental conditions (No feedback/"Explain own" (Control), Ambiguous feedback/"Explain own and alternative", Feedback/Explain correct, and Feedback/Explain correct and incorrect"). Students were asked to provide algebraic equations for each of 10 problems, and to explain why they thought these equations were correct (or incorrect). Finally, an algebra post-test, identical in form to the pretest, was administered.

Results & Discussion

Pre- to post-test improvements in performance for students in each of the experimental conditions exceeded those for students in the control condition. Results indicated that feedback and self-explanation conditions positively affected post-test performance. Students who self explained both correct and incorrect solutions outperformed all others, and students in the control group had the smallest increase in performance between pre- and post-tests.

This study extends our knowledge of the strategies that could be used to facilitate the processes by which students learn, and offers insights that could prove valuable to educators in selecting task appropriate instructional techniques.

References


