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Brief Report

Are self-explanations always beneficial?

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ABSTRACT

We present evidence suggesting that the effect of self-explanations on learning is not always beneficial and, in fact, in some contexts has a detrimental effect. Over eight sessions, fourth-graders engaged in investigation of a database with the goal of identifying causal effects. In a separate task, children in one condition also generated self-explanations regarding the mechanisms underlying the causal effects they believed to be present. In a comparison condition, they did not. On a transfer task, children in the no-explanations condition showed superior causal inference performance. The findings are discussed as reflecting the development of "data-reading" skill with which an emphasis on explanations may interfere.

Self-explanations have received increasing attention as a vehicle for learning. When repeated over time, they have been shown to enhance various kinds of learning (Amsterlaw & Wellman, 2006; Chi, 1994; Rittle-Johnson, 2006; Roy & Chi, 2005; Siegler, 2002), a finding that has begun to influence educational practice (Resnick, 2007). Rittle-Johnson, Saylor, and Swygert (2007), for example, reported a study in which 4- and 5-year-olds were asked to solve a series of multiple classification problems. Those who were also asked to explain the correct solutions, either to themselves or to their mothers, outperformed nonexplainers on a posttest of problem-solving skill. A number of suggestions have been made regarding the mechanism involved in the facilitative effect of explanation, such as facilitation of encoding (Calin-Jageman & Ratner, 2005). In a review of the literature on explanations, Lombrozo (2006) claimed that better understanding of the mechanisms is required but drew the firm conclusion that generating explanations is a beneficial exercise.

Lombrozo (2006) identifies causal explanation as the most prevalent kind of explanation. In this case, the causal reasoning literature suggests a mechanism responsible for the facilitative effect of explanation: Explanation of a causal effect, by identifying a mechanism that links cause and effect, helps the learner to connect the two (Koslowski & Masnick, 2002). If the learner is able to posit such

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a mechanism (whether or not it is in fact correct), it becomes easier to identify and represent a causal relation.

The question we address here is whether there are any conditions under which self-explanation regarding causal mechanisms has a detrimental effect. Establishing some boundary conditions regarding the role of explanation in learning should assist in achieving a more comprehensive understanding of the process by which explanations achieve their effects.

Our studies of children engaged in scientific investigation of a multivariable database (see Kuhn, 2002, for review), for the purpose of identifying the causal (and noncausal) relations that characterize it, led us to suspect that in certain contexts self-explanation not only would fail to have a beneficial effect but in fact would have a detrimental effect. Although a few studies have failed to find a facilitative effect of self-explanation, to our knowledge none has predicted or reported a detrimental effect. Our study is further unique in predicting that this detrimental effect would involve skills children took away from the self-explanation activity rather than simply the content involved in the activity itself.

This prediction, moreover, runs counter to much of the literature on the development of scientific reasoning as well as causal reasoning, which has emphasized how understanding of mechanism and processing of evidence function together to support causal inference (Keil, 2006; Klahr, 2000; Koslowski, 1996; Schauble, 1996). If so, children's data-based investigation and identification of causal effects should be facilitated, rather than hampered, by their generating plausible mechanisms that might underlie such effects.

We tested this hypothesis here. In one of two conditions, students working on a scientific inquiry task over multiple occasions generated self-explanations regarding the mechanisms producing the causal effects they hypothesized to be present in a database. In the other condition, they did not. We examined the effects on their causal inference skills in a parallel task in a new domain.

Method

Participants

Participants were the fourth-grade class of 30 students (13 girls and 17 boys) attending an urban independent school serving a diverse population. Roughly half were Caucasian, and the remainder were of African American, Hispanic, or Asian backgrounds. Family socioeconomic status at this school was wide-ranging. Students participated as part of their science class. The school had divided the class into two academically and socially comparable subgroups, as students often met as a half-class for small-group and specialized activities. The two subgroups were randomly assigned to the two conditions involved in the current study.

Procedure

Pretest

Content for the individual pretest and posttest was Earthquake Forecaster, illustrated in Figs. 1–3. This software-based scientific investigation task entails selecting cases for examination and drawing and justifying conclusions regarding the effects of five binary variables on an outcome. Three variables additively influence outcome and two have no effect. Participants made choices and, where required, typed verbal justifications on the computer in response to software probes.

Each participant was assessed on Earthquake Forecaster at an individual pretest. The software introduced the task, explaining the importance of developing means to predict earthquakes so as to protect others and maintain safety. To accomplish this, one must learn which features do and do not make a difference to earthquake risk. Following this introduction, students again were first asked to choose what they wanted to find out about in their first selection of a case to examine (Fig. 1). They identified whether they were or were not finding out about features by clicking the feature pictures corresponding to their choices. They then constructed a case of their own choosing (Fig. 2) by selecting the level of each feature. When completed, these choices yielded an outcome displayed on the next screen in the form of a gauge representing the earthquake risk level. Students then were asked to