A Test of the Interaction Hypothesis: Joint-explaining vs. Self-explaining

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The Interaction Hypothesis

It is widely assumed that students learn more from interactive learning situations than non-interactive; however, recent evidence from human tutoring suggests this generalization may not always hold (VanLehn et al., 2007). Instead of merely contrasting interaction with non-interaction, a more appropriate test may be to hold the type of interactive activities constant, while manipulating the degree of interactivity.

Explaining was chosen as the interactive activity because it is well known that explanation is an effective, individual learning strategy that is easily trained, which produces deep learning (McNamara, 2004). The effect size is estimated to be between $d = .74 - 1.12$. Furthermore, there is mounting evidence that explanation activities during collaboration can also result in deep learning (Hausmann, Chi, & Roy, 2004). The effect size for peer collaboration, in general, is estimated to be between $d = .21 - .88$.

The present study tests the interaction hypothesis by explicitly contrasting two interactive activities (i.e., self- vs. joint-explanation). The interactive hypothesis predicts joint-explanation will lead to better problem-solving performance because there are more opportunities to be interactive.

Method

Participants and Design. Thirty-nine undergraduates, enrolled in a second semester physics course, were randomly assigned to one of two experimental conditions: self-explanation ($n_{k=1} = 11$) or joint-explanation ($n_{k=2} = 14$).

Materials and Procedure. First, participants were trained in their respective explanation activities. Then they watched an introductory video to the Andes physics tutor. Afterwards, they solved a simple, single-principle electrodynamics problem. Once they finished, participants then watched a video solving an isomorphic problem. The video was decomposed into steps, and students were prompted to explain each step. The cycle of explaining examples and solving problems repeated until either 4 problems were solved or 2 hours elapsed. The first problem was used as a warm-up exercise, and the problems became progressively more complex. The dyads solved all of their problems together.

Dependent variable. We used normalize assistance scores, which is the sum of all the errors and help requests on a problem, divided by the number of entries. Thus, lower assistance scores indicate better problem-solving performance.

Results

The joint-explanation condition ($M = .45$, $SD = .33$) demonstrated lower normalize assistance scores than the self-explanation condition ($M = 1.00$, $SD = .67$). The difference between conditions was statistically reliable and of high practical significance, $F(1, 23) = 7.33$, $p = .01$, $d = 1.14$. Moreover, this pattern replicated when Problem was entered as a within-subjects factor in a repeated measures ANOVA, $F(3, 19) = 3.51$, $p = .04$, $d = 1.49$ (see Figure 1).

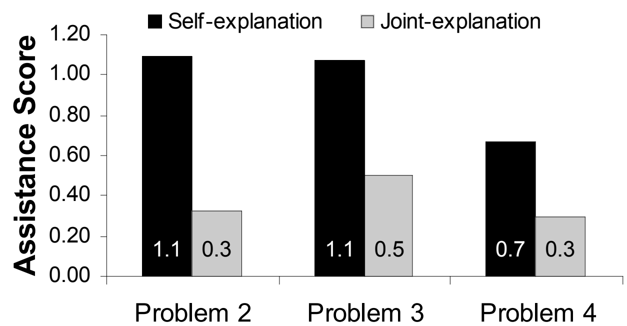

Figure 1: Normalized Assistance Scores per Problem.

Discussion

The results suggest collaboratively developing an explanation enhances problem-solving and learning over and above the effects of self-explaining, which supports the interaction hypothesis. More research is needed to understand why this is the case. One hypothesis is that having a communicative partner provides a social cue to avoid glossing over the material, which then leads to explanations that are of higher quality than those produced individually. Future analyses will qualitatively code the quality of explanations produced by each condition.

Acknowledgments

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