Clinton, V., Alibali, M. W., & Nathan, M. J. (November, 2013). Why do diagrams increase learning from lessons? In Proceedings of the 35th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (p. 318). Chicago, IL: University of Illinois-Chicago. ABSTRACT

WHY DO DIAGRAMS INCREASE LEARNING FROM LESSONS?

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Relevant visual representations, such as diagrams, can increase learning from textbooks (Mayer, 2009). There are two proposed reasons for the benefit of diagrams. One is that diagrams increase learning because they make the corresponding text easier to comprehend. This is because diagrams convey information in a manner that text cannot (Schnotz, 2002). The second is that students make connections between the visual information in the diagram and the verbal information in the text. These connections may deepen their comprehension of the material, thereby increasing learning (Mayer, 2009). Despite these claims, the influence of diagrams on both text difficulty and making connections has not been well examined.

The purpose of our study is to understand why diagrams increase learning from lessons. To address this issue, we randomly assigned undergraduates ($N = 36$) to read a probability lesson either with or without diagrams, while their eye movements were recorded. Students whose lessons included diagrams solved more probability problems correctly at post-test than did students whose lessons did not include diagrams. Students whose lessons included diagrams also had smaller average pupil size and spent less time reading the text than did students whose lessons did not include diagrams. Pupil size and reading times typically increase with task difficulty (Rayner, 1997; van Gog et al., 2009); therefore, this finding indicates that the diagrams lessened the difficulty of reading the lesson. In addition, students whose lessons included diagrams frequently looked to and from the diagram and the text. Their looks to and from the diagram and text may indicate that they were integrating the visual and verbal representations in the lesson (Mason, Tornatora, & Pluchino, 2012).

These findings indicate that both of the previously proposed reasons may explain why students whose lessons included diagrams answered more problems correctly than did students whose lessons did not have diagrams. One is that the diagrams made the lesson text easier to understand; therefore, students could focus their efforts on extracting the content of the lesson, rather than working to comprehend the text. The other is that diagrams encourage students to make connections within the lesson material, which prompts deeper comprehension. These findings enrich our understanding of the benefits of visual representations.

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