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Using Causality to Map Difficulties in a Qualitative Physics Problem

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Abstract

A key element of conceptual understanding in physics education is the ability to make qualitative inferences. In this study, we investigated whether people use causal notions when solving simple, qualitative physics problems. We utilized the principles of directionality and holding variables constant to assess participant's accuracy in answering questions about inferences from cause to effect (CE), effect to cause (EC), and from one cause to the other cause (CC). Participants responded with greater accuracy for CE and EC questions when alternative causal information was held constant compared to when it is made explicitly unknown. For CC questions accuracy was lower across all alternative information types. Further, participants generally treated ambiguous alternative causes as if they were held explicitly constant. These results indicate that using notions of causality can potentially help identify difficult qualitative physics questions and be used as a tool in instructional design.