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Relations between Types of Reasoning and Computational Representations.

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This paper examines the idea that particular representations differentially support and enhance different cognitive processes, in particular different types of reasoning. Five case studies were conducted consisting of detailed observations of pairs of middle-school students interacting with a computer-based learning environment. The software environment, called NumberSpeed, deals with kinematics concepts by having students construct various motion scenarios by adjusting numerical motion parameters: position, velocity and acceleration. NumberSpeed provides feedback about the student-specified motion using two representations: the motion representation and the number-lists representation. Two distinct types of reasoning were recognized in students' learning while interacting with NumberSpeed: (1) model-based reasoning and (2) constraint-based reasoning. These two types of reasoning are characterized in detail and their roles in problem-solving are analyzed. A cross-analysis between the types of reasoning and the use of particular NumberSpeed representations reveals a correlation between type of reasoning and representational choice. These findings are explained by analyzing the representations' characteristics and the ways they may differentially support and enhance particular types of reasoning.

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