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# Multimedia Representations for Science Learning: A Cautionary Tale

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## Introduction

Will Internet access to multimedia resources change science learning in the classroom? What are the cognitive effects of representing information using multimedia technology? Research is beginning to elucidate the role of representation on cognitive processes during problem solving (Larkin & Simon, 1987; Zhang & Norman, 1994) and learning (Kozma, 1991). The empirical research described here further explores these issues by investigating the role of multimedia representations in science learning through a comparison of students' categorical and explanatory responses to a set of text and multimedia isomorphs of scientific evidence.

## The Study

The study investigated middle school students working on a science activity within the instructional context of an Internet-focused learning environment called the Knowledge Integration Environment (KIE). As a part of this activity on the nature of light, students developed theoretical accounts of scientific evidence and communicated their findings during a class debate. Students explored and categorized a set of evidence within the conceptual framework of the debate, as well as produced written explanations for the evidence they deemed most relevant. One-half of the students received a mixed set of text and multimedia evidence, while the other half received a complementary set consisting of text and multimedia isomorphs.

Analyses were conducted on students' categorizations of the evidence in order to compare the representational effect of the text and multimedia modalities. Additionally, students' written explanations were coded for subject matter science conceptions like "telescopes look at light which is closer to the light source" (see Guesne, 1985).

## Results & Implications

For three-quarters of the evidence pairs, students linked the text and multimedia versions significantly differently to the debate. In other words, the representation of evidence was found to play a strong role in the cognitive behavior of students. This effect was further investigated by comparing the range of conceptions used to describe the evidence in students' explanations. For almost all of the evidence pairs, a trend existed where students associated a broader range of

conceptions (or scientific ideas) to the multimedia evidence than the text isomorph. In spite of these broader connections, students were not found to associate more scientifically normative ideas to the multimedia evidence.

From an instructional perspective, it may be appropriate to incorporate multimedia cautiously given the representational effect described in this research. Multimedia representations may not have the expected effect on learning compared to that of corresponding text representations of similar phenomena. At certain points of instruction, however, it can be beneficial for students to consider a repertoire of ideas to help determine which are more productive, flexible, and more coherent with their prior knowledge (Linn et al., 1994). Results suggest that multimedia instructional materials may be useful in eliciting a broader range of conceptions from a group of students.

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