

“I got to see, and I got to be a part of it”: How Cued Gesturing Facilitates Middle-school Students’ Explanatory Modeling of Thermal Conduction

Nitasha Mathayas, David E. Brown, Robb Lindgren

Overview: “I got to see, and I got to be a part of it:” Gesturing with a Mixed Reality simulation helps middle school students construct scientific explanations.

Audience: Formal educators; Education Technology developers; Curriculum developers

Key Points

- Although modeling is a key practice of the scientific community, students struggle to construct scientific models that involve hidden entities like molecules to explain experiential phenomena like heat transfer.
 - We developed a gesture-augmented computer simulation that prompted students to gesture about the underlying mechanism of thermal conduction.
 - Mixed method analysis of students’ verbal explanations showed improvement in their scientific explanations after using the simulation.
 - Gesturing about scientific ideas fosters students’ causal reasoning and helps them articulate their models in greater detail.
-

INTRODUCTION In this study, we examined how gesturing with a computer simulation that depicts how heat transfers through a spoon at the molecular level helped middle school students construct scientific explanations. We developed a computer simulation that works with Leapmotion™ so that students use hand gestures to interact with the simulation. The gestures depict important features of the scientific model of thermal conduction. We studied how 21 middle school students explained how heat transfers through a silver spoon partially immersed in hot water and explored how gesturing supported their scientific modeling.

FINDINGS Quantitative analysis shows that students’ verbal explanations were more scientifically accurate after using the simulation. Case studies show two main ways the gestures supported student modeling: (a) by enhancing their attention on molecules, and (b) by supporting their understanding of molecular collisions.

TAKEAWAYS Prompting students to gesture about scientific models while explaining their thinking helps their learning about scientific models. Education technology developers can consider ways to use advanced technologies to have students use body movements to interact with complex science models in simulations. Teachers should encourage students to gesture about scientific ideas as a means of expressing their thinking.