

Preparing Tomorrow's Teachers to Use Technology: Analysis of Pre-service Elementary and Middle School Teachers' Interactions With Computer Modeling and Simulation Tools

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Tomorrow's teachers need to be prepared to use technology in their classrooms. However, student teachers have little knowledge about what kind of computer software to use, where to find good examples of such software, or how to use it with their own students. It is the premise of this paper that computer modeling and simulation software can play a pivotal role in helping pre-service elementary and middle school teachers learn about robust uses of technology in the science classroom as well as helping them learn about important issues of science pedagogy and epistemology. Computer modeling and simulation software, or software that represents data or phenomena in a way that can help predict and explain those phenomena often by visually representing abstract components and causal relationships over time, lies at the core of scientific practice and has revolutionized science and engineering. Further, educational versions of such software enable students and teachers to visualize and develop reasoning about abstract scientific concepts and phenomena, access cutting-edge scientific research, engage in authentic practices of science, and do so in interesting ways.

In order to prepare pre-service elementary and middle school teachers to use technology in their future science classrooms while learning about scientific pedagogy and epistemology, the authors designed an intervention in the first author's one-semester elementary science methods class at a large state university in the Midwest in which the twenty-five student teachers used and studied computer modeling and simulation software within their own science learning and teaching. The intervention included three core components. First, the student teachers read about, discussed, and debated the use of computer software and the role of modeling in science. Second, they learned and used two simulation tools in the course within science explorations on solar motion and light. Third, they conducted an in-depth investigation with a partner of one of five modeling tools chosen from our website <http://ott.educ.msu.edu/2002pt3/INDEX.HTM>. As part of this investigation, student teachers evaluated their modeling tool, wrote a lesson plan using the tool, and taught another pair of students about the tool they had learned. What did student teachers learn about modeling and simulation software from this intervention, and how did the intervention impact their views of science pedagogy and understanding of scientific epistemology?

Several results emerged from analysis of written pre/post assessments, weekly student journals, videotapes of classroom conversations, and interviews with half the class after the semester ended. First, student teachers expanded their understanding of the role technology can play in the classroom and their understanding of the kind of software available for science teaching. Second, we found that strengths of the modeling software were misaligned with student teachers' goals for computer software use. Student teachers valued software that was fun, easy to use, aesthetically pleasing, and provided a source of scientific information. As a result, they responded most favorably to the commercially produced computer simulations, and remained highly skeptical of the value of research-based modeling tools—particularly the ones that did not impart direct scientific information. The dissonance between student teachers' goals and the purposes of the software provided a platform for fruitful pedagogical and epistemological discussions. Third, we found evidence that student teachers struggled with the notion and purpose of scientific modeling and had difficulty conceiving of science and science learning as a process of creating and revising models using scientific tools within a learning community. Given that pedagogical and epistemological change is difficult and requires long-term exposure in multiple settings, this result is not entirely surprising. Finally, we found that institutional factors such as few samples of discipline-specific modeling software for elementary school science, no prior exposure to such an approach within other discipline-specific courses, and lack of time within the course played a role in the impact of this approach. Nonetheless, overall results suggest that computer modeling and simulation tools can be used to expand and challenge student teachers' understanding of the role that technology can play in the science classroom as well as their views of science pedagogy and epistemology. As a result, such teachers may be better prepared to use technology in tomorrow's classroom.