

Grounding Students' Understandings of "Doing Science" In Actual Lab Experiences

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Background

Students' experiences in science labs often involve hands-on activities. Recent advances in technology have led to increases in the use of simulations and remote online labs, which avoid the costs associated with costly lab hardware. Simulations allow students to explore a phenomenon or system by manipulating variables and observing resulting outputs that are generated by an underlying computer model. In contrast, remote labs allow students to manipulate variables and collect data using actual devices at off-site locations in real time, through online means (e.g., web-based interfaces). Hands-on, simulation, and remote lab activities are all intended to ground STEM experience in the activities that scientists undertake as they test hypotheses and analyze data.

In the current project, we examined whether beliefs about the nature of scientific inquiry might differ when students' scientific investigations are based on explicitly simulated or remote labs. Any potential differences would speak to whether different types of grounded STEM experiences might encourage different beliefs with respect to the nature of scientific practices.

Findings

Although content learning was robust for both versions of the lab (computer simulation and remote lab), participants in the remote condition were more

likely to feel as though they had done a real experiment, $F(1, 55) = 8.24, p < .01$. A qualitative analysis of the results indicated that participants felt the remote lab gave them more control over their data and felt more authentic. ...

The majority of participants (71%) would prefer to do a remote lab to a simulation. Participants liked the idea that "the experiment is actually happening" and "something real is being measured." The simulation felt less authentic. One participant who used the remote lab felt that he would not have the same satisfaction in using the simulation. "The simulation is just kind of looking at numbers instead of doing it again, but like with data that has already been found. So I found some kind of satisfaction in being able to control an experiment and that the numbers that you got are partly due to your actions." ...

Summary

Although content learning can occur when using either a simulation or a remote lab, students perceive a remote lab as being a more authentic method of inquiry. Most participants view the simulation and remote lab as qualitatively different, and attribute experimental qualities (e.g., rerunning trials) to the remote lab. These results have important implications for student engagement during computer-mediated lab activities, as well as methods to foster student inquiry.

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