Background: EcoMUVE

EcoMUVE Pond is an existing two week, inquiry-based curriculum unit centered on a virtual pond and the surrounding watershed. Students explore the pond and its biodiversity, and travel in time to see changes over the course of a virtual summer. They discover biodiversity, and travel in time to see changes over the course of a virtual summer. They discover that using the tool supported student development of causal relationships, address misconceptions, and draw conclusions through experimentation.

Understanding Experimentation in Ecosystems: EcoXPT

With EcoXPT, students go beyond observational inquiry to authentically test their own hypotheses through epistemologically authentic experimentation and investigation, extending their comprehension of underlying causal relationships.

Causal reasoning in purely observational environments tends to be inferential, based on visual information, measurements and correlations observed over time. Experiment-based learning can support students’ understanding of difficult science concepts, and development of mental models (Duit & Treagust, 1998; McIlhany & Linn, 2001; Rea-Ramirez, 2006) and experimentation is promoted in the Next Generation Science Standards (NGSS) middle grades life science standards for ecosystems science (Achieve, 2013). In addition to more traditional, isolation and control of variables forms of experimentation, EcoXPT aims to help students learn forms of experimentation that are contextualized in the complexity of the environment and that offer systems perspectives on the underlying causal dynamics. These include epistemologically authentic forms of “whole ecosystem” exploration.

Pilot Studies of EcoXPT Experimental Approaches

Pilot 1: The Fish Tank Tool displays two virtual fish tanks within a 3D lab environment. Each tank has an associated shelf of objects: a fan, a fish, a plant, or acid. Students choose to fill each tank with either pond or tap water, and select up to one (or “none”) object to place in each tank. Once the tanks are set up, students can “run” the experiment and use the water measurement tools to see the results.

Pilot 2: The Mesocosm Tool allows students to configure up to four pools with up to two factors each. Once the pools are set up, student can “run” the experiment and use the water measurement tools to see the results.

Pilot 3: Tracers Placed in the Ecosystem allow students to understand the movement of matter in the environment. They are able to test how the spatial layout and topography play a role in the process. We are currently piloting the use of tracers with the students. They can choose to place tracers of different colors in different places.

Results

This work is supported by the National Science Foundation grant No. 1416781 to Tina Grotzer and Chris Dede. All opinions, findings, conclusions or recommendations expressed here are those of the authors and do not necessarily reflect the views of the National Science Foundation.

For more information, visit: http://ecolearn.gse.harvard.edu

The outcomes can reveal surprising information about the terrain and proximal and distal causes.