

STUDENTS AND TEACHERS USING DATA FROM INVESTIGATIONS IN EARTH SYSTEMS (STUDIES): Award Number NNX10AE34G

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Final Report: February 2010 through December 2012

Discussion

The STUDIES project developed learning progressions that employ appropriate on-line tools and MyNASA Data to overcome misconceptions people have about the Earth sciences. Many students have difficulties visualizing how the Earth orbits the Sun, and how this orbit determines the seasons. An objective of this project was to address this with a combination of activities. The misconceptions about the Earth's orbit and its seasons have been studied and identified. Our team developed a pedagogical strategy; a lesson progression that uses text, media, interactivity and assessments to support the learning goals. We instructed important concepts to the learner with opportunities for them to practice or apply what they've learned.

Using a team approach, we developed a standards-based learning progressions to improve pedagogy in selected, challenging Earth system science topics. A common misconception of students and adults is that the seasons are caused by the Earth's distance from the sun, rather than its revolution about the sun. A team of concept experts, education experts, NASA experts and teachers was employed to develop a learning progression on the cause of the seasons that addresses this misconception. The UW-Madison team was to develop the on-line activity, which can be found at:

<http://profhorn.meteor.wisc.edu/wxwise/buffalo/seasons/> Aspects of the activity are available and can be downloaded for users, so they can develop their own story around the (e.g., <http://profhorn.meteor.wisc.edu/wxwise/>).

The on-line "Reasons for the Seasons" activity was pilot tested during a workshop and Buffalo State College. Educators who attended the Buffalo workshop during July 2011 provided valuable feedback on the on-line "Reasons for the Seasons" learning activity. This feedback led to some programming improvements and restructuring of the progressive learning activities. Additional testing with teachers was conducting during the 2012 winter ESIP meeting. We evaluated the activity in an introductory weather class for non-science majors. The class included about two dozen students. Two common theme emerged from an open ended survey. Independent of the student understanding of the season, the participants found the visuals effective as well as an ability to manipulate various features. The most criticized aspect was the display of the temperature maps. The next step, to be addressed by one of our partners, is to test this broadly in K-12 NY state classrooms (they have requested an extension to finish their work).

During some evaluation workshops, some teachers noted that some students have the misconception that half the Earth is not in darkness at any one time. As a result, we developed a new activity that

addresses this misconception. The activity, which focuses on how day and night change with region on the globe and time of year, can be found at the following URL:

<http://profhorn.meteor.wisc.edu/wxwise/radiation/sunshade.html>)

We also developed an activity on the phases of the moon. That URL is:

<http://profhorn.meteor.wisc.edu/wxwise/radiation/moonphases.html>

Summary

Applets developed: Seasons, Incoming Solar Energy Model, SunShade, Sun's Energy, Milankovich Cycle, Make The Earth, and Phases of the Moon. These applets addressed some commonly misunderstood concepts based on the Earth's shape, axis tilt, distance from and orbit around the Sun, as well as day/night and climate change concepts.

Project has built-in evaluation framework using Reusable Content Objects: As part of the lesson, we used Quizzing Reusable Evaluation Objects (REOs), which can be embedded in any web page and log all answers to a MySQL database. Lesson was used in an undergraduate college course, data captured, exported to Excel, analyzed. We iteratively refined and improved the online course by usability testing employing middle-school, high-school, and college level students. Since many tablets (e.g. iPad) cannot execute Java programs or Flash, we have begun to convert our activities to HTML5, making the activities more broadly available to web and mobile devices.

Workshops and conferences

Lange, C., L. Chambers, S. A. Ackerman, P. Higgins, J. Carbonara, D. & Henry, T. Jasmin, D. MacIssac, B. Martinez-Hackert, J. Sabato, T. Whittaker, K. Williams, and J. Zawicki: 2012: The application of simulations and My NASA DATA to increase understanding of rotation & revolution. Poster presented at National Conference on Science Education and Public Outreach Astronomical Society of the Pacific, Tucson, Arizona, August 4-8.

Whittaker, T. M., S. A. Ackerman and T. Jasmin, 2012: From Java to Flash to HTML5: Chasing Technologies for Interactive Applets. 92nd American Meteorological Society Annual Meeting, Jan 22-26, New Orleans, LA.

S. Ackerman attended the STUDIES Teacher Workshop in Buffalo (one of our partners). During the week of July 11th, 2011

Summer ESIP meeting: Teacher workshops, My NASA Data breakout, STUDIES breakout. Each teacher given iPad for evaluation of use for lessons developed during following academic year.

Live presentation of HTML5 ported applets at AMS Annual Meeting, Jan 2013, Austin, TX