Investigations in Cyber-enabled Education

Merging indigenous and non-indigenous knowledge in an online climate course for educators

Overview

Investigations in Cyber-enabled Education (ICE) was a study designed to clarify a framework for creating online professional development to enhance educator ability to provide science, technology, and math (STM) instruction. Research was focused in Alaska, where geographic barriers hinder in-person professional development efforts and much of the student population is indigenous, while most teachers are not.

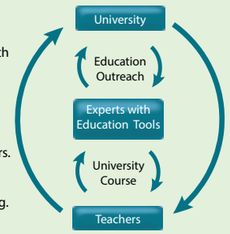
The ICE framework was developed to provide sustainable, affordable, replicable, and broadly accessible online professional development and cyber-enabled scientist/teacher partnerships. The team used this framework to develop a prototype online course for educators, and then conducted research to determine course impacts. The course focused on snow and global climate and merged indigenous and western science knowledge. It included six units of interactive tutorials, discussion questions, classroom resources, and an online learning community for communication among educators and scientists. Findings indicate that the course successfully improved teacher content knowledge, online STM workforce skills, and STM teaching self-efficacy.

ICE Framework

The ICE Framework provides a replicable platform for involving scientists in a continuum of K-12 teacher professional development. Involvement begins as scientists help education specialists develop materials for an online course for educators, and continues as scientists help create tools to facilitate transfer of online training to classroom instruction. It culminates with teacher and scientist communication via an online learning community during the course.

Reciprocal Model

The ICE Framework connects university researchers with teachers to benefit both groups. The reciprocal model involves university scientists and education outreach staff in the creation of STM education tools, which provide the foundation for online STM professional development courses for educators. Scientists gain an outlet for education outreach and teachers gain a source of cutting edge STM resources and training.



Indigenous Perspectives

ICE tutorials and virtual classroom resources include indigenous knowledge and incorporate pedagogies aligned with indigenous learning styles.

Interactive web-based tutorials provide teachers with climate research skills and are transferable to Alaska classrooms.

Interactive multimedia is graphically rich, embeds indigenous knowledge and experience, and allows learning to proceed at a pace set by the user.

Collaborative group work in the online learning community allows educators to work with peers and a scientist network to answer discussion questions about snow and climate.

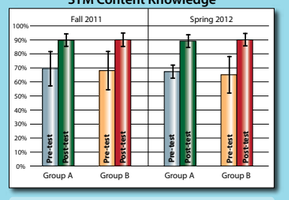
Digital scientist lectures are segmented to allow skipping and browsing.

Databases include weather and climate data from across Alaska to ensure teachers and students have access to relevant place-based climate data.

Research Outcomes

Research occurred during two trials in Fall 2011 and Spring 2012 with 80 teachers randomly assigned to two treatment groups (A & B). Both groups received: scientist-developed interactive web-based tutorials, questions and assessments, databases designed with scientists to serve as virtual classroom resources, and access to peers in an online learning community. Treatment group B additionally received access to a scientist network within the learning community and links via this network to scientist lectures and multimedia. Results indicate that treatments A and B were equally effective in significantly increasing teachers' snow and climate knowledge, skills, and teaching efficacy.

Educator Pre-/Post-Test of Climate-Related STM Content Knowledge



Educators showed statistically significant increases in STM climate knowledge between pre- and post-assessment scores from both trials using a paired-sample two-tailed t-test, ($p < 0.05$). Bars represent means (± 1 SD).

Educator Pre-/Post-Survey Ratings of Online STM Workforce Skills

Educators reported improvement in online STM workforce skills related to tools and approaches for accessing, analyzing, and understanding online weather and climate data from indigenous and non-indigenous sources. Improvement was statistically significant as measured by a six-item pre- and post-survey subscale ($p < 0.05$).

Teacher Self-Efficacy

Educators reported enhanced STM teaching self-efficacy and increased plans to teach about climate-related STM content in the classroom, as measured by pre- and post-survey. Educator lesson plans and reports on classroom implementation indicate that teachers were able to incorporate the training into the classroom.

Discussion

The project successfully improved teacher knowledge, skills, efficacy, and interest in teaching climate science, but further research is needed to determine how these improvements impact student learning and interest in STM. Teachers clearly benefited from having access to relevant, authentic climate research; however, teacher communication with the scientist network during course implementation did not significantly increase course outcomes. Further work is required to determine how this portion of the framework can be revised to maximize its benefits to teachers and how scientists can benefit from involvement.

Photo courtesy of Chris Maier

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