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Research Interests

I began my career as a geological engineer in industry, then returned to graduate school in geophysics, and ultimately became an academic. The change in careers reminded me how little scientific inquiry was integrated into undergraduate programs and how few skills students were acquiring for work outside of academia. My interests turned to the challenge of making science and science research more accessible to broad audiences through curricula and research experiences that promote inquiry, data analysis, and scientific thinking. This drove me to develop technology-based, data-rich curricula, explore effective use of data and visualizations for learning, and foster scientist-teacher partnerships to infuse real science in K-12 education. At this time, via my company and a non-profit organization, I am creating free-choice learning programs for youth and developing educational games that promote STEM learning.

Education

B.S. Geological Engineering - SD School of Mines and Technology, 1981
M.S. Geosciences - University of Arizona, 1988
Ph.D. Geosciences - University of Arizona, 1992

Dissertation: Application of numerical techniques to faulting and flexure of the lithosphere.

Professional Honors

American Geophysical Union Excellence in Geophysical Education Award, 2012
National Association of Geoscience Teachers Distinguished Speaker, 2003-2006
University of Arizona APEX Apple Award for Distinguished Service, 1996
Kay Robertson Award from Friends of Mineralogy for Best Educational Exhibit, 1996
Outstanding Achievement Award, U Arizona K-12 Academic Outreach, 1995
Citation for Excellence in Reviewing, American Geophysical Union, 1994

Professional Experience

Program Director, National Science Foundation, Division of Ocean Sciences, 2010-2012.
Executive Director, Institute for Science Education New Mexico, 2009-.
President, Science Education Solutions, 2004-.
Visiting Scientist, EES Division, Los Alamos National Laboratory, 2004-.
Executive Director, Digital Library for Earth System Education 2004-06.
Adjunct Research Scientist, New Mexico Tech, 2003-2005.
Research Scientist and Faculty Member, University of Arizona, 1994-2004
NSF Earth Sciences Postdoctoral Fellowship, 1992-1994
Geological Engineer, Shell Oil Company, 1981-1983; Shell Mining Company, 1983-1986

Professional Service

Department of Defense, Education Affiliate, 2012
NAGT Councilor SW Section, 2006-07
Chair, DLESE Quality Review Team, 2004
Chair, EarthScope Education and Outreach Steering Committee, 2002-2003
NSF Committee of Visitors, Geoscience Education Program Review, 2000 and 2003
US Educational Seismograph Network Steering Committee, 2000-2003
Associate Editor, Journal of Geoscience Education, 1999-2002
National Earth Science Teachers Association State Representative, 1999-2004
IRIS Committee on Education and Outreach, 1996-2001

Select Contributions

To share my love of analysis of geophysical data, in 1995 I began working with the Princeton Earth Physics Project to develop the first school-based seismograph network and myriad related classroom activities. The Web had not been commercialized and Windows was years away from real functionality. We faced a huge challenge to develop both data-intensive and hands-on resources for teaching about seismology in 7-12 grade earth and physics classes. I was part of a small group that dedicated themselves to overcoming these obstacles. Our efforts resulted in the program now run by IRIS, which has thousands of schools across the country recording and analyzing earthquake recordings. It also spawned the IRIS Education and Outreach program; Larry Braile and I were the lead authors of the original program plan. We gradually established a vibrant community of geophysicists skilled at outreach and communicating their science to the public. Later, when the EarthScope experiment was conceived, I took the lead in organizing this community to develop a comprehensive EarthScope E&O plan.

In 1997, teaching ***with***—rather than *about*—GIS at the high school and undergraduate level was pretty much unheard of. GIS was taught at the graduate level in Geography departments. Yet, this is a tool that opens doors to exciting, well-paid geoscience careers requiring only a bachelor's degree. We assembled a team of curriculum designers and GIS experts to develop the first set of GIS-based earth science laboratory manuals that taught the fundamentals of plate tectonics, physical, chemical, and biological oceanography, tropical cyclones and atmospheric science, and water resources. The college editions were published in 2004 and were adopted in over 135 colleges and universities. Revised college and high school versions were published in 2008 and are still popular. They are designed so that neither the student nor professor need prior GIS experience. Evaluation showed that students learned the essentials of how to use a GIS through the process of exploring earth science problems and datasets, rather than through direct instruction in GIS techniques. We used this curriculum in a course for majors, and more than 30% of the students later took an advanced GIS class in an effort to boost their employment opportunities. http://www.scieds.com/saguaro.html

Mentoring young scientists to fully realize their potential as scholar-educators is a personal priority. I led an NSF-funded GK-12 program from 1999 to 2003 that engaged 43 graduate and 35 undergraduate fellows in outreach to local schools. Students were paired for a year with a teacher to address a specific need in the teachers' classrooms. Evaluation showed that 74 of the 90 teachers changed their instructional practices with the help of the fellow and sustained that change in the following year. We remain in contact with the fellows and all but one has continued to engage in outreach to the public and schools as a result of their training. Three fellows started private elementary schools with a science focus.

After learning about the popularity of adult Science Cafés, I wanted to see if this approach would work to engage teenagers in science; I wanted to foster a culture that made science cool and encouraged lifelong learning about science among teens. Since 2007, I have worked with underserved youth to design and implement the first teen Café Scientifique in the U.S. This youth-led program engages scientists and youth in discussion, debate, and hands-on exploration of hot topics in science and technology. Over 4000 teens have attended the program in the past four years with more than half attending multiple programs in the school year. Evaluation results show that the Café program has positively influenced teens' interest in science and science careers and their understanding of the nature of scientific research. 71% of respondents agreed that the Café changed their view of the importance of science to their lives. The Café positively changed teens' ability to use facts to support scientific points of view, and to consider multiple sides of an issue. Scientists participating receive substantive training to help them communicate with this audience, and a significant majority report that the experience has given them a wholly new perspective on their own research. We are currently building partnerships for national dissemination of the model. See http://www.cafenm.org, http://www.teensciencecafe.org