ED72A-03 1615h

Using a modified Learning Potential Assessment Device and Mediated Learning Experiences to Assess Minority Student Progress and Program Goals in an Undergraduate Research Based Geoscience Program Serving American Indians

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During the initiation of a new program at the University of North Dakota designed to promote American Indians to engage in geoscience research and complete geoscience related degrees, an evaluation procedure utilizing a modified Learning Potential Assessment Device (LPAD) and Mediated Learning Experiences (MLE) to assess minority student progress was implemented. The program, called Indians Into Geosciences (INGEOS), utilized a modified form of the Learning Potential Assessment Device first to assess cultural factors, determination, and other baseline information, and second, utilized a series of Mediated Learning Experiences to enhance minority students' opportunities in a culturally appropriate, culturally diverse, and scientifically challenging manner in an effort to prepare students for competitive research careers in the geosciences. All of the LPADs and MLEs corresponded directly to the three goals or eight objectives of INGEOS. The three goals of the INGEOS program are: 1) increasing the number of American Indians earning degrees at all levels, 2) engaging American Indians in challenging and technically based scientific research, and 3) preparing American Indians for successful geoscience careers through multicultural community involvement. The eight objectives of the INGEOS program, called the Eight Points of Success, are: 1) spiritual health, 2) social health, 3) physical health, 4) mental health, 5) financial management, 6) research involvement, 7) technical exposure, and 8) multicultural community education. The INGEOS program goals were evaluated strictly quantitatively utilizing a variety of data sources such as grade point averages, number of credits earned, research project information, and developed products. The INGEOS Program goals reflected a combined quantitative score of all participants, whereas the objectives reflected qualitative measures and are specific for each INGEOS participant. Initial results indicate that those participants which show progress through Mediated Learning Experiences within all of the Eight Points of Success, have a higher likelihood of contributing to all three of the INGEOS programs goals.

ED72A-04 1630h INVITED

The Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) Geoscience Initiative

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The Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) focuses on encouraging undergraduate and graduate minority students to pursue higher degrees. For over 29 years, SACNAS has provided strong national leadership in improving science and math education, as well as expanding opportunities for minorities in the scientific workforce and academia. SACNAS Annual National Conference and Teacher Workshops, summer research opportunities, E-mentoring program, and online internship/job placement resources are tools that help a diverse community of students, professors, administrators, and K-12 educators achieve expertise within their disciplines.

The SACNAS Annual National Conference is the centerpiece of our programs. The conferences feature career advancement workshops, scientific symposia, exhibits, student presentations and guest speakers designed to provide the resources Chicano/Latino, Native American, and other postdoctoral, graduate and undergraduate science and engineering students need to pursue a advanced degrees in the sciences. Guest speakers are chosen for their excellence in scientific research and their ability to convey the wonder and importance of science through the presentation of their research results.

SACNAS has recently included a geological science emphasis to its existing programs to address the need to diversify the field. This talk will outline our approach, and outline how SACNAS has been able to grow over the past 30 years.

ED72A-05 1645h INVITED

Increasing Diversity in the Geosciences: A Bridging Program from Middle School to College

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A bridging program to increase the diversity in the geosciences was created at Hampton University to address the underrepresentation of certain groups across the geosciences. The primary goal of this program is to expand the opportunities and awareness of these groups in geoscience education and research so they may be inspired to pursue an educational path that advances them towards careers in the geosciences. The approach used to achieve this goal is to develop activities from middle school to college that expands the pipeline of diverse students entering advanced education and careers in the geosciences.

Activities target formal and informal K-14 education outreach and university education and research. Informal K-14 activities include an after school geoscience club, a middle school geoscience summer enrichment camp, and a research/mentorship program for high school students. These activities will inspire a diverse population of middle and high school students, outside of the classroom, to develop a continued interest in the geosciences. Formal K-14 activities include a professional development workshop that fills the need for geoscience curriculum content requested of science teachers and administrators who work primarily with underrepresented middle school populations. University education and research activities include continued development of the Hampton University geoscience curriculum, establishment of a distance-learning program, and enhancing the research facilities including development of a weather station and cloud/aerosol lidar. All three areas of activity provide opportunities and participation of underrepresented groups in the geosciences and bridge those activities from middle school through college and into careers.

The first year of the program proved to be successful in all of the major objectives of the program. The middle school summer enrichment camp, high school mentorship program, and teacher workshop were well attended and feedback obtained from the participants highlight the success of the activities in meeting the program objectives. A space and geosciences minor is in development and will represent an increase in the number and breadth of the undergraduate course offerings in the geosciences at Hampton University. The distance-learning program, weather station, and cloud/aerosol lidar are under early development.

ED11A MCC: Hall D Monday 0830h

Geophysics Data in the Classroom II Posters *(joint with NG, OS, S, T, PA)*

Presiding: **M Hamburger,** Indiana University**; J Virieux,** Université Nice Sophia Antipolis/Centre National de la Recherche Scientifique, UMR Geosciences Azur

ED11A-0025 0830h POSTER

Education and Outreach at the USGS Albuquerque Seismological Laboratory

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The Education and Outreach effort at the USGS Albuquerque Seismological Laboratory (ASL) over the past decade has evolved into an exciting program that provides many new educational opportunities in seismology and related science, engineering, and mathematics. Our target audience includes K-12, postsecondary, undergraduate, graduate, continuing education and the general public. With an emphasis on reaching young people, our major goal is to provide to the local community an increased understanding, awareness and appreciation of the relevance of Earth science and technology in daily life. A broadened base of public support for science helps enable us to stimulate the intrinsic curiosity of youngsters who may find science and technology exciting and challenging. Our programs capitalize on the natural interests of young students in earthquakes, volcanoes, magnetism and other scientific fields. Our hands-on interactive presentations foster a students sense of inquiry and increase their knowledge of science. We see an increased amount of confidence displayed by young students as they begin to understand basic scientific principles. We attempt to increase scientific literacy within the community and help create a new generation of students with a greater understanding of the opportunities in Earth science.

We outline recent Earth science and Career Day presentations we have made at numerous elementary schools. Many of these presentations are made both in English and Spanish. Also featured are other cooperative bilingual projects that have been coordinated with the New Mexico Museum of Natural History, the National Atomic Museum and the New Mexico State Fair.

ED11A-0026 0830h POSTER

The Promotion of the use of Seismic Data via the IRIS Education and Outreach Program

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The Incorporated Research Institutions for Seismology (IRIS) recognizes the potential for coordinated Education and Outreach activities in seismology to contribute significantly to the advancement of national awareness, interest, and understanding of science and mathematics. IRIS E&O activities are targeted at audiences ranging from K-16 students to the general public, and are focused on areas where IRIS is well-positioned to make substantive contributions stemming from its strong research and data resources. Program goals are advanced by the E&O staff in close collaboration with diverse allies, including IRIS members, K-12 teachers, undergraduate institutions, the media, and science museums. IRIS also works closely with other national and regional Earth science organizations to maximize effectiveness and reduce redundancy.

Leveraging IRIS resources to produce nationally significant results requires substantial and sustained outreach to the wider education community. Important efforts in this direction include a range of K-16 teacher workshops, a new Educational Affiliate membership for undergraduate institutions, and widely distributed teaching modules and associated tools. Students can access global seismic data from the IRIS Data Management System in near real time as well as by selecting events from the online archives. Earthquake locations and information are available via a new interactive map (the Seismic Monitor). Students can also collect their own seismic data using a stand-alone, relatively inexpensive seismograph (the AS1), or with research-quality broadband instruments with continuous network connections. Consortium members are currently developing new visualization tools and classroom activities using seismic data. Outreach to the general public includes a distinguished lecture program, museum exhibits with real-time displays of earthquake locations and ground motion, access to and use of seismic data via our website, and other informational materials.

URL: http://www.iris.washington.edu/EandO/

ED11A-0027 0830h POSTER

Teaching with Real-Time Seismic Data

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Many terabytes of digital seismic data have been gathered in the past decade. These data include summary tables of events as well as raw seismograms. The event information, which can be plotted, analyzed statistically and interpreted in the context of plate tectonics and geologic hazards, make excellent classroom investigations. However, the bulk of the data are raw seismograms that require advanced knowledge and specific software to analyze and manipulate thus, they are generally inaccessible to a non-seismologist.

To make real-time seismic data more accessible to students in high schools and colleges, we are developing a network of school seismometers through the IRIS Seismometer in Schools Program. The goal of this program is to promote seismology as a platform for teaching principles of physics and Earth science in schools across the nation. When studying plate tectonics and earthquakes, a seismometer in the classroom promotes awareness of earthquake activity around the world and provides an opportunity to teach with real-time data and real-world examples. The AS-1 seismometer is a low cost, durable, yet precise instrument that allows students to both investigate how a seismometer works and the recordings of the instrument, making it ideal for student and classroom use. The AS-1 recording and analysis software, AmaSeis, is simple to use yet includes all the basic tools needed for analysis: waveform display, filtering, and phase picking. The software also includes travel time curves to determine event distance and location. The seismometer keeps time using the computers clock, which can be updated regularly through the Internet. While each instruments response is unique, it is possible to calibrate the instrument and determine accurate magnitudes for events.

In the past year our efforts have resulted in teachers using the seismometer effectively in high school classrooms. For example, using data from their own station and several others, students located several small events in the western United States and were able to keep logs of local mining explosions and earthquakes. The opportunity to work with real scientific data has generated excitement and interest in studying Earth Science and in pursuing careers in the field. Working in partnership with schools, we are continuing to explore the potential of teaching with the seismograms recorded in the classroom.

ED11A-0028 0830h POSTER

Earthquakes in the Classroom, Las Vegas, NV: The Nevada Educational Seismic Network (NESN)

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Geophysics is a term guaranteed to strike fear into the heart of the bravest high school science student. Using math to describe the earth can involve complex equations that can only be deciphered by enigmatic computer programs. But high school science students in the Las Vegas Valley have been given a unique opportunity to gather important research information while learning about geophysics, real-time data collection, and Internet communications in a less threatening environment.

Three seismograph stations funded by the Department of Energy and the University of Nevada, Las Vegas have been installed in three different high schools in the Clark County School District. These three stations form a triangle in the Las Vegas Valley basin covering areas where the basin depths change significantly. The geophones are buried outside and a cable connects the sensors and GPS receiver to a digitizer on a local PC. The data is transmitted continuously in real-time via Internet communications protocols to the Seismic Explorer Monitoring Network. There it is available to all schools and to researchers who will analyze the data. These short-period geophones will record small local earthquakes and larger more distant events contributing to real-time seismic network operations in southern Nevada. Students at a school site are able to see live real-time data from other school stations as well as from seismograph stations in southern Nevada, the western US, and the world. Mentored by researchers at the University of Nevada, Reno and University of Nevada, Las Vegas, the teachers and students conduct simple waveform analysis to determine earthquake locations and magnitudes and operate the stations in this cooperative research effort.

The goal of this partnership between secondary and university educational systems is to create a successful alliance that will benefit the research community as well as the classroom teacher and his/her students. Researchers will use the data collected from the schools in studies of the structure in the Las Vegas Valley basin and evaluation of the local seismicity. A major goal for the secondary teacher is the development of lesson plans that will use the collected data as a learning tool to help their students gain a better understanding of specific scientific concepts. Using the latest software and data communications technologies, students participating in this project will be on the cutting edge of establishing a model for urban seismic networks.

URL: http://www.equakenet.com/

ED11A-0029 0830h POSTER

Integrating Seismology into the Physics Curriculum: An Opportunity to Introduce High-School Students to Scientific Research

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High school physics provides a natural vehicle for introducing seismology and geophysics concepts into the secondary science curriculum. Fundamental principles of mechanics and wave motion can be studied through investigation of the real-world phenomena of earthquakes and the seismic waves they generate. In turn, the excitement of a major earthquake and news media coverage stimulates student interest and involvement, especially if students are able to record the event. Too often, students exposure to science has been confined to textbook work or cookbook lab exercises and they develop a very limited understanding of how science works. The National Science Standards, as well as many state standards, have emphasized the importance of hands-on inquiry-based activities, the use of real data and the introduction of research as fundamental to improving students understanding of science. Students who run their own seismic station have the opportunity to experience the rewards and frustrations that can result from real scientific work. At Northview High School (Brazil, Indiana) we have installed a PEPP broadband seismometer in an external vault. Physics students are responsible for the day-to-day operation of the station. They download data and produce and post seismograms of earthquakes that have been recorded by the station and identified by the students. A hallway display case provides students, faculty and staff with a continuous (nearly) live display of the data being collected. The operation of the station has generated a great deal of student and community interest in the study of earthquakes. In this presentation, I will describe how seismology has been incorporated into the physics curriculum at Northview High School, and how our students have benefited from the opportunity to take part in hands-on scientific research. I will describe our participation in a regional seismic network through seismic data acquisition, data analysis using seismological software, and students' experiences in a university-based student research symposium. I reflect on a high school teachers experiences during a summer seismology research project in a university setting. Finally, I will discuss, based on my six years' experience with the PEPP seismology program, some of the successes and barriers to high-school teachers' and students' involvement in scientific research programs.

ED11A-0030 0830h POSTER

EDUSEIS Project : an On-Going Education and Adwardness Experiment in Europe

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Education and awardness on sciences and on natural phenomena is a concern of both researchers teachers with many social issues. A well-defined frame is critical for interaction and collaboration and should be illustrated on key examples. Observing and analysing seismic data is one of these examples because earthquakes with strong implications in our industrial society attract young people and because different area around the world may share observations, informations and activities concerning earthquakes both local if there is any and global if they are strong enough.

In order to focus on doing science and on analysing data, one has to reduce efforts for collecting data (if not hiding it) while having them measuring the same physical quantities and in a format readable by different available softwares. We shall illustrate solutions we have developped in an interaction between colleges and laboratories with different specific cultural approaches of European countries.

Activities ranging from metrology to interpretation and presentation should improve scientific behaviour of students as well as increase their understanding of the Earth. We shall illustrate through the diversity of European initiatives that we share common objectives. Systematic use of new technologies for collecting numbers (measurements) and for crunching them (interpretation) will retain the attention of the students and will hopefully attrack them to Sciences related to the Earth.

In the present on-going process, we shall show the necessity for an European organisation and support inside the more global international interaction. Such initiatives focus on scientific training of people for making more award citizens of our society.

URL: http://www.eduseis.org

ED11A-0031 0830h POSTER

Discovering Plate Boundaries, a data rich classroom exercise

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I have developed an exercise called "Discovering Plate Boundaries" that is getting increasing use in the Houston area, via teacher workshop sessions I give, and nationally through my web page and teacher workshops lead by colleagues. The exercise is based on 5 world maps containing earthquake, volcano, topography, satellite gravity, and seafloor age data. The novel aspect of the exercise is the "jigsaw" manner in which student groups access the maps and use them to discover, classify, and describe plate boundary types. The exercise is based only on observation and description, which makes it useful at a wide variety of levels; I have used it successfully in 5th grade classes, 8th grade classes, as well as in high school and earth science classes at Rice University. The exercise is based on a set of wall maps that are not consumed during the exercise. The consumables are inexpensive: two 11x17 in. B&W copies per student and some colored pencils. Because the exercise is not based on student access to the web, it is not dependent on classroom technology equipment. The exercise takes three 50 minute class periods to complete and involves the students in making presentations to one another in small groups as well as to the whole class. The students come away from the exercise with knowledge of the key features of each type of plate boundary and a sense of why each looks/acts the way it does.

URL: http://terra.rice.edu/plateboundary

ED11A-0032 0830h POSTER

Incorporating GPS geodetic data into the undergraduate classroom to improve data and information literacy

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As part of an NSF-funded project, we are incorporating Global Positioning System (GPS) geodesy into the classroom to improve data and information literacy among undergraduate students. Our objectives are: to introduce statistical concepts essential for the interpretation of large datasets; to promote communication

skills; to enhance critical thinking; and to build teamwork. GPS geodesy is ideal for illustrating data literacy concepts. Data precision and accuracy depend upon several factors, including type of equipment, environmental conditions, length of occupations, monument design, site location, configuration of the geodetic network, and processing strategies. All of these can be varied, allowing the students to learn the trade-offs among cost, time, and quality and to determine the most efficient methodology for specific problems. In addition, precision, accuracy, and errors govern the interpretations that can be made and the potential to distinguish among competing models. Our focus is a semester-long course that uses GPS geodesy in real-world applications and also requires integration of GPS data into oral presentations and written reports. Students work in teams on cases that pose hypotheses for testing. The cases are derived from our on-going research projects and take advantage of on-line continuous GPS (CGPS) data as well as our archived campaign data. The case studies are: 1) Microplate tectonics in the northeastern Caribbean; 2) Inflation/deflation cycles of the Soufriere Hills volcano, Montserrat; and 3) Contribution of monument instability to the overall error in geodetic data from the New Madrid Seismic Zone. All course materials will be on-line and available for the community.

ED11A-0033 0830h POSTER

Solar Data in the Classroom: the TLRBSE Experience

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The Teacher Leaders in Research Based Astronomy program, based at the National Optical Astronomy Observatory in Tucson, has created an immersive research experience for middle and high school teachers at the National Solar Observatory at Sacramento Peak, New Mexico and provides support for teachers to use real solar data in the classroom. Teachers explored two months of daily multispectral images of the Sun during solar maximum using hard copy images and computer-based image processing tools and data CD-ROMs. These data sets included white light intensity, magnetograms, H-alpha, extreme ultraviolet, and x-ray images that students can explore as introductions to solar activity and to features such as sunspots, prominences, and faculae. The data can be used to trace the evolution of solar phenomena, track solar differential rotation, or to calculate daily sunspot numbers that can be compared with professional counts.

Teachers also constructed and aligned low cost solar telescopes that will be used to gather data on sunspots and other white light solar phenomena. This experience with solar data and images provides a direct lead-in to additional professional data sets available online at solar observatory sites. These data can be used to detail the development of energetic events such as coronal mass ejections and to follow solar phenomena over long time periods. Of greatest relevance to the teachers were the solar data that can be correlated with space weather data and regional terrestrial data on magnetic storms, satellite failures, and power outages.

URL: http://www.noao.edu/education/noaoeo.html

ED11A-0034 0830h POSTER

Interactive Geophysical Mapping on the Web

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We have developed a set of interactive, web-based map utilities that make geophysical results accessible to a large number and variety of users. These tools provide access to pre-determined map regions via a simple Html/JavaScript interface or to user-selectable areas using a Java interface to a Generic Mapping Tools (GMT) engine. Users can access a variety of maps, satellite images, and geophysical data at a range of spatial scales for the earth and other planets of the solar system. Developed initially by UNAVCO for study of global-scale geodynamic processes, users can choose from a variety of base maps (satellite mosaics, global topography, geoid, sea-floor age, strain rate and seismic hazard maps, and others) and can then add a number of geographic and geophysical overlays for example coastlines, political boundaries, rivers and lakes, NEIC earthquake and volcano locations, stress axes, and observed and model plate motion and deformation velocity vectors representing a compilation of 2933 geodetic measurements from around the world. The software design is flexible allowing for construction of special editions for different target audiences. Custom maps been implemented for UNAVCO as the Jules Verne Voyager and Voyager Junior, for the International Lithosphere Projects Global Strain Rate Map, and for EarthScope Education and Outreach as EarthScope Voyager Jr.. For the later, a number of EarthScope-specific features have been added, including locations of proposed USArray (seismic), Plate Boundary Observatory (geodetic), and San Andreas Fault Observatory at Depth sites plus detailed maps and geographically referenced examples of EarthScope-related scientific investigations. In addition, we are developing a website that incorporates background materials and curricular activities that encourage users to explore Earth processes. A cluster of map processing computers and nearly a terabyte of disk storage has been assembled to power the generation of interactive maps and provide space for a very large collection of map data. A portal to these map tools can be found at: http://jules.unavco.ucar.edu.

ED11A-0035 0830h POSTER

Introducing Space Weather to the Standard Physics Curriculum

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A series of computer based modules is being developed that use the real-life effects of Space Weather to motivate the study of the basic concepts of Electricity and Magnetism at the level of a typical introductory physics course for non-majors. The modules are designed to enable instructors to engage students in exploring problems that are complex enough to be of practical interest, while still allowing them to concentrate on the simple concepts they need to learn. Extensive testing of students actual use of computer-based resources is being undertaken, to ensure that the modules will be effective in realistic classroom environments. The modules are based on similar units for Earth Science that have been developed and tested over the past five years, and evaluation results show both an improvement in student attitudes towards science, and content assimilation equal or better to that of textbook-based instruction.

ED11B MCC: Hall D Monday 0830h

Evaluating Geoscience Education Projects II Posters *(joint with OS, PA)*

Presiding: **K Garvin-Doxas,** Center for Integrated Plasma Studies**; S Henderson,** University Corporation for Atmospheric Research

ED11B-0036 0830h POSTER

Are we Meeting our Goals in Geoscience Education Projects? The Critical Need for Program Evaluation

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In response to the need for collaboration between geoscientists and educators, many universities and research institutions have organized and implemented a multitude of education and outreach efforts. Programs have been developed to reach diverse audiences including K-12 science teachers and their students, undergraduate and graduate students, and the general public. While the breadth and scope of geoscience education and outreach activities are growing, program results and outcomes are not always clearly tracked or reported. It is important to determine if the goals and objectives of geoscience education projects are being met through a well designed evaluation approach. Traditionally, many education and outreach programs have asked for feedback in either a cursory fashion (short participant satisfaction feedback) or relied on anecdotal evidence. The University Corporation for Atmospheric Research's (UCAR) Office of Education and Outreach (EO) is building an extensive framework to gather evaluation and assessment information from all of its education programs that will inform program organizers and be of use to others interested in implementing similar programs. EO is the point of contact and dissemination for education and outreach at UCAR, the National Center for Atmospheric Research (NCAR), and the UCAR Office of Programs (UOP). EO collaborates with NCAR scientists through the creation of K-12 educational resources and technologies, web sites, professional development workshops, special events, public tours, and exhibits. To meet the diverse evaluation needs of those various education and outreach programs, qualitative and quantitative information gathering techniques are being used. This presentation will provide an overview of evaluation tools and techniques as well as the findings from two 2002 summer workshops, a mentor program, and a web site.

ED11B-0037 0830h POSTER

The DLESE Evaluation Toolkit Project

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The Evaluation Toolkit and Community project is a new Digital Library for Earth System Education (DLESE) collection designed to raise awareness of project evaluation within the geoscience education community, and to enable principal investigators, teachers, and evaluators to implement project evaluation more readily. This new resource is grounded in the needs of geoscience educators, and will provide a virtual home for a geoscience education evaluation community.

The goals of the project are to 1) provide a robust collection of evaluation resources useful for Earth systems educators, 2) establish a forum and community for evaluation dialogue within DLESE, and 3) disseminate the resources through the DLESE infrastructure and through professional society workshops and proceedings.

Collaboration and expertise in education, geoscience and evaluation are necessary if we are to conduct the best possible geoscience education. The Toolkit allows users to engage in evaluation at whichever level best suits their needs, get more evaluation professional development if desired, and access the expertise of other segments of the community.

To date, a test web site has been built and populated, initial community feedback from the DLESE and broader community is being garnered, and we have begun to heighten awareness of geoscience education evaluation within our community. The web site contains features that allow users to access professional development about evaluation, search and find evaluation resources, submit resources, find or offer evaluation services, sign up for upcoming workshops, take the user survey, and submit calendar items. The evaluation resource matrix currently contains resources that have met our initial review. The resources are currently organized by type; they will become searchable on multiple dimensions of project type, audience, objectives and evaluation resource type as efforts to develop a collection-specific search engine mature. The peer review criteria and process for ensuring that the site contains robust and useful resources has been drafted and received initial feedback from the project advisory board, which consists of members of every segment of the target audience. The review criteria are based upon DLESE peer review criteria, the MERLOT digital library peer review criteria, digital resource evaluation criteria, and evaluation best practices.

In geoscience education, as in most endeavors, improvements are made by asking questions and acting