# A NEW MODEL FOR SCIENCE COMMUNICATION AND OUTREACH: INTERACTION, INSTRUCTIONAL DESIGN, AND INCLUSION

Carrie Bruno Meisner[1], Danielle Beazer[1], Dori Andrepont[2], Melanie Garcia[3], Allen McGrew[4], James Metcalf[5]

(1) Earth and Physical Sciences, Great Basin College, 1500 College Parkway, Elko, NV 89801, (2) Arts and Letters, Great Basin College, 1500 College Parkway, Elko, NV 89801, (3) Computer Technologies, Great Basin College, 1500 College Parkway, Elko, NV 89801, (4) Department of Geology, The University of Dayton, 300 College Park, Dayton, OH 45469-2364, (5) Department of Geological Sciences, University of Colorado, Boulder, CO 80309

RuGGEd Ruby Mountains-Geology, Geochron, and Education

# Updating Broader Impacts

## Why do we need a new broader impacts model?

Broader impacts present a powerful, yet underutilized, opportunity to disseminate science to the public and policy makers, especially in populations who feel little connection to science or the environment. As we see with contentious environmental issues involving water, air, other natural resources, and climate, scientists need to revise current communication techniques to improve science literacy and trust. Scientific issues have become entwined with the psychological, religious and social identities of many of our citizens, therefore scientists need to embrace the social sciences and learn to communicate our work effectively (Hayhoe and Schwartz, 2017) with a variety of audiences.

Additionally, mistrust in science has a long history in the United States dating back to World War II and the atomic bomb (Otto, 2016). We must drastically improve science literacy and science public relations in our nation, so voters and policymakers can make educated choices regarding health, resources, energy, and the environment.

## Promote Science Literacy with Community Interaction and Academic Inclusion

### Embed a Local Earth Sciences Professor

We start by embedding a local earth sciences educator from Great Basin College (GBC), as a Principal Investigator (PI), in a National Science Foundation grant focusing on the uplift and exhumation of the Ruby Mountains – East Humboldt Range Metamorphic Core Complex. The local connection promotes:

- easier access to private property,
- greater media exposure, and opportunities to speak at local and regional organizations, such as, the Rotary Club and the Geological Society of Nevada,
- students in GBC's enormous, rural GBC service area to participate in the field, and collaborate with geologists from other institutions,
- confidence and trust in the research, and
- researchers and educators to use their skill sets effectively.

### Include Non-Science Majors

Our broader impacts model involves working with a multi-disciplinary team of GBC students, including majors in Graphic Communications, English, Natural Resources, and Education.

Broader impacts in large federally funded grants generally focuses on graduate and post doc **science** students (Lok, 2010). These students are already hooked on science, and although it is important to foster their growth, it is also imperative to expose non-science majors to the scientific process. This model incorporates students from multiple disciplines to aid in researching science communication and creating instructional materials. For their work, GBC Graphic Communications, Natural Resources, and English students all earned capstone or internship credit participating in Year 1 activities.

*Photograph by Adriana Mendez*

*GBC Education students work with CO-PI Meisner to discuss strategies on presenting geochronology concepts to secondary math and science students. Materials developed for secondary learners will align with Nevada Academic Content Standards for Science and Math.*

### Incorporate Sense of Place and Local Art

Sense of place, defined by Semken (2005), is the *meanings of* and the *attachments to* a place held by a person or a group. By incorporating art into outreach, the researcher provides additional perspective and connection to the landscape, therefore collaboration with local artists can be a symbiotic relationship. Artwork of a famous peak or a well-known canyon can connect a wide range of learners, particularly those with interests in the arts and humanities, immediately to the field location. Geologists can team with artists to write brief geologic descriptions to accompany artwork.

*Water Color Drawing of the Ruby Mountains by Great Basin College Art Professor, Patty Fox*

Hayhoe,K. & Schwartz, J. (2017). The Roots of Science Denial. *Scientific American, 317(4)*, 66-68.

Lok, C. 2010. Science for the masses. *Nature*, 465(27), 416-418.

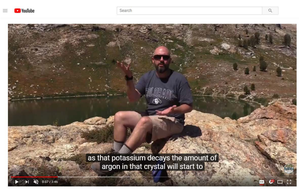
Semkin, S. (2005). Sense of Place and Place-Based Introductory Geoscience Teaching for American Indian and Alaska Native Undergraduates. *Journal of Geoscience Education*, 53(2), 149-157.

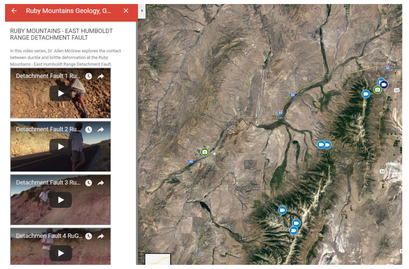
Science Communication Logo - GBC Graphic Communications graduate, Maggie Bowman

## Increase Accessibility with Instructional Design and Technology

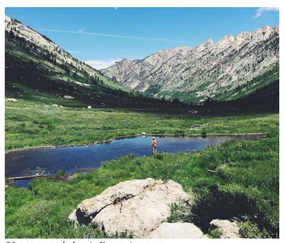
### Create Interactive, ADA Compliant Instructional Materials

Instructional materials include short video-tutorials, filmed in the field, of CO-PIs and prominent regional geologists discussing the local geology, sampling techniques, and geochronology.* The recordings are available to students and the public on the Ruby Mountains Geology, Geochronology and Education YouTube Channel. These tutorials are linked to interactive fieldtrip guides using Google Maps, which can be downloaded by the public prior to a hike or a road trip so they can be viewed in areas with limited cellular service. To increase accessibility in the earth sciences, instructional materials produced are Americans with Disabilities Act (ADA) compliant; this means the videos are closed captioned, and figures and photographs have alt text and can be read by a screen reader.

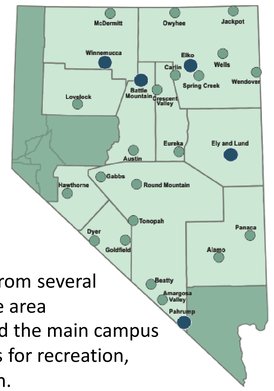



Great Basin College covers a gigantic, 86,000 square mile service area (that's larger than the state of Utah) and offers 2 and 4 year degree opportunities including a BA in Natural Resources and a BS in Biological Sciences.



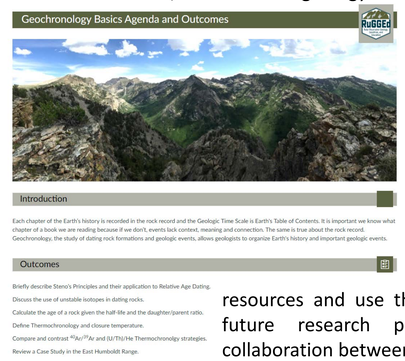
*Photograph by Joliene Jensen*

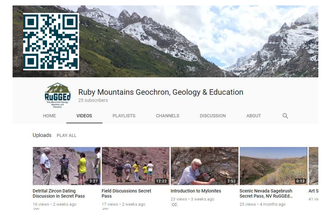


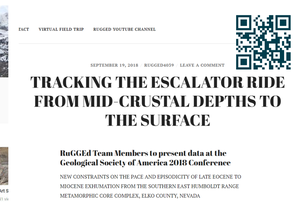

The Ruby Mountains are visible from several communities in GBC's vast service area including, Wells, Spring Creek, and the main campus in Elko, and provide opportunities for recreation, inspiration, and scientific research.

## Share Resources with the Scientific Community, Science Educators and the Public

Content modules regarding Metamorphic Core Complexes, Geochronology, and Methods are in development and will be accessible as open educational resources (OER) in Canvas Commons for all geoscience educators (K-12 and beyond) to access. These resources include learner outcomes, short lectures, aligned self-check assessments, an interactive geology field guide and links to additional resources. Short tutorials from the field and lab are available to the public on the RuGGEd YouTube Channel. Research results, updates, and links to the interactive map are available below. We plan to build these resources and use the same platforms on future research projects to promote collaboration between various institutions working on Nevada geology and to create a one-stop-shop for geoscience educators, professionals, and enthusiasts.




## Beyond Broader Impacts: The Future of Science Outreach

- Unify efforts throughout the sciences to improve public relations and trust – seriously, a full-throttle media campaign is required.
  - Commercials/PSAs highlighting researchers and their work
  - Science 'product placement' in films in TV shows
- Place more emphasis on the rigor and elegance of the scientific process, so scientific facts are put in context and not 'pulled out of the air'.
- Include non-scientists in the scientific process.

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*No rocks were harmed in the making of these films.

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