Broader Impacts and Evaluation: An Entry Point to ENGAGE Physical Scientists in Discussions of Geoscience Education Research

NICOLE LADUE, NORTHERN ILLINOIS UNIVERSITY

MICHAEL HUBENTHAL, IRIS
Purpose of this talk:

ENGAGE attendees, as a subset of the broader early-career population, are interested in learning more about GER.

Broader Impacts is a prime entry point to GER for physical scientists.

Clarifying the purpose of evaluation and research is key strategy for engaging physical scientists in GER.

Engaging with physical scientists could expand GER.
Rationale:
- Broader Impacts at NSF is ~20 years old
- GER has focused on solid earth, how can we expand this scope?
- Get them early!
  - Early career are forming their attitudes towards Geo Ed
  - GER as an opportunity to make broader impacts “scholarly”
  - Foster new projects and raise prestige of GER
Workshop Goal

Promote cross-disciplinary awareness and relationships among early-career researchers in geoscience and geoscience education.

For the workshop report:
Participation
33 early career participants selected from over 100 applicants

**Discipline Focus**
- Geoscience Education Research: 11
- Atmospheric Science: 3
- Ocean Science: 7
- Solid Earth: 7
- Polar Science: 3
- Other: 2

**Career stage**
- Post-doctoral Researcher: 8
- Research Associate: 4
- Instructor/Non-tenure track professor: 5
- Tenure-track professor: 13
- Other: 3
Prior Knowledge of Education Research

I can distinguish between high-quality and low-quality education research

I am very involved in education research projects

I have participated in education research

I can distinguish between education evaluation and education research...

I can distinguish between outreach and education research activities
Prior Knowledge of Education Research

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ENGAGE attendees, as a subset of the broader early-career population, are interested in learning more about GER
Broader Impacts & GER

Few broader impacts are GER projects.

B.I. budget in basic science proposal can be allocated to GER.

<5% of the EHR-IUSE budget goes towards geosciences.

J. Lawrence

Word cloud of B.I. 2007-2012
Broader Impacts & GER

Broader Impacts is a prime entry point to GER for physical scientists

Word cloud of B.I. 2007-2012

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CASE STUDY 3. RESEARCH OR EVALUATION

An education group designs a museum display to provide real-time earthquake information. The display includes a large screen map of current seismicity of different regions, a monitor with the list of earthquakes, and a set of mechanical drums showing current ground motion at three locations. A graduate student creates a set of questions to ask museum visitors based on the display design goals, and then spends time watching, tracking, timing, and interviewing museum visitors at two museums where the display is installed. Her results are used to determine whether the display is effective and to inform changes in future displays.
## Evaluation versus Research

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Research</th>
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<tbody>
<tr>
<td>Test the effectiveness of a model or intervention</td>
<td>Purpose is testing theory and producing generalizable findings</td>
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<tr>
<td>Questions originate with key stakeholders and primary intended users of findings</td>
<td>Questions originate with scholars in the discipline</td>
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<tr>
<td>Quality judged by those who will use those findings</td>
<td>Quality judged by peer review</td>
</tr>
<tr>
<td>Ultimate test of value is usefulness to improve effectiveness</td>
<td>Ultimate test of value is contribution to knowledge</td>
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Evaluation & Research

Evaluation:
Explains impact or efficacy

Research:
Explains phenomena
Geoscience Example

Baber et al., 2010

NSF-funded project: *Building and Maintaining a Pipeline for Diversity in the Geosciences* (Tanya Furman, P.I.)

- Summer research experience for undergraduates
- Evaluation of the program
- Theoretical Framework: Self-Efficacy
- Program increased Self-Efficacy – in particular Mastery Experiences and Role Modeling

Research was built into the evaluation
How to develop research from a broader impacts project:

- Identify a collaborator
- Develop a concise research question
- Identify appropriate existing theory related to that research question
- Choose methods that will answer your question
  - Are there particular methods appropriate for the educational theory guiding your work?
  - Are there particular methods associated with literature that informs this work?
- Provide adequate support in your proposal!!
How to develop research from a broader impacts project:

- What is your project? Who are you impacting?
- Identify a collaborator
- Develop a concise research question
- Identify appropriate existing theory related to that research question
- Choose methods that will answer your question
- Are there particular methods appropriate for the educational theory guiding your work?
- Are there particular methods associated with literature that informs this work?
- Provide adequate support in your proposal

Clarifying the purpose of evaluation and research is key strategy for engaging physical scientists in GER
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Engaging with physical scientists could expand the field of GER
Workshop Recommendations: Broadening the Impact of Geoscience Education Research

A deeper understanding of other DBER fields’ experience
  ◦ Examples of paths forward to increase scope and impact of geoscience education research (GER)

Increasing the number of GERs at more institutions, particularly at R1 institutions
  ◦ Opportunities to create research programs to train PhDs in DBER and hybrid programs

Dissemination of GER to a broader geoscience audience
  ◦ Find ways to advertise GER as an avenue for developing stronger Broader Impacts
Workshop Recommendations: Resources Needed

A new funding mechanism to support both the geoscientist and the GER in joint projects across NSF GEO and EHR

An electronic network to provide opportunities for geoscientists to meet or learn about GERs looking for collaborators on research.

A geoscience education research primer, including a summary of promising directions for the field, written for geoscience researchers.

Future opportunities to meet to continue sharing across discipline boundaries
Acknowledgements

Workshop Report:

EAR-1425893
EAR-1425927
Some Current Hurdles to Geoscience Education Research

*Shifting funding opportunities* present a challenge for new investigators to build upon pilot work targeted towards a particular solicitation.

*Recognition within departments* is needed for researchers to be able to engage in this type of work.

*Perceptions of the value of geoscience education research publications* as not equal to publications in other geoscience journals.