Introduction to Geoscience Education Research Methods

Hosted by the NAGT Geoscience Education Research Division

Presenter: Julie Sexton, Ph.D., University of Northern Colorado
Host and Logistics

Host

- Anne Gold

Logistics

- Audio on mute
- How to participate in polls
- How to provide input and ask questions in the chat box
- Troubleshooting
- Record webinar
About the Presenter

Julie Sexton
Assistant Director of Assessment
Research Associate
University of Northern Colorado

Geology Training
B.A. Geology
M.S. Geology

Geology Career
Petroleum Industry
Community College
Geol. Soc. Amer.

Geo Education Training & Career
Ph.D. Geo Ed
Geo Ed Researcher
Education Administrator
Agenda

1. What are topics people research?
2. What are the types of education research?
3. What are the purposes and characteristics of quantitative and qualitative research?
4. What are research study steps and components of a research plan?
5. Wrap-Up
Learning Outcomes

1. Describe differences between quantitative and qualitative education research
2. Describe the steps of the research cycle
3. Describe the components of a research plan
Activities

1. Polls

2. Input
In the chat box ....

3. Stretch & Ask Questions
Which option best describes your current position?

a. Student: undergraduate or graduate
b. Faculty: 2 or 4-year college/university
c. K-12 teacher
d. Researcher
e. Other
1. What are topics people research?
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5. Wrap-Up
<table>
<thead>
<tr>
<th></th>
<th>What are topics people research?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How do two teaching strategies affect student learning?</td>
</tr>
<tr>
<td>2</td>
<td>What are student attitudes about various teaching methods?</td>
</tr>
<tr>
<td>3</td>
<td>What is the relationship between students’ spatial abilities and their science knowledge?</td>
</tr>
<tr>
<td>4</td>
<td>What are the success factors for completion of a science degree?</td>
</tr>
<tr>
<td>5</td>
<td>What are the experiences of underrepresented students in science?</td>
</tr>
<tr>
<td>6</td>
<td>What are the characteristics of effective teacher professional development?</td>
</tr>
</tbody>
</table>
Current Research

What attracts students to a geology major?
1. What are topics people research?
2. What are the types of education research?
3. What are the purposes and characteristics of quantitative or qualitative research?
4. What are research study steps and components of a research plan?
5. Wrap-Up
What are the types of education research?

<table>
<thead>
<tr>
<th>Type</th>
<th>Data</th>
<th>Analysis Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative</td>
<td>Qualitative</td>
<td>Qualitative (text analysis)</td>
</tr>
<tr>
<td>Quantitative</td>
<td>Quantitative and/or Qualitative</td>
<td>Quantitative (statistical analysis)</td>
</tr>
<tr>
<td>Mixed</td>
<td>Qualitative &amp; Quantitative</td>
<td>Qualitative &amp; Quantitative</td>
</tr>
</tbody>
</table>
Poll

Question: Which of the research types have you conducted?

a. Qualitative only
b. Quantitative only
c. Mixed methods (in one study)
d. Both qualitative research and quantitative research (but not in the same study)
e. None yet
Poll

Research topic: What attracts students to a geology major?

Question: Which research type is most appropriate for the topic above?

a. Qualitative
b. Quantitative
1. What are topics people research?
2. What are the types of education research?
3. What are the purposes and characteristics of quantitative and qualitative research?
4. What are research study steps and components of a research plan?
5. Wrap-Up
What are the Purposes and Characteristics of Quantitative Research?

**Purpose**
1. Describe trends or explain the relationship among variables
2. Investigate or examine causality
3. Generalize findings to other groups
4. Need numerical results
What are the Purposes and Characteristics of Quantitative Research?

**Purpose**
1. Describe trends or explain the relationship among variables
2. Investigate or examine causality
3. Generalize findings to other groups
4. Need numerical results

**Characteristics**
1. Ask specific, narrow questions
2. Collect data that can be quantified
3. Large number of participants
4. More controls on design
5. Conduct statistical analysis and report numerical results
Two versions

• Version 1: Is flipped teaching effective?

• Version 2: What is the effect of flipped teaching and traditional lecture on college students’ conceptual understanding as measured by the final exam?
<table>
<thead>
<tr>
<th>Two versions</th>
<th>Elements to include</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Version 1</strong>: Is flipped teaching effective?</td>
<td>1. Clarify exactly what is to be investigated</td>
</tr>
<tr>
<td><strong>Version 2</strong>: What is the effect of flipped teaching and traditional lecture on college students’ conceptual understanding as measured by the final exam?</td>
<td>2. Identify variables (independent and dependent)</td>
</tr>
<tr>
<td></td>
<td>3. Identify participants</td>
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Stretch and Ask Me a Question
What are the Purposes and Characteristics of Qualitative Research?

Purpose
1. Investigate in-depth understanding of topic
2. Seek perspective of participant
3. Identify variables
4. Develop hypotheses and theories
What are the Purposes and Characteristics of Qualitative Research?

**Purpose**
1. Investigate in-depth understanding of topic
2. Seek perspective of participant
3. Identify variables
4. Develop hypotheses and theories

**Characteristics**
1. Ask broad, general questions
2. Collect descriptive data (e.g., words and pictures)
3. Small number of participants
4. Fewer/no controls on study
5. Conduct non-numerical analysis and report categorical results
Two versions

• Version 1: To what extent do students use the tutoring center to help them be successful in an intro geology class?

• Version 2: What are the resources and strategies students use to be successful in an intro geology class?

Input
In the chat box, list one way that the versions differ.
Qualitative Research Question Elements

Two versions

• Version 1: To what extent do students use the tutoring center to help them be successful in an intro geology class?

• Version 2: What are the resources and strategies students use to be successful in an intro geology class?

Elements to include

1. Clarify exactly what is to be investigated
2. Identify participants
3. Exploratory, broad language
4. Avoid language leading to quantification
## Deciding between Qualitative and Quantitative Research

<table>
<thead>
<tr>
<th>Quantitative</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Investigates causality and numerical relationships</td>
<td>1. Investigates what and how, in-depth participant perceptions</td>
</tr>
<tr>
<td>2. Numerical data</td>
<td>2. Non-numerical data</td>
</tr>
<tr>
<td>3. More controls on design</td>
<td>3. Fewer controls on design</td>
</tr>
<tr>
<td>4. Large sample size</td>
<td>4. Small sample size</td>
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## Deciding between Qualitative and Quantitative Research

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Research topic: What attracts students to a geology major?

Question: Which research type is most appropriate for the topic above?

a. Qualitative
b. Quantitative
### Case Study

#### Research topic: What attracts students to a geology major?

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<th>Type</th>
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<th>Data Collection</th>
<th>Analysis</th>
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<td>Quant</td>
<td>To what extent do interest, self-efficacy, and having role models predict students' intent to major in geoscience?</td>
<td>Likert-scale questions on a survey</td>
<td>Multiple step regression</td>
</tr>
<tr>
<td>Qual</td>
<td>What are the reasons students select a geoscience major? How did those reasons influence their decision to major in geology?</td>
<td>Interviews</td>
<td>Constant comparative analysis</td>
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5. Wrap-Up
What are research study steps?

1. Identify a problem or topic to investigate
2. Review literature
3. Create a research plan
4. Get institutional review board approval
5. Conduct study
6. Report results
What are research study steps?

1. Identify a problem or topic to investigate
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What are components of a research plan?

1. Identify a problem or topic to investigate
2. Review literature
3. Create a research plan
4. Get institutional review board approval
5. Conduct study
6. Report results

Research Plan
1. Research purpose and questions
2. Theoretical framework
3. Variables, factors, constructs
4. Research design
5. Participants and recruiting
6. Data and collection
7. Data analysis
8. Ensuring quality
9. Study Management
What are components of a research plan?

1. Research purpose and questions
2. Theoretical framework
3. Variables, factors, constructs
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Stretch and Ask Me a Question
1. **Topical Sessions**
   - T100: Barriers, Misconceptions, and Progress in Improving Climate Literacy and Strategies for Communicating about Climate Change
   - T113: Geoscience Education Research: Implications for Undergraduate Geoscience Teaching and Learning
   - T120: Making Thinking Visible: Actions and Expressions of Problem Solving and Decision Making in the Geosciences

2. **NAGT GER Division Meeting** - Sunday, Oct. 22, 6:10-6:55pm, Sheraton Seattle Hotel - Willow A

3. **GSA Town Hall on Geoscience Education Research Grand Challenges and Strategies** - Monday, October 23, 5:30-6:30pm, Washington State Convention Center - Room 2A
Thank you for attending and participating!

Please provide feedback on the webinar at

https://tinyurl.com/GERWebIntroEval

We will also send you the link.