Research on Geoscience Learning

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I am planning to talk about:

- What is research on learning?
- Why conduct research on learning?
- How is research on learning compare to traditional geoscience research?
- How does one get started conducting research on learning?

Are there other topics you would like us to address?

Brainstorm:

- What is research on geoscience learning?

What is research on learning?

- Geoscience education research:
  - Identify and understand learning in geoscience
  - Determine how learning is brought about
- Geoscience education includes:
  - Geoscience content
  - Social science
  - Pedagogy (teaching methods)

What is research on learning?

- Curriculum and Instruction research:
  - The links between classroom experiences and learning
- Application of research to developing and implementing new educational tools or materials to enhance learning

What is research on learning?

- Geocognition research:
  - The cognitive processes underpinning perception, understanding, learning
- Other factors that influence learning, such as:
  - Metacognition
  - Affective domain
  - Place-based learning

Example topics

- Investigating the role of illustrations and animations in learning
- Determining the effects of spatial visualization skills
- Developing and assessing strategic earth science teacher preparation
- Tracing the novice-expert continuum from pre-college to professional geoscientists

Example topics

- Developing instruments to assess student learning
- Measuring the effectiveness of teaching strategies
- Investigating the connection between the affective domain and learning
- Determining causes of misconceptions

Why research learning?

- To explore the fascinating realm of human learning
- To become a better teacher
- To level the playing field
  - E.g. Figure out how to help strugglers thrive
  - E.g. Increasing representation of women and minorities in STEM disciplines
- Your reasons?

Brainstorm:

- How is research on learning similar to and different from traditional geoscience research?

Similarities to geoscience research

- Working to answer significant and interesting questions
- Testing multiple working hypotheses
- Collecting data via observations
- Interpreting large, incomplete data sets (sometimes using statistical analyses)
- Exploring causal relationships within a complex system, inferring process and cause from observed behaviors

Similarities to geoscience research

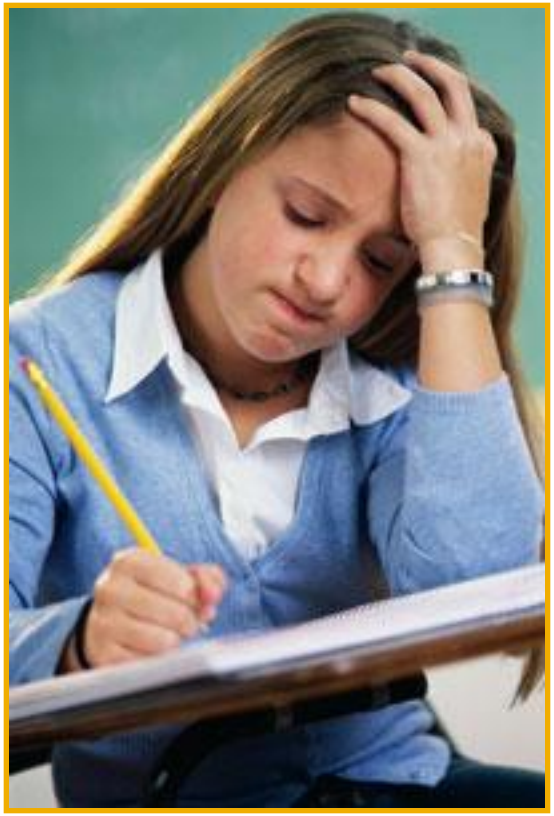
- Collaborate with scientists in other fields
- Data only good if instrument is calibrated/valid and reliable
- Better if you collaborate
- Test hypotheses with experiments
- Qualitative vs. quantitative

Differences from geoscience research

- Human subjects!
  - IRB (Institutional Review Board): your ethical watchdog
  - So many possible confounding factors….
- Your classroom is your laboratory
- How you collect data
  - Instruments used

Getting started: ideas

- Identify a question that intrigues you: what do you want to know about the learning process?
- Watch your students:
  - Where do they struggle?
  - Why are they struggling?
  - Who is struggling? With what?



Getting started: ideas

- Do your homework: find out what has been done and who is currently working on similar questions
  - Read the science education literature (e.g. Journal of Geoscience Education)
  - Go to research on learning sessions at conferences
  - Join the geoscience education research interest email list (run by Julie Libarkin)
  - Read successful educational research proposals

Getting started: resources

- Funding:
  - Can you do a pilot study without funding?
  - If not, how much funding do you need to collect preliminary data (to convince people that your idea is worth pursuing further)?

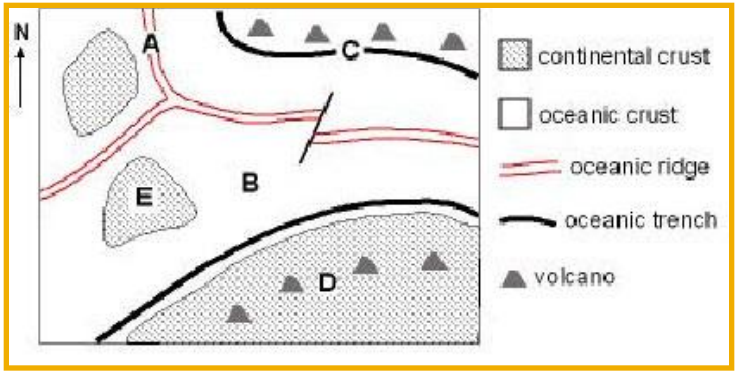
Getting started: resources

- Expertise:
  - Do you have the expertise you need, or will you need to find or recruit collaborators?
    - From Education?
    - From Psychology?
    - From other science departments?
    - From other institutions?
  - Is there someone on your campus (in your department, even) who has submitted a proposal to your IRB?

Your questions?

Our current projects: Karen

- Identify and explain student misconceptions
  - Rocks
  - Tectonic plates and boundaries
  - Organismal relationships and cladograms
- Develop and assess pedagogic tools to improve learning
  - Lecture Tutorial worksheets
  - ConcepTest questions
  - Middle-school investigation
  - Intro Geo Textbook
- Assess knowledge
- Disseminate information / lead workshops



Our current projects: Carol

- Spatial thinking in the geosciences:
  - What spatial skills do students bring to geoscience classes?
  - How do geoscience courses affect students' spatial skills?
  - What can instructors do to help students develop their spatial thinking skills?