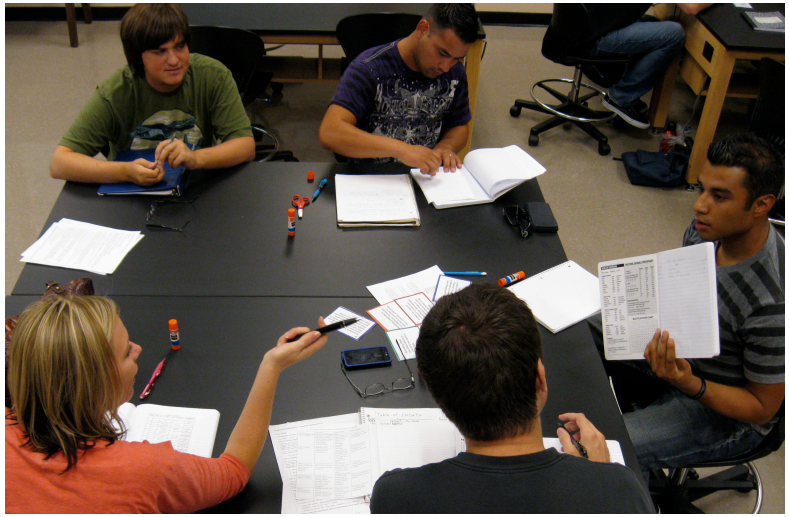
Educational Research on Teaching: Integrating with your Research & Teaching Program



Tuesday July 11th

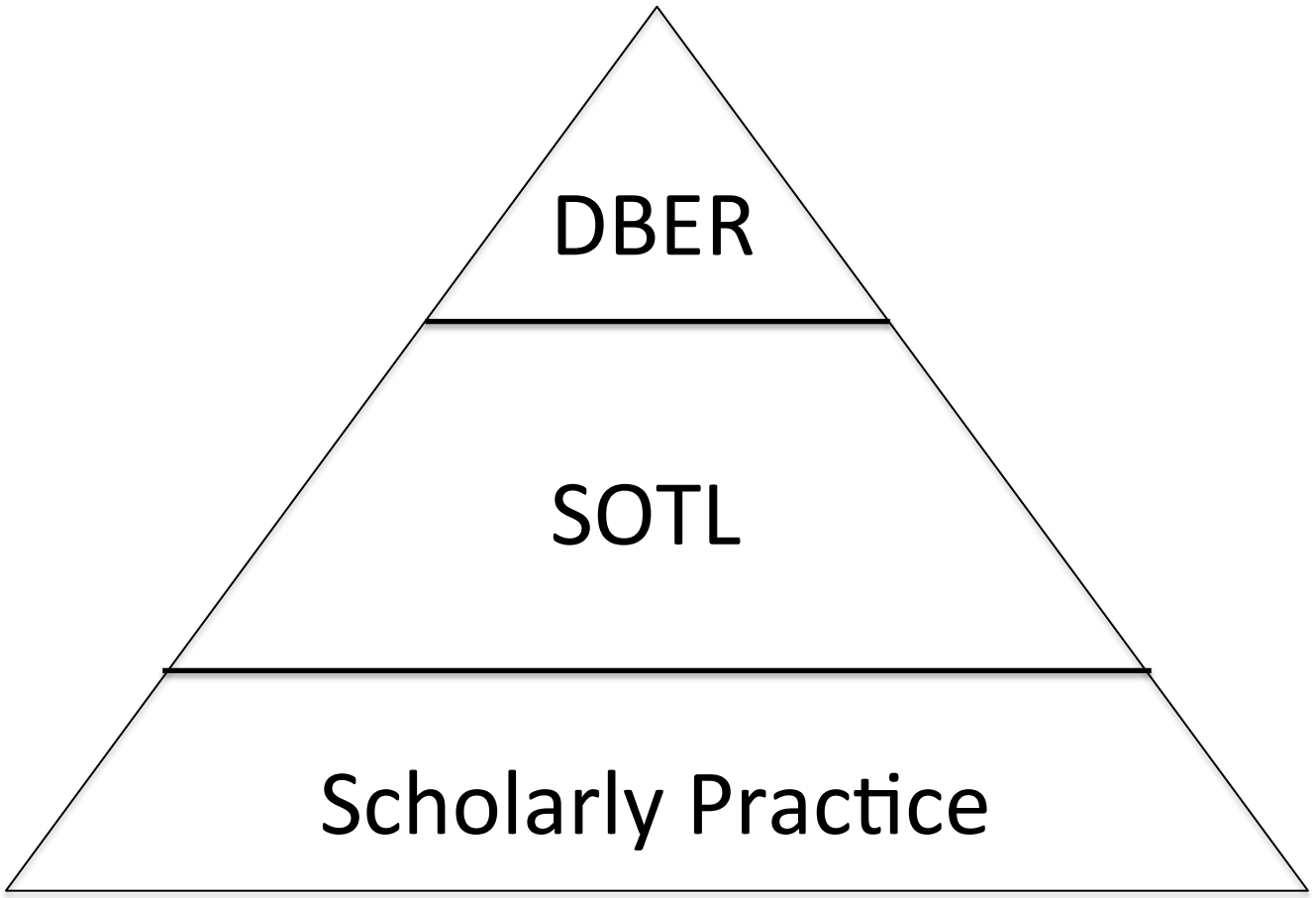
Kaatje Kraft with contributions from Karen Kortz, Carol Ormand, and Cindy Shellito

Questions to answer for this session:

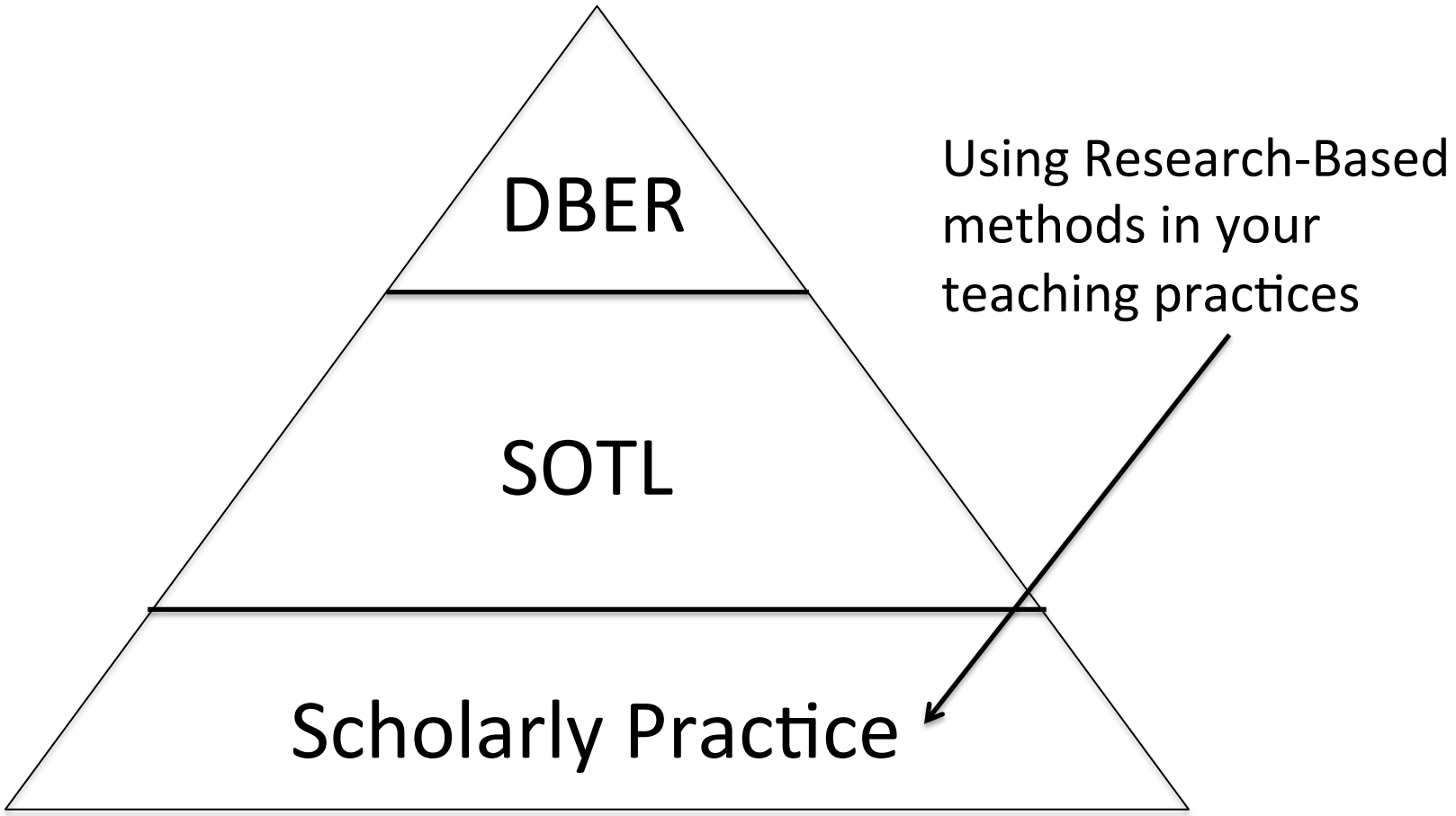
- What is this learning alphabet soup?
- How does research on learning compare to traditional geoscience research?
- How does one get started conducting research on learning?

At the end, you will brainstorm a small research project you can implement next semester.

Welcome to the Alphabet Soup…

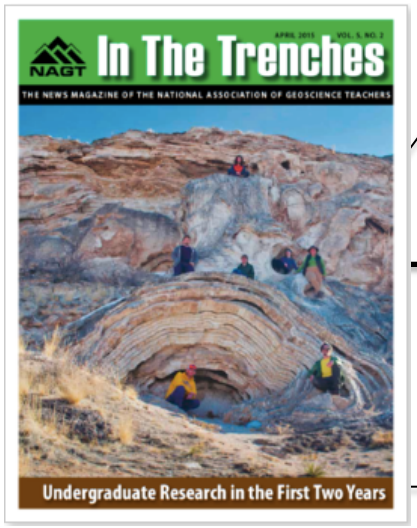


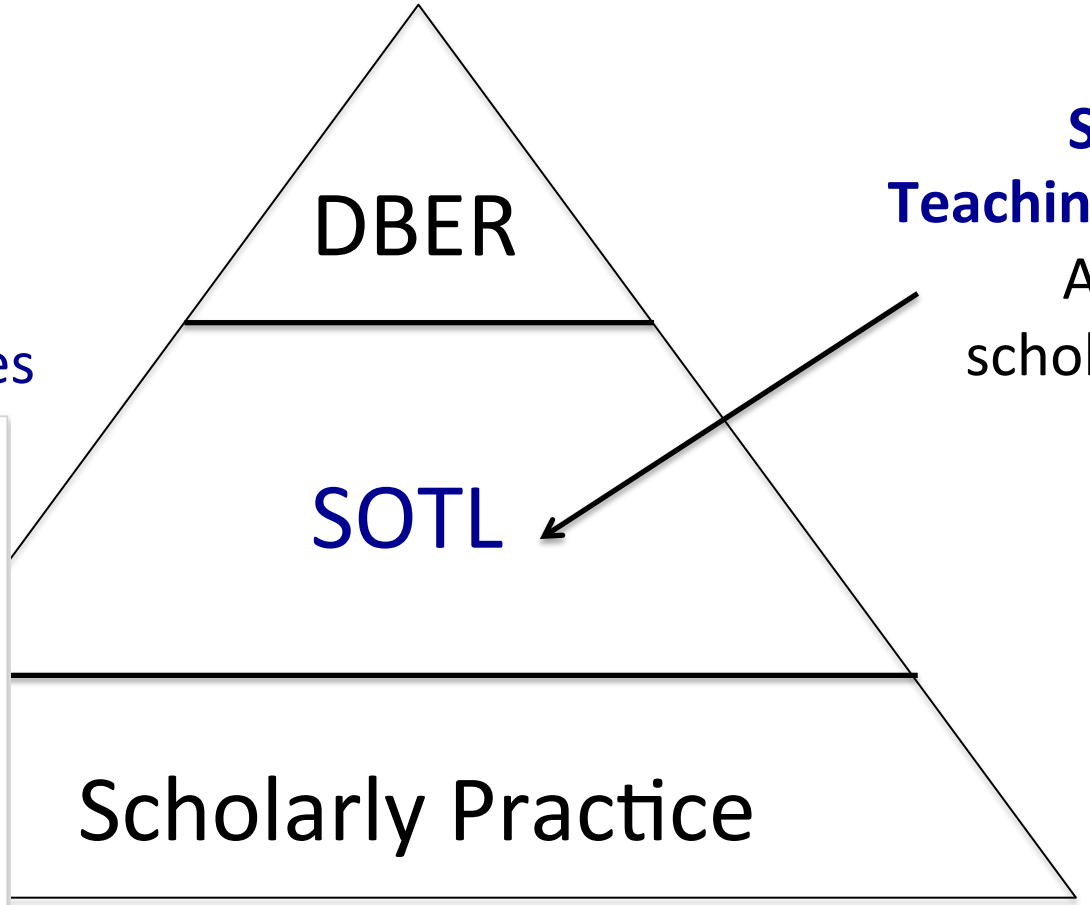
Welcome to the Alphabet Soup…



Welcome to the Alphabet Soup…

GSA/
In the Trenches

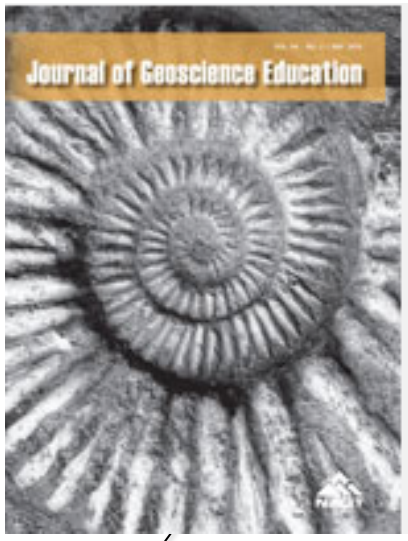




Scholarship of Teaching & Learning:
Assessing your scholarly practices

Welcome to the Alphabet Soup…

GSA/
Journal of Geoscience Education



Discipline Based Education Research: Analyzing teaching practices at a larger scale and/or for a broader audience

Kinesthetic continuum

- On a line from Scholarly practitioner to DBER, put yourself where you currently see your practice.
- Now move to where you would like to see yourself (or stay still if you are content with your current location). Talk with your neighbors:
  - What do you see as the challenges of getting to where you want to be/where you are?
  - What questions do you have?

DBER: Discipline Based Educational Research

- Understand how people learn the concepts, practices, and ways of thinking of geoscience
- Understand the nature and development of expertise
- Identify and measure learning objectives and instructional approaches
- Contribute to the knowledge base to transfer DBER findings to classroom practice
- Identify approaches to make geoscience education broad and inclusive

Singer et al., (2012) Discipline Based Education Research, National Academies Press.

Theoretical vs. Applied Research

- Theoretical (Research)
  - The cognitive processes underpinning perception, understanding, learning
  - Metacognition, affect (motivation, emotions, interest), place-based learning
  - Programmatic analysis
- Applied (Curriculum and Instruction)
  - The links between classroom experiences and learning
  - Application of research to developing and implementing new educational tools or materials to enhance learning

Determine if the following research questions are Theoretical or Applied

1. Do students learn concepts better if they have illustrations or animations?
2. How do spatial visualization skills affect learning?
3. How do students move from novices to experts, from pre-college to professional geoscientists?
4. What is the effectiveness of process-of-science labs?
5. How does student motivation influence learning in the classroom?

Brainstorm with your neighbor(s):

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

Similarities to Geoscience Research:

- Answering significant and interesting questions
- Testing hypotheses (often with experiments)
- Collecting data via observations
- Interpreting large, incomplete data sets (sometimes using statistical analyses)
- Inferring process and cause from observed behaviors
- Collaborating with scientists in other fields
- Data only good if instrument is calibrated/valid and reliable
- Qualitative vs. quantitative
- Theoretical vs. applied

Differences from Geoscience Research:

- Human subjects!
  - IRB (Institutional Review Board)
    - St. John, K. (2016) JGE 64(2) 99-100.
  - So many possible confounding factors….
- Your classroom *may* be your laboratory
- How you collect data
  - Instruments used
- Attitude of other faculty/administrators
- Less professional support

Getting Started

- Identify a question that intrigues you
  - What do you want to know about the learning process?
  - What do you want to know about what works in your own classes?
- Watch your students and where/why/who struggles
- Most faculty start with applied research

Getting Started

- Read the science education literature & other key meta-studies
- Go to research on learning sessions at conferences (e.g. GSA)
- Read successful educational research proposals

http://nagt.org/nagt/geoedresearch/toolbox/index.html

Quick Ideas

- Spend a few minutes coming up with a small research project you can implement next semester.
  - What question do you want to answer?
  - What methods will you use to answer your question?
  - How will you collect data?

Example Future Geoscience Education Research

- Spatial Thinking
  - Describe the suite of spatial skills that geoscientists use
  - Measure the extent to which these spatial skills are cognitively related (are students who are good at mental rotation also good at navigation?)
  - Measure the efficacy of different teaching methods for developing spatial thinking skills: what training works, when, for whom?
  - Characterize how experts differ from novices
    - In their proficiency at specific spatial thinking tasks
    - In the types of errors they make
    - In their choice of spatial problem-solving methods

Other Resources

- GER Toolbox: http://nagt.org/nagt/geoedresearch/toolbox/index.html
- Earth & Mind Blog: https://serc.carleton.edu/earthandmind/index.html
- Discipline Based Education Research Report (2012): https://www.nap.edu/catalog/13362/discipline-based-education-research-understanding-and-improving-learning-in-undergraduate
- Outcome of DBER Report (2015): https://www.nap.edu/catalog/18687/reaching-students-what-research-says-about-effective-instruction-in-undergraduate