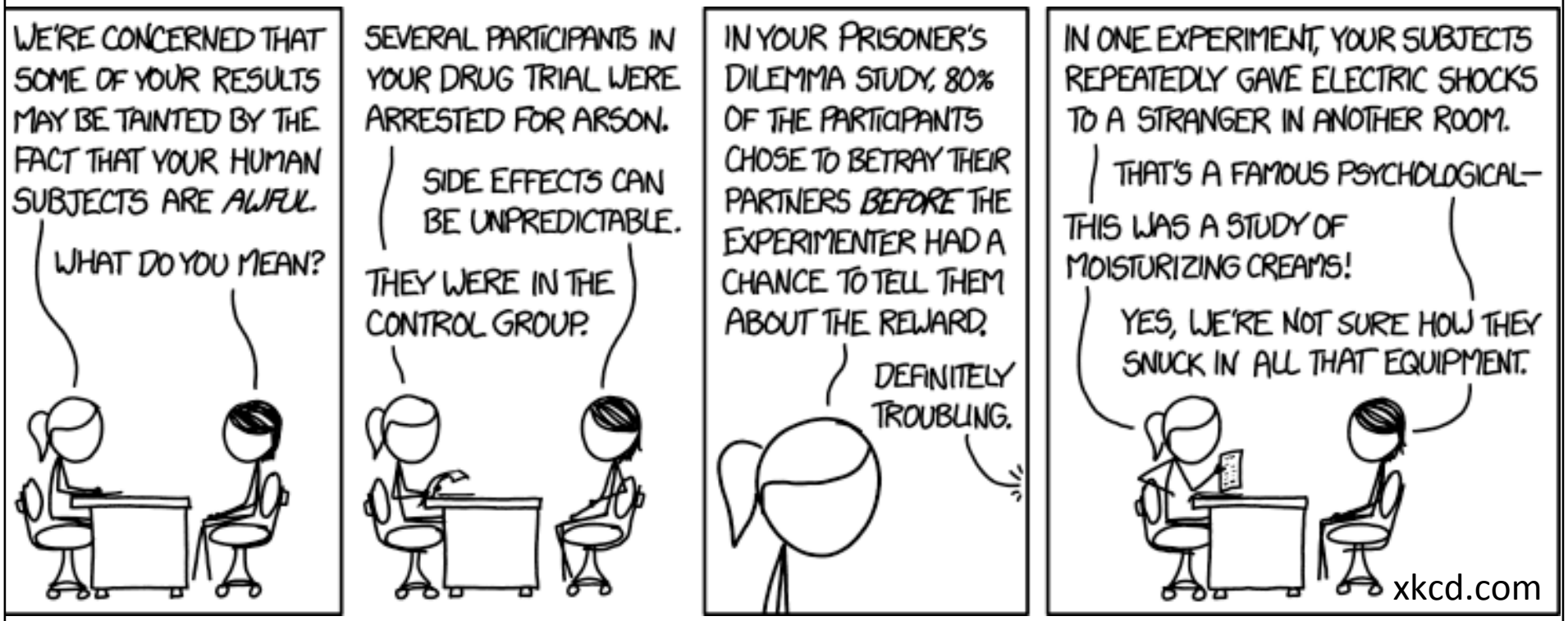
# Scholarship of Teaching and Learning




*Strategies for Research & Scholarship*

*Tuesday July 26th*

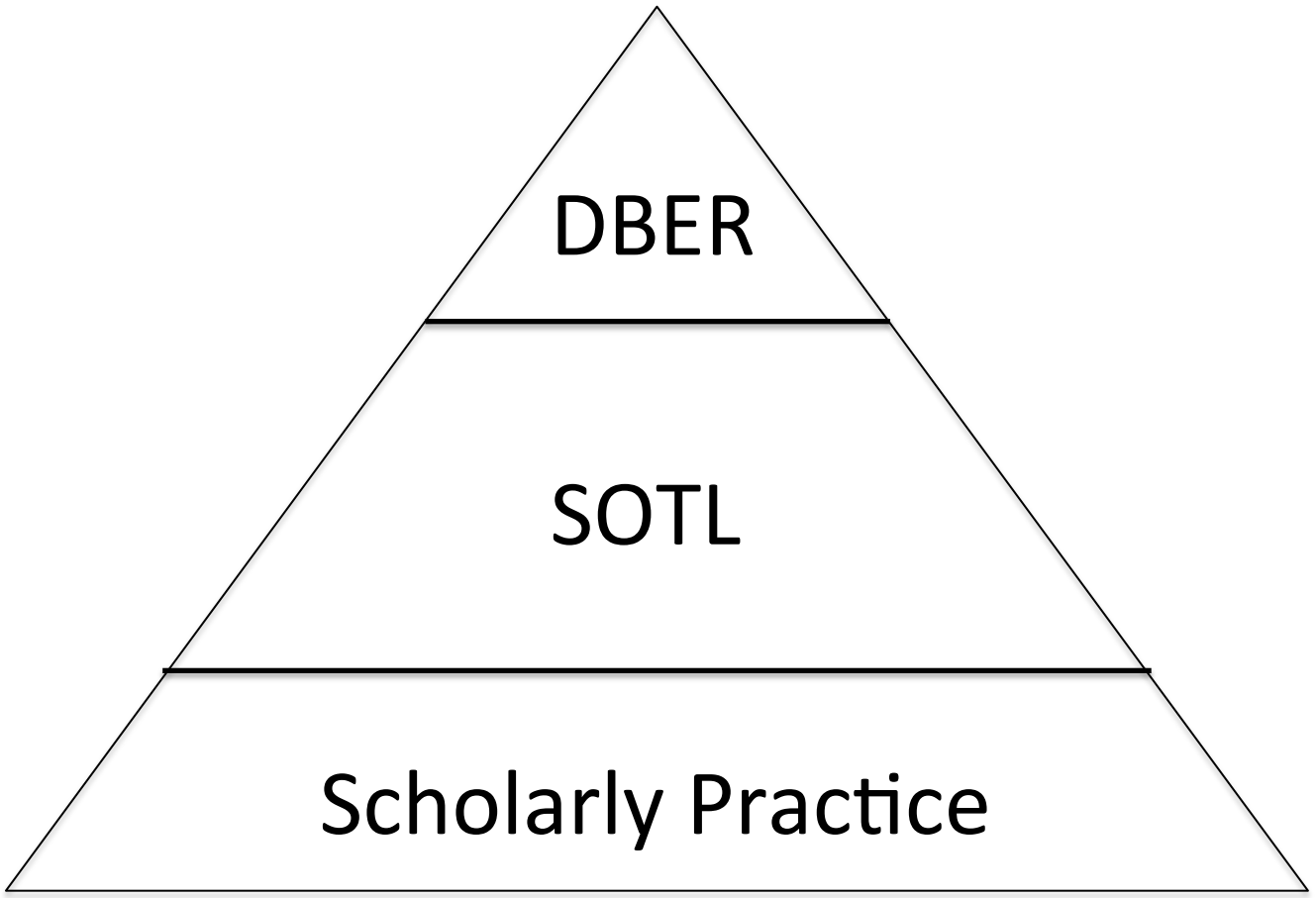
*Kaatje Kraft with contributions from Karen Kortz, Carol Ormand, and Cindy Shellito*

# 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…



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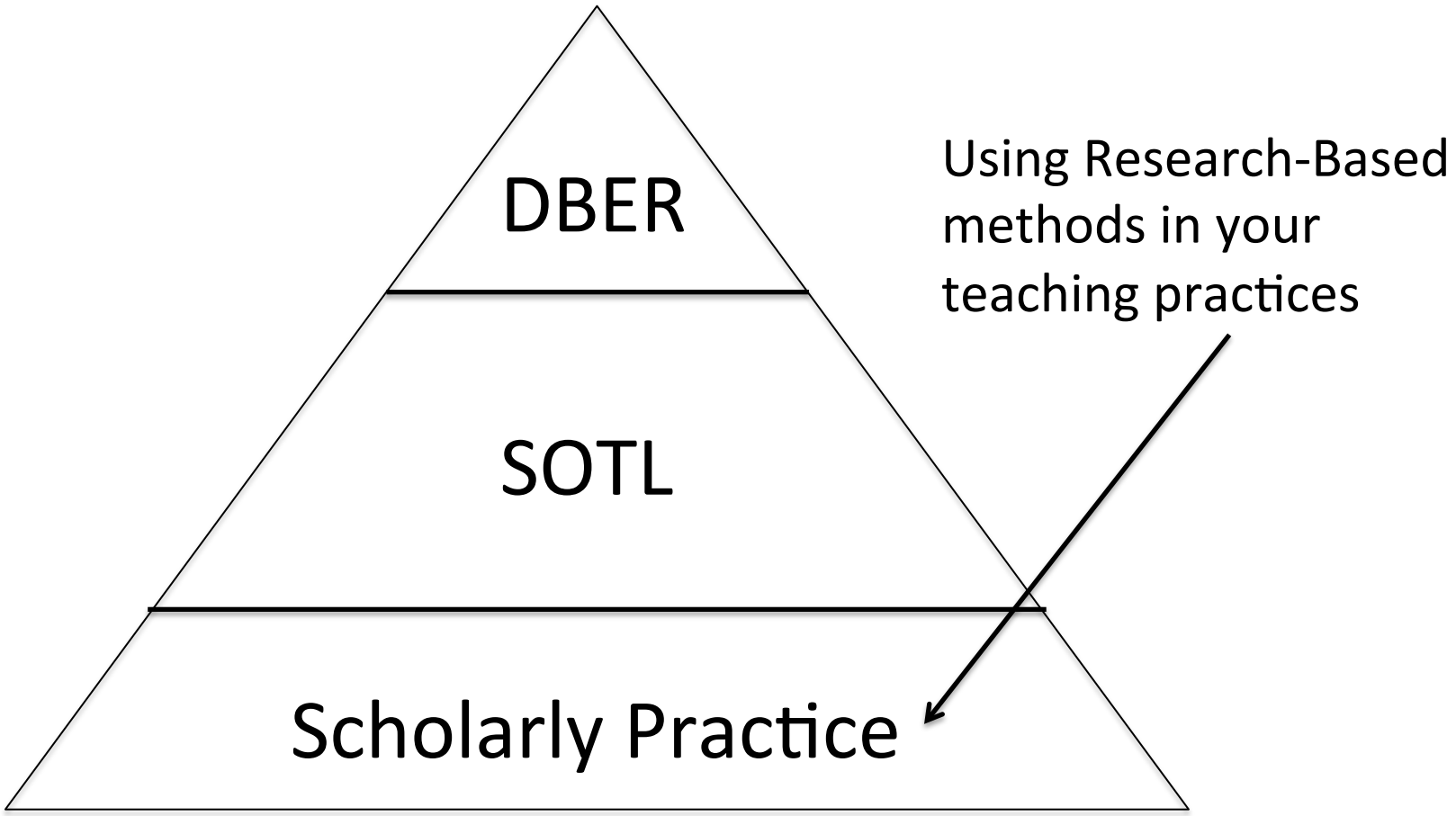
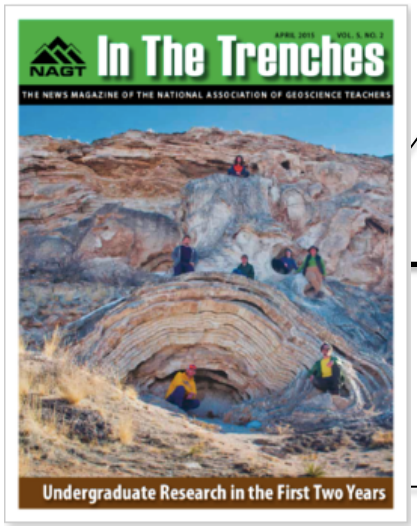
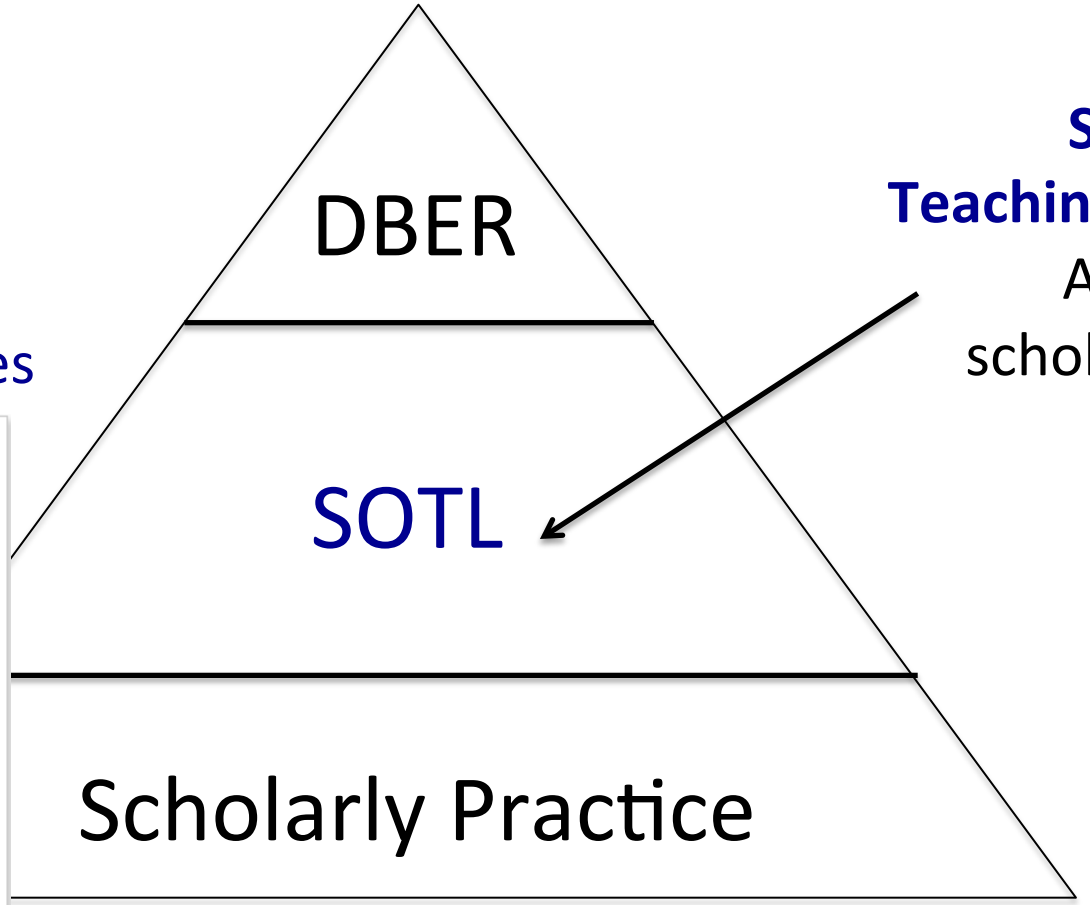


# Welcome to the Alphabet Soup…

GSA/
In the Trenches

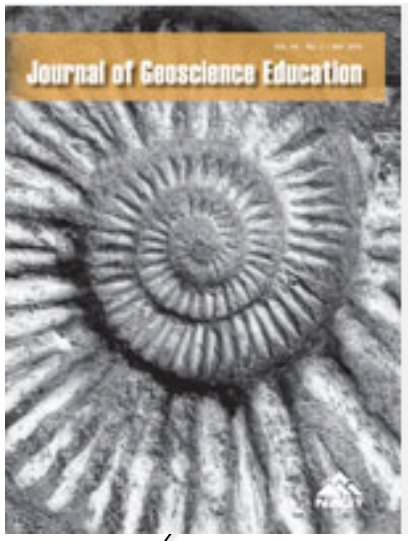



**Scholarship of Teaching & Learning:**
Assessing your scholarly practices

# 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

# Place yourself on a continuum

- On a line from Scholarly practitioner to DBER, put yourself where you currently see yourself.
- 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?

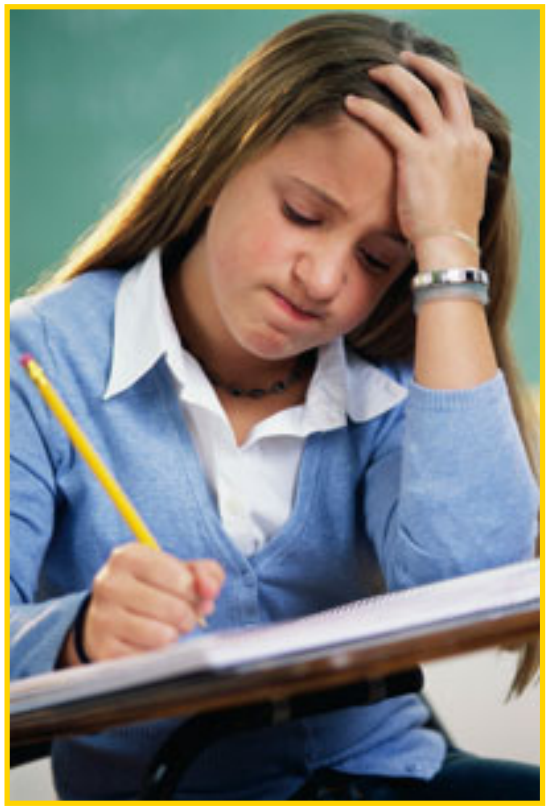
# Similarities to Geoscience Research:

# 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

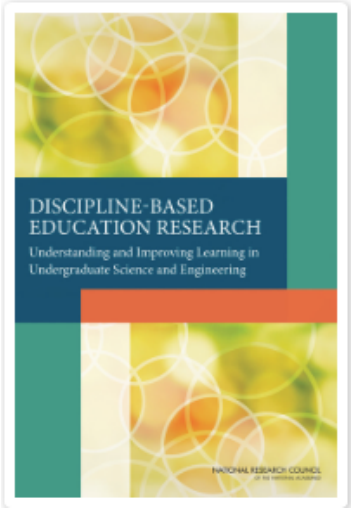
# Getting Started

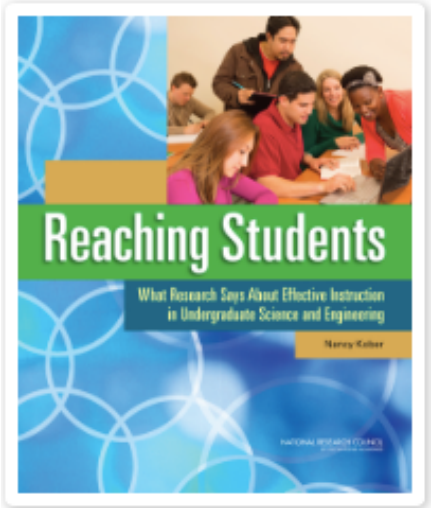
- Identify a question that intrigues you
  - What do you want to know about the learning process?
  - What do you want to know about what works in your own classes?
- Watch your students and where/why/who struggles
- Most faculty start with applied research



# Getting Started

- Read the science education literature (e.g. Journal of Geoscience Education)
- Go to research on learning sessions at conferences (e.g. GSA)
- Read successful educational research proposals
- National Academies DBER Report and accompanying support documents:



# Strategies for Aspiring JGE Authors

1. Do your homework, and put your work in a literature-based context.
2. Provide a well defined purpose with methods that are appropriately explained and applied.
3. Description of the study setting and population
4. Evidence of effectiveness is essential to a strong argument: conclusions need to be evidence based with validity and reliability
5. Do not just report results; discuss why they are meaningful both to your particular situation and more broadly.
6. Have IRB approval
7. **Remember, you don't have to do this alone: don't be afraid to collaborate**

St. John et al. (*2016*) Un-packaging Manuscript Preparation and Review Guidelines for Curriculum and Instruction and Research Papers. JGE: 64(1):1-4.

# Strategies for Aspiring "In the Trenches" Authors

1. Document your experiences with new teaching methods in an informative, accessible, and entertaining way
2. Share your thoughts about teaching and interesting ideas – start a trend!
3. Share you great photos with the NAGT community (or have your students share their photos)

# 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?

# Geo-DBER Future Research Needs

1. **Students' conceptual understanding** (DBER Ch 4)
   - Misconceptions and preconceptions
   - Concept inventories
2. **Cognitive domain and problem solving** (DBER Ch 5)
   - Quantitative reasoning
   - Spatial reasoning
   - Using and understanding models, simulations, and visualizations of Earth processes
3. **Instructional strategies to improve geoscience learning** (DBER Chap 6)
   - Design, use, and evaluation of different instructional strategies and their effectiveness in various settings (e.g., large lecture, lab)
   - Role of technology (e.g., hybrid learning, e-learning)
4. **Students' self-regulated learning / metacognition**
   - Basic learning assessment methods: Minute papers, knowledge surveys, etc.
   - Developing students' study skills

Source: http://nagt.org/nagt/profdev/workshops/geoed_research/ger_topics.html

# Geo-DBER Future Research Needs

5. **Affect and geoscience students** (DBER Chap 7)
   - Attitudes and motivation
   - Values
6. **Access and success**
   - Recruitment and retention of geoscience students
   - Broadening participation, diversity and inclusion
7. **Nature of science / nature of geoscience** (DBER Chap 7)
   - Teaching nature of science throughout the curriculum (e.g, introductory, upper-level)
   - Using research and research-like experiences
8. **Elementary, middle, and secondary teacher education**
   - Pre-service teacher preparation
   - Development and assessment of NGSS curriculum
9. **Professional development of college/university educators**
   - Preparation and continuing professional development for geoscience faculty
   - Preparation and professional development of teaching assistants

# 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