# Heads and Chairs: Future of Undergraduate Geoscience Education

## Day 2

**Reflection:**

- What stood out from Day 1?
- What was relevant/important?
- What are key next steps?

8:30-8:45

# Introduction to Backward Design and a Matrix tool for Program Design

I. Identifying Desired Skills, Experiences, Content, and Values

II. Building Program Matrices

III. Using the matrix for Assessment

*Slides adapted from TWP program and Dave Mogk*

8:45-9:05

# Curriculum Approach – Traditional instructional paradigm

Build from content - emphasis on individual courses and content

# Curriculum Development – Backward Design, Learning paradigm

**Start by Identifying desired outcomes of degree program (Program Level Learning outcomes – PLLOs)**

- *Discipline concepts and content*
- *Discipline specific skills*
- *Earth science habits of mind*
- *Professional skills*

***"Threshold concepts"*** *– "the ideas that are fundamental to progressing beyond elementary thinking in a discipline"*

*--Meyer and Land, Bass*

# Backward Design – Fundamental Questions

- What is the desired profile of the student leaving your department?
  - Learning outcomes (skills, concepts, competencies) identified for the program, linked to workforce preparation (Day 1)
- How does the program help students achieve outcomes?
  - Matching outcomes to curricular/extra curricular experiences
- Considerations
  - Opportunities and challenges related to resources (faculty, course credits, equipment…)

# A Matrix Approach to Curricular Design

| **Courses→ Skills↓** | 110 | 120 | 210 | 220 | 230 | 240 | 250 | 255 | |
|---|---|---|---|---|---|---|---|---|---|
| General skills | | | | | | | | | |
| Computer skills | | | | | | | | | |
| Field skills | | | | | | | | | |
| Lab skills | | | | | | | | | |
| Interpretive skills | | | | | | | | | |

This matrix concept has been used by the geology departments at Carleton College and at College of William & Mary.

# A Breakdown by Experience

| **Courses→ Skills↓** | 110 intro | 120 intro | 210 geomorph | 220 tect | 230 paleo | 240 Italy | 250 min | 255 pet | |
|---|---|---|---|---|---|---|---|---|---|
| Essay | | a | a | | a | | | | |
| Poster | s | s | a | a | a | | | | |
| Field report | a | | a | | a | a | | a | |
| Library research | s | s | s | a | | | a | a | |
| Research proposal | | | | | s | s | s | | |

A = always; S = sometimes

# Rule of 3's (or 4's)

– If something is worth learning, students need multiple exposures and opportunities

| | |
|---|---|
| • Exposure<br>• Familiarization<br>• Competency<br>• Mastery | • Introduced<br>• Practiced<br>• Mastered/Evaluated |

# Learning Sequences

Based on Bloom's Taxonomy

- Observation of Earth **(remembering)**
- Description of Earth materials and land forms **(understanding)**
- Interpretation of Earth processes **(application)**
- Integration of multiple lines of evidence to address geologic (and societal) problems of consequence **(analysis, synthesis, evaluation)**

# Whole Student Approach

- Define programmatic student learning goals
- Align course sequences to reinforce and anticipate essential concepts and skills
- Integrate co-curricular elements.
- Embed assessments throughout the program to demonstrate mastery
- Prepare students to be life-long learners

# Examples

Matrix Approaches to Program and Curriculum Design

https://serc.carleton.edu/NAGTWorkshops/departments/degree_programs/matrix.html

Carleton

Montana State

Georgia Southern

New Mexico Environmental Sciences

St. Mary's Environmental Studies

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*Interdisciplinary Teaching about Earth for a Sustainable Future*

| | | | | GEOLOGIC TIME | | COMPOSITION AND ARCHITECTURE of EARTH | | | EARTH SURFACE | | | HUMAN DIMENSIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Evolution Life | History of Earth | Mineral, Rock, Fossil Identification, core | Structural Geology, Tectonics | Internal Processes that Shape Earth | Landforms Surface Processes | Weather, Climate, Oceans | Biosphere | Environmental, Hazards, Resources | Human Systems, Cultural Historical Economic | Policy Planning | Technical Skills ; e.g. petrography core logging X-sections | Computation, modeling | Analysis, Experiment | Application of principles, physics, chemistry, biology | Field Methods Practices |
| **Year 1** | | | | | | | | | | | | | | | | | | | |
| Erth 101 | Earth System Science | F, S, Su | Schmitt | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | | | 1 | |
| Erth 201 | Honors Earth System | F | Lageson | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | | | 1 | |
| Erth 102 | Topics in Earth Science | F,S | Mogk | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | | | 2 | | 1 |
| **GPHY 121** | **Human Geography** | **F** | **Haggerty** | | | | | | | **1** | **1** | **1** | **3** | **1** | | | | | |
| GPHY 141 | World Regional | F, S, Su | Wyckoff | | | | | | 1 | 2 | 1 | 1 | 3 | 3 | | | 1 | | 1 |
| GEO 103 | Introduction Enviromental | S | Mogk | | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | | | 2 | | |
| GEO 105 | Oceanography | F alternate even | Schmitt | 2 | 2 | | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | | | | | |
| GEO 111 | Dinosaurs | F alternate odd | Varricchio | 3 | 2 | 1 | | | | | 1 | | | | | | | 2 | |
| GEO 140 | Planetary Geoscience | F alternate odd | Schmitt | 1 | 2 | 1 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | | | | | | |
| YEAR 2 | | | | | | | | | | | | | | | | | | | |
| Erth 212 | Yellowstone Scientific Lab | F | Whitlock | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | | | 2 | 2 | 2 |
| GPHY 284 | Intro to GIS Science | F,S | Challender | | | | | | | | | 2 | 2 | 1 | | | 1 | | 1 |
| GEO 208 | Earth Materials | F | Mogk | | 1 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 1 | | 3 | 1 | 2 | 2 | 1 |
| GEO 211 | Earth History and Evolution | S | Feeley | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | | | | | | | | |
| Year 3 | | | | | | | | | | | | | | | | | | | |
| | Weather and | | | | | | | | | | | | | | | | | | |

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| **BACHELOR OF SCIENCE IN GEOLOGY PROGRAM LEARNING OUTCOMES** | **CORE COURSES Core Area** | | | **COURSES REQUIRED FOR THE MAJOR** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CORE AND REQUIRED COURSES | D1, BS | D1, BS | D1, BS | BS | BS | BS | BS | BS | BS | BS | BS | BS |
| **ACTIVITIES** | GEOL 1110 Earth Lab | GEOL 1121 Introduction to the Earth | GEOL 1122 General Historical Geology | GEOL 3520 Field Methods | GEOL 3541 Mineralogy | GEOL 3542 Petrology and Petrography | GEOL 4120 Introduction to Research | GEOL 4610 Senior Seminar | GEOL 4820 Senior Thesis Research | GEOL 5142 Stratigraphy and Sedimentation | GEOL 5440 Structural Geology | OFF CAMPUS Field Geology |
| Computer Methods | | | | | | | | | | | | |
| Term Paper | | | | Term Paper | | | Term Paper | Term Paper | Term Paper | Term Paper | | Term Paper |
| Poster Presentation | | | | | Poster or | Poster | | | | | | |
| Oral Presentation | | | | | Oral | | Oral | Oral | | | | |
| Group Projects | | | | Group | Group | | Group | | | | Group | Group |
| Field Work | Field Work | | | Field Work | Field Work | Field Work | | | Field Work | Field Work | Field Work | Field Work |
| *Discipline Specific Knowledge* | | | | | | | | | | | | |
| 1. Graduates will be able to identify common Earth materials and interpret their composition, origin, and uses. | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Considered | *Strongly Emphasized* | Strongly Emphasized | Emphasized | Emphasized | Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized |
| 2. Graduates will be able to describe the processes operating at and beneath the Earth's surface, how those processes create the Earth's landscape, and how humans affect and are affected by the processes. | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Considered | Considered | Strongly Emphasized | Emphasized | Emphasized | Emphasized | Emphasized | *Strongly Emphasized* | Strongly Emphasized |
| 3. Graduates will be able to outline the broad physical and biological history of the planet and the evidence for that history. | Emphasized | Considered | Emphasized | Not Considered | Considered | Not Considered | Emphasized | Emphasized | Emphasized | *Strongly Emphasized* | Emphasized | Strongly Emphasized |
| 4. Graduates will be able to outline the regional geology of the Southeastern United States and North America. | Considered | Considered | Considered | Considered | Emphasized | Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | *Strongly Emphasized* | Emphasized | Strongly Emphasized |
| *Problem-Solving Skills* | | | | | | | | | | | | |
| 5. Graduates will be able to apply physics, chemistry, biology, and mathematics concepts to the study of the Earth's Systems Science and the planet's evolution. | Emphasized | Emphasized | Strongly Emphasized | Considered | Strongly Emphasized | *Strongly Emphasized* | Considered | Considered | Emphasized | Strongly Emphasized | Strongly Emphasized | Emphasized |
| 6. Graduates will be able to use specific skills (e.g., map reading, field methods and observations, laboratory methods for analysis, image processing) to interpret geological materials, history, and features. | Strongly Emphasized | Emphasized | Considered | *Strongly Emphasized* | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized |
| 7. Graduates will design and complete a program of independent research under the direction of the faculty. | Not Considered | Not Considered | Not Considered | Considered | Considered | Considered | Strongly Emphasized | *Strongly Emphasized* | Strongly Emphasized | Considered | Considered | Strongly Emphasized |
| *Communication Skills* | | | | | | | | | | | | |
| 8. Graduates will be able to critically evaluate fundamental Earth science literature and spatial data (e.g., photographs, maps, remotely sensed images). | Strongly Emphasized | Considered | Not Considered | Strongly Emphasized | Considered | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | *Strongly Emphasized* | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized |
| 9. Graduates will able to present geological information clearly in written, graphic, and oral form. | Considered | Considered | Not Considered | Strongly Emphasized | Emphasized | Strongly Emphasized | *Strongly Emphasized* | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized |
| 10. Graduates will be able to articulate the benefits and responsibilities of working as a member of a team. | Strongly Emphasized | Not Considered | Strongly Emphasized | Strongly Emphasized | Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Strongly Emphasized | Emphasized | *Strongly Emphasized* |

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| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | ENVS CORE CLASSES | | | | | | | | |
| 2 | | | | F | Sp | F | F | Sp | F | Sp |
| 3 | **Learning Outcome/objective** | **The Blue Planet (ENVS 101)** | **The Blue Planet Lab (ENVS 102L)** | **ENVS 320L (4): Environmental Systems (*formerly ENVS 330)** | **ENVS 321L (4): Earth Materials / Critical Zone** | **ENVS 322L (4): Life and the Earth Systems** | **ENVS 315 Statistics in Earth Sciences** | **ENVS 323L (4): Water in the Earth System** | **ENVS 324 (3): Earth's Climatic Environment** | **ENVS 430L: Advanced Environmental Systems / Environmental Field Methods (Capstone)** |
| 4 | | 3 | 1 | 4 | 4 | 4 | 3 | 4 | 3 | 4 |
| 5 | **Pre-Requisites** | None | | ENVS 101/102 OR EPS 101/105L; MATH 121 | ENVS 320L; CHEM 121/122L; MATH 150 OR MATH 153 | ENVS 321L; MATH 150 OR MATH 153; BIOL 123/124L | | ENVS 321L OR EPS304L; MATH 162; PHYC 160; CS151L; ENVS 315 | ENVS323L; MATH 163; PHYC 160 | ENVS 324L |
| 6 | **Co-Requisites** | None | | | | | MATH 162 | MATH 163 | | |
| 7 | **CLASSES YOU SHOULD BE TAKING** | Math 121 or Math 150 or Math 153; CHEM 121/123L | MATH 121 OR MATH 150 OR MATH 153; CHEM 121/123L | CHEM 122/124L; MATH 150 OR MATH 153 | MATH 162 | PHYS 160 | | MATH 163 | | |
| 8 | | Staff | | Weissmann | Fisher | Myer | Gutzler | Weissmann | Gutzler | Meyer |
| 9 | | | | Scuderi | | Scuderi | Galewsky | Galewsky | Fawcett | Crossey |
| 10 | | | | Worthington-Lowe | | | Myer? | | | |
| 11 | | | | Schmandt | | | | | | |
| 12 | P1. Students will be able to evaluate conservation of mass, momentum and energy transformations in Earth's Systems | Introduced | Introduced | Practiced | Practiced | Practiced | | Practiced | Mastered - Evaluated | |
| 13 | P2. Students will be able to analyze the role of Earth Materials (rocks and minerals) and Earth Structure (plate tectonics) in Earth Systems. | Introduced | Introduced | Practiced | Practiced | Practiced | | Practiced | | Mastered - Evaluated |
| 14 | P3. Students will be able to evaluate a landscape to infer active and past processes and current and past climates. | | | Introduced | Practiced | | | Practiced | | Mastered - Evaluated |
| 15 | P4. Students will be able to evaluate interactions between different spheres (Atmosphere, hydrosphere, biosphere, geosphere) | Introduced | Introduced | Practiced | Practiced | Practiced | | Practiced | Practiced | Mastered - Evaluated |
| 16 | P5. Students will be able to evaluate atmospheric processes and impacts of global climate change on atmospheric systems. | Introduced | Introduced | Practiced | Practiced | Practiced | | Practiced | Mastered - Evaluated | |

University of New Mexico – Environmental Sciences

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## Environmental Studies

**Major**

Enter a PLO number(s) for each CLO, in the orange boxes below.

*PLO Stem: At the completion of the environmental studies major, students will be able to ....*

| | | | | PLO No. ----> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PLO Domain ----> | KNOWLEDGE | KNOWLEDGE | KNOWLEDGE | SKILLS | SKILLS | SKILLS | SKILLS | VALUES | VALUES |
| | | | | PLO Dimension ----> | NATURAL SCIENCE | SOCIAL SCIENCE | HUMANISTIC FOUNDATIONS | CRITICAL THINKING | WRITTEN COMMUNICATION | ORAL COMMUNICATION | CRITICAL THINKING | CIVIC AND GLOBAL ENGAGEMEN | ENVIRONMENTAL STEWARDSHIP |
| | | | | **PLO Level ---->** | **UNDERSTAND** | **UNDERSTAND** | **UNDERSTAND** | **MANIPULATION** | **ARTICULATION** | **ARTICULATION** | **ARTICULATION** | **ORGANIZE** | **ORGANIZE** |
| | | | | | explain core concepts in the natural sciences underlying major environmental issues. | explain policy aspects of major environmental issues using the lens of anthropology, sociology, or economics. | explain major environmental issues using the lens of history, philosophy, religious studies, the arts, or literature. | interpret environmentally related quantitative information. | communicate environmental ideas effectively in writing. | communicate environmental ideas effectively in an oral presentation. | construct a well-supported argument or creative work about environmental issues. | integrate classroom and co-curricular learning related to civic engagement. | integrate classroom and co-curricular learning related to environmental stewardship. |
| Course | CLO Text (Prose) | CLO Domain | CLO Dimension | CLO Level | PLO | CLOs matching PLO1 | CLOs matching PLO2 | CLOs matching PLO3 | CLOs matching PLO4 | CLOs matching PLO5 | CLOs matching PLO6 | CLOs matching PLO7 | CLOs matching PLO8 | CLOs matching PLO9 |
| | At the completion of ENST 245, students will be able to critique interpretations presented in scientific literature as demonstrated by critically analyzing results of scientific studies. | SKILLS | CRITICAL THINKING | *PRECISION* | 7 | | | | | | | PRECISION | | |
| | At the completion of ENST 245, students will be able to collaborate on projects related to environmental studies as demonstrated by working together on hands on course exercises. | VALUES | CIVIC AND GLOBAL ENGAGEMENT | *RESPOND* | 8 | | | | | | | | RESPOND | |
| **ENST250** | | | | | | **UNDERSTAND** | | | **MANIPULATION** | | | | | |
| | At the completion of ENST250, students will be able to explain core concepts in the natural sciences underlying major environmental issues. | KNOWLEDGE | NATURAL SCIENCE | *UNDERSTAND* | 1 | UNDERSTAND | | | | | | | | |
| | At the completion of ENST250, students will be able to formulate environmental ideas effectively in an oral presentation. | SKILLS | ORAL COMMUNICATION | *PRECISION* | 6 | | | | | | PRECISION | | | |
| | At the completion of ENST250, students will be able to formulate environmental ideas effectively in writing. | SKILLS | WRITTEN COMMUNICATION | *PRECISION* | 5 | | | | | PRECISION | | | | |
| | At the completion of ENST250, students will be able to interpret environmentally related quantitative information. | SKILLS | CRITICAL THINKING | *MANIPULATION* | 4 | | | | MANIPULATION | | | | | |
| **ENST345** | | | | | | | | | | | | | | |
| | At the completion of ENST 345, students will be able to communicate environmental ideas effectively in writing | SKILLS | WRITTEN COMMUNICATION | *PRECISION* | 5 | | | | | PRECISION | | | | |
| | At the completion of ENST 345, students will be able to develop a persuasive and well-supported argument or thesis about an environmental issue that takes into account the complex, interdisciplinary nature of these issues. . | SKILLS | CRITICAL THINKING | *PRECISION* | 7 | | | | | | | PRECISION | | |
| **ENST375** | | | | | | | **UNDERSTAND** | | | | | | | |
| | At the completion of ENST 375, students will be able to explain the historical, philosophical, religious, artistic, or literary ideas that underlie major environmental issues. | KNOWLEDGE | HUMANISTIC FOUNDATIONS | *UNDERSTAND* | 3 | | UNDERSTAND | | | | | | | |
| | At the completion of ENST 375, students will be able to communicate environmental ideas effectively in writing. | SKILLS | WRITTEN COMMUNICATION | *PRECISION* | 5 | | | | | PRECISION | | | | |
| | At the completion of ENST 375, students will be able to develop a persuasive and well supported argument or thesis about an environmental issue that takes into acount the complex, interdisciplinary nature of these issues. | SKILLS | CRITICAL THINKING | *PRECISION* | 7 | | | | | | | PRECISION | | |

St. Mary's College of Maryland Environmental and Sustainability programs

# Individual/Department teams

- Each department/program team/individual reflects on Day 1 discussion to select a 1-2 key skill/concept/competencies
- How are these are currently addressed across program curricular matrix?
- Identify key questions and challenges

9:05-9:50

# Break-out groups

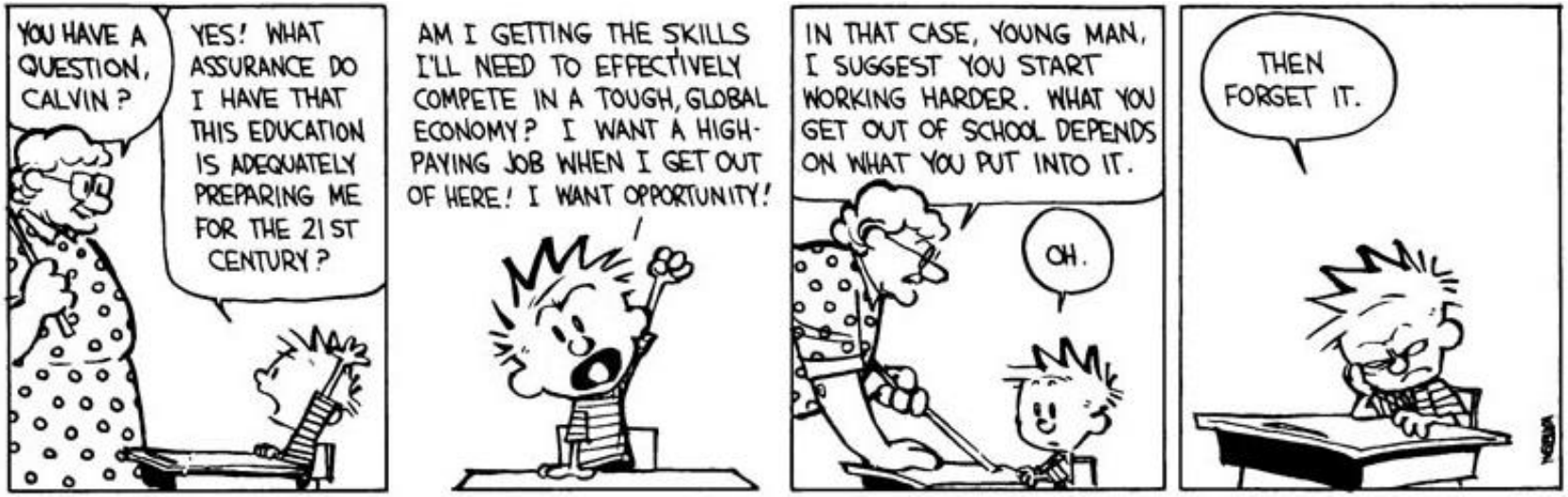
**Collect into working groups:**

- Share approaches, challenges, ideas for curricular change in breakout groups
- Select one idea per group to share

9:50-10:05

# Whole group discussion

- Break-out group sharing – share one idea per group
- Strategies for curricular redesign buy-in, common challenges




10:20-10:35

# Big Challenge: Knowing (and showing) it works!

**Evaluation: Does the program succeed in attaining its targeted outcomes?**

- **Should include "throughput" measures (no. graduates, avg. GPA employment success, grad school admits, etc. ) as well as learning assessment data for students.**

*from Jeff Ryan*

10:35-10:50

# Big Challenge: Knowing (and showing) it works!

**Assessment:** **Do students gain the targeted competencies and skills by the end of the program?**

**Student learning assessment data ≠ GPA!**

- **Collected at the course level for program-scale results**

**Using the Matrix for formative and summative assessment**

# Learning Assessment "instruments" for concepts/knowledge

- **Surveys**
  - **SALG - Student Assessment of Their Learning Gains (http://www.salgsite.org/ ): a customizable instrument that allows faculty to tailor questions to their courses.**
    - **Includes both conceptual and attitudinal (affective) measures**
    - **Can be designed (by instructors) for any course**
    - **Limitations: student self-reporting, participation**
- **Concept inventories**
  - **Validated measures (questions) targeting conceptual understanding**
  - **Mostly for introductory courses, but expanding….**
    - **Geoscience Concept inventory (GCI) (https://geoscienceconceptinventory.wikispaces.com/ )**
    - **Conceptest collection (SERC): originally designed for "clicker" use, but has broadened out (https://serc.carleton.edu/introgeo/interactive/conctest.html )**
    - **Oceanography Concept Inventory (Arthurs, Hsia, Schweinle, 2015, J. Geosci. Ed., 63: 310-322)**
- **"3rd Party Instruments":**
  - **ASBOG Fundamentals of Geology: conceptual exam now available for graduating Seniors seeking Geologist-in-Training (GIT) certification (http://www.asbog.org/ )**
    - **Students take it in their last semester**
    - **Currently used as assessment tool in MS and GA**
    - **Departments get anomymized results**
    - **NOT FREE…**

# Assessment of Skills Development

- **Capstone/integrative experiences**
  - **Geology Field Camps**
    - Mapping and other field data collection/interpretation (geophysics, hydrology, etc.)
  - **If your Dept. doesn't teach field camp, other courses/assignments may be appropriate (at USF we do both…)**
    - **rubric based, multiple raters…**
- **Undergraduate Research**
  - **High Impact Pedagogy (PCAST 2012; Lopatto 2007; 2010)**
  - Develops key scientific skills + technical + "soft" skills
    - **Senior Theses** (some do this as a capstone...)
    - **Course-based undergraduate Research Experiences (CURES)** – advocated by PCAST and by the National Academies **(NRC 2015; 2017)**
      - Research products (papers, presentations) can provide evidence of accomplishment/success in a course or a program, as can perspectives from students and their mentors
      - See Singer and Mogk for strategies/background: https://serc.carleton.edu/NAGTWorkshops/undergraduate_research/assessment_pedagogy.html

**(None of these are very easy to do, but they're important...)**

# Assessment/Evaluation/Curriculum change doesn't happen…

**…Unless a Department is willing to do it!**

- **Chair leadership is critical!**
  - **"sticks"**
    - **An annual requirement, an evaluated activity**
      - **(everybody plays: participation can't be optional...).**
      - **Data collection, and data review/analysis has to occur routinely.**
  - **"carrots"**
    - **Re-assign time for curricular work**
    - **Professional development for course transformation ($$)**
    - **Granting opportunities (IUSE-EHR, the ICT track...)**

"When John Seely Brown talks about what he calls "reversing the flow," he claims that the typical school curriculum is built from content ("learning about") leading to practice ("learning to be"), where the vast majority of useful knowledge is to be found. In a typical formal curriculum, students are first packed with knowledge, and if they stick with something long enough (i.e., major in a discipline), they eventually get to the point of engaging in practice.

Brown argues that people instead learn best by "practicing the content." That is, we start in practice, and practice drives us to content. Or, more likely, the optimal way to learn is reciprocally or spirally between practice and content. Brown's formulation echoes the growing body of inductive and inquiry-based learning research that has convincingly demonstrated increased learning gains, in certain well-designed conditions, when students are first "presented with a challenge and then learn what they need to know to address the challenge."

*Disrupting Ourselves: The Problem of Learning in Higher Education – blog by Randall Bass*

# Work on Action plan

- Based on the workshop so far, update your action plan.
- Articulate for yourself, one or two action items that you would like to pursue when you leave this workshop? (goal, timetable, opportunities, barriers…)

10:50-11:20

Disrupting Ourselves: The Problem of Learning in Higher Education – blog by Randall Bass

https://er.educause.edu/articles/2012/3/disrupting-ourselves-the-problem-of-learning-in-higher-education

Summary of Meyer and Land Threshold concept

https://www.ee.ucl.ac.uk/~mflanaga/thresholds.html

Bottlenecks and Threshold initiative – Georgetown University

https://cndls.georgetown.edu/bottlenecks-and-thresholds/