Tools and Strategies for Finding Programmatic Strengths and Weaknesses

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https://nagt.org/index.html
A framework for program design

Program learning outcomes

Continuously align and improve program components to maximize significant learning

Curriculum (courses, experiences, etc.)

Program assessments

Situational Factors

Adapted from Dee Fink, *Creating Significant Learning Experiences* (Jossey-Bass, 2003), p. 62
Why do we assess our programs?

- Identify places for improvement that will lead to better outcomes for students
- Highlight areas of success
- Be thoughtful and data-driven when making changes
- Look for relationships between changes made and outcomes
Answer the following questions in the chat:

1. What do you feel your program/department is assessing well?
2. What would you like to improve in your program/departmental assessment?
3. What tools do you currently use for assessment?
What should we be assessing?

- Your program learning outcomes define what you should be assessing

- What are the learning outcomes for your degree program?
  - Type an example in the chat

- If you don’t think your outcomes describe meaningful learning in your program then it’s time to revisit them!
Types of knowledge:
Which are important in your program?

- Factual knowledge
  - Terms, specific details

- Conceptual knowledge
  - Classifications and categories
  - Theories, models, structures

- Procedural knowledge
  - Subject-specific techniques, skills, methods, algorithms
  - Criteria for determining when to use procedures

- Metacognitive knowledge
  - Self knowledge
  - Strategic knowledge
Graduates from this program should be able to…..

Strong program learning outcomes should be:

- Specific
- Measurable or observable
- Describe meaningful learning
- Attainable
- Written in clear, understandable language
Learning outcomes should start with active verbs:

<table>
<thead>
<tr>
<th>Example verbs: Lower-order thinking skills</th>
<th>Example verbs: Higher-order thinking skills</th>
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<tbody>
<tr>
<td>Define</td>
<td>Analyze</td>
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<td>Identify</td>
<td>Evaluate</td>
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<td>List</td>
<td>Appraise</td>
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<td>Select</td>
<td>Construct</td>
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<td>Recognize</td>
<td>Differentiate</td>
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<td>Classify</td>
<td>Critique</td>
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<td>Explain</td>
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<td>Support</td>
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<td>Generate</td>
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<td></td>
<td>Argue</td>
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<td></td>
<td>Synthesize</td>
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Avoid the verb “understand”-- to measure understanding what would you ask...
Example program outcomes

Graduates from the BS Geoscience program will be able to….

- Effectively communicate results of geologic investigations in written, graphic and oral formats
- Articulate the benefits and responsibilities of working as a member of a team
- Describe the processes that operate on or beneath the Earth’s surface and the resulting planetary features
- Produce and use field-based measurements to interpret geologic history
- Apply quantitative approaches to the analysis of data sets and to problem solving
- Critically evaluate data, interpretations and conclusions in their own work and the work of others

https://serc.carleton.edu/NAGTWorkshops/departments/degree_programs/learning_goals.html
Example program outcomes

Graduates from the BS Geoscience program will be able to….

- Effectively **communicate** results of geologic investigations in written, graphic and oral formats
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- Critically **evaluate** data, interpretations and conclusions in their own work and the work of others

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One outcome (team work) several ways...

1. **Articulate** the benefits and responsibilities of working as a member of a team
2. **Work** effectively as a member of a team
3. **Describe** characteristics of a well-functioning team
4. **Behave** as part of a team, **leading** the team as needed
5. **Assemble** a team with the appropriate expertise to solve a problem

How would you assess each of these?
Help for writing/revising learning outcomes

Traveling Workshops Program

- Expert facilitators work (virtually for now) with your department
- Upcoming application deadlines: October 15, January 15, March 15

https://nagt.org/nagt/profdev/twp/index.html
Desired Workforce Skills: General Skills

Association of American College & Universities Essential Learning Outcomes:

- Inquiry and analysis
- Critical and creative thinking
- Written and oral communication
- Quantitative literacy
- Information literacy
- Teamwork and problem solving
- Civic knowledge and engagement (local and global)
- Intercultural knowledge and competence
- Ethical reasoning and action
- Foundations and skills for lifelong learning
- Synthesis and advanced accomplishment across general and specialized studies

https://www.aacu.org/essential-learning-outcomes
Desired Workforce Skills: Geoscience Skills

Future of Undergraduate Geoscience Education Employers Workshop and Survey:

- Critical thinking & problem solving
- Data collection and interpretation
- Evaluate data quality
- Work with uncertainty, non-uniqueness
- Apply skills in new scenarios
- Systems thinking
- Quantitative skills
- Written and oral communication
- Evaluation of literature
- Temporal and spatial thinking
- Field skills
- GIS
- Work as part of a team
- Time management
- Understand societal relevance
- Computer programming
- Manage large datasets
- Ethics
- Leadership

https://www.jsg.utexas.edu/events/future-of-geoscience-undergraduate-education/
Program outcomes related to teaching

- You can also set goals related to teaching, such as use of active learning strategies
- Assess using structured classroom observations and/or peer evaluations
- COPUS (Classroom Observation Protocol for Undergraduate STEM) is easy to learn
- Can set benchmarks based on data across all STEM disciplines or...

Stains et al., 2018
Teaching data in the geosciences

National Geoscience Faculty Survey (NGFS)

● Has reached ~25% of faculty
● Can see trends over time
● Use of active learning has increased; can assess your own faculty against this benchmark

https://serc.carleton.edu/NAGTWorkshops/CE_geo_survey/index.html
Other NGFS data and published research

- Viskupic, Egger, McFadden & Schmitz (2020) *Comparing desired workforce skills and reported teaching practices to model students’ experiences in undergraduate geoscience programs*, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2020.1779568
Tools for assessing student outcomes

1. Professional licensure exams (ASBOG)
2. Disciplinary and skills-specific assessments
3. Student portfolios
4. Reflections and exit interviews
5. Alumni and employer feedback

Scribner & Harris, 2019
Licensure exams: ASBOG

ASBOG® Task Analysis 2015
FG Blueprint - Domain Percentages

- A. Field and General Geology (21%)
- B. Mineralogy, Petrology, and Geochemistry (11%)
- C. Sedimentology, Stratigraphy, and Paleontology (12%)
- D. Geomorphology, Surficial Processes, and Quaternary Geology (13%)
- E. Structure, Tectonics, and Seismology (11%)
- F. Hydrogeology (12%)
- G. Engineering Geology (11%)
- H. Economic Geology and Energy Resources (9%)
ASBOG Curriculum Performance Assessment Tool

Caveats:

- This will only work for you if a lot of your students take the ASBOG exam most years.
- The exam costs >$200, so will limit the number of students would take it for assessment purposes.
- The tasks focus on professional geology, which may or may not align well with the goals of your program.
Answer in the chat:

Have you used ASBOG’s Curriculum Performance Assessment Tool?

If so, what have you found useful?

If not, is it something you think you might use? Why or why not?
Disciplinary and skill-specific assessments


VALUE Rubrics define skills at capstone and milestones for critical thinking, quantitative literacy, written communication, etc. (16 total): they are NOT assessments

In-house repeated skill or conceptual assessments

Best used as pre-/post-assessments

Best used as milestone & capstone assessments
Answer in the chat:

Have you used discipline- or skill-specific assessments? These or others?

If so, what have you found useful?

If not, is it something you think you might use? Why or why not?
### Student portfolios

- Students curate materials to demonstrate and reflect on their achievement of program learning outcomes
- Creation of portfolio could be built into the program over time
- Portfolios evaluated according to a rubric
- Could ask reflection questions as part of an end-of-program survey or capstone course evaluation

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Artifacts</th>
<th>Reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Effectively communicate results of geologic investigations in written, graphic</td>
<td>GEOS 313 report</td>
<td>PLO 1 reflection</td>
</tr>
<tr>
<td>and oral formats</td>
<td>GEOS 482 report</td>
<td></td>
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<tr>
<td></td>
<td>GEOS 498 group project</td>
<td></td>
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<td></td>
<td>Senior thesis</td>
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<tr>
<td>2. Articulate the benefits and responsibilities of working as a member of a team</td>
<td>GEOS 498 group project</td>
<td>PLO 2 reflection</td>
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<td></td>
<td>Internship</td>
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<tr>
<td>3. Describe the processes that operate on or beneath the Earth’s surface and the</td>
<td>GEOS 314 final exam</td>
<td>PLO 3 reflection</td>
</tr>
<tr>
<td>resulting planetary features</td>
<td>GEOS 498 group project</td>
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<tr>
<td>4. Apply quantitative approaches to the analysis of data sets and to problem</td>
<td>GEOS 343 problem sets</td>
<td>PLO 4 reflection</td>
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<tr>
<td>solving</td>
<td>GEOS 425 problem sets</td>
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<td>GEOS 357 final project</td>
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<tr>
<td>5. Critically evaluate data, interpretations and conclusions in their own work</td>
<td>GEOS 357 final project</td>
<td>PLO 5 reflection</td>
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<tr>
<td>and the work of others</td>
<td>GEOS 498 group project</td>
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</table>
Answer in the chat:

Have you used student portfolios?
If so, what have you found useful?
If not, is it something you think you might use? Why or why not?
Reflections and exit interviews

- Students reflect on how well the program helped them meet PLOs
- Could be:
  - Survey
  - Knowledge survey
  - Exit interview
  - Curriculum matrix

I am able to interpret the rock and sediment record to reconstruct past and predict future Earth system states and processes

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
<th>Percentage</th>
</tr>
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<td>0%</td>
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<tr>
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<td>2</td>
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<td>3</td>
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<td>8.8%</td>
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<tr>
<td>4</td>
<td>30</td>
<td>44.1%</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>44.1%</td>
</tr>
</tbody>
</table>

Strongly agree
Reflections and exit interviews

- Students reflect on how well the program helped them meet PLOs
- Could be:
  - Survey
  - Knowledge survey
  - Exit interview
  - Curriculum matrix
Answer in the chat:

Have you used reflections and exit interviews?

If so, what have you found useful?

If not, is it something you think you might use? Why or why not?
Alumni and employer feedback

- Provides a different perspective on student achievement of learning outcomes
- Best used as a supplement to other assessment means
- Could be:
  - Survey
  - Interviews or focus group
  - Informal feedback

https://serc.carleton.edu/sage2yc/careers/index.html
www.americangeosciences.org
Answer in the chat:

Have you used alumni and employer feedback?

If so, what have you found useful?

If not, is it something you think you might use? Why or why not?
Final thoughts

- Remember that programmatic assessment is meant to help you understand what is working and what needs improvement in your program.
- You don’t need to assess every outcome and every year
  - Consider developing a rotating schedule
- You don’t need to evaluate every student’s work
  - Consider looking at representative samples
- Many resources available to help:
  - Building Strong Geoscience Departments: [https://serc.carleton.edu/NAGTWorkshops/departments/index.html](https://serc.carleton.edu/NAGTWorkshops/departments/index.html)
  - Traveling Workshops Program: [https://nagt.org/nagt/profdev/twp/index.html](https://nagt.org/nagt/profdev/twp/index.html)

Contact us!
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