Assessing the Geology Department’s statement of learning outcomes and goals

The What: One of the four major themes in the Geology Department's learning outcomes and goals statement (attached at end of document) is that 'students will learn the fundamental concepts of Geology'. Supporting this statement are seven bullets that describe the different areas in which the Geology Department feels our students need to demonstrate expertise. To date the Geology Department has simply taken it on faith that our colleagues are doing an effective job at teaching to these goals, and that our students are leaving Bryn Mawr with value-added in the seven sub-fields of Earth Science.

For this assessment loop the Geology Department plans to focus on three of the seven fundamental concepts over the next three years. It is our intent that over the next several years all seven concepts areas will be evaluated using similar methodology. The first three concepts are:

1. Each graduate will demonstrate an understanding of plate tectonics and be able to describe how it operates;
2. Each graduate will demonstrate an understanding of the geologic time scale and the timing of major events in Earth history;
3. Each graduate will demonstrate an understanding of global climate change on various time scales.

Each of these three assessment efforts will be spearheaded by a different faculty member whose expertise addresses the stated concept area (Prof. Weil for concept 1; Prof. Marenco for concept 2; Prof. Barber for concept 3). Specifically, we hope to assess the effectiveness with which the geology major curriculum teaches and reinforces the stated concepts.

The How: Assessment of these outcomes will take place at several different stages of a student’s progress in the Geology Major.

First, a basic multiple-choice concept test will be given on the three concept areas during the first week of our introductory geology courses. Each of the three intro Geology classes, Physical Geology (101), Historical Geology (102), and Earth Systems and the Environment (103), deals specifically with one of the three stated goals above. These tests will be graded, tallied and kept on record according to student ID#. The test will have a mix of basic fact questions, nomenclature questions, and higher-order concept questions. The entire Geology faculty will agree on the final test content. As a secondary outcome, the tests will be repeated at the end of each introductory course as a way to assessing the effectiveness of the individual course in teaching the stated concepts.
Second, two course-embedded assessment assignments (CEAA) in each of the three concept areas will be tracked for each student major. Course-embedded assessment gives useful feedback on what, how much and how well a student is achieving an instructor’s stated learning goals. In the ideal, the two CEAAs will be given at different stages of the student’s major experience. All CEAAs will be scored using a standardized rubric that will be compatible across concepts and quantifiable. Using a rubric that evaluates at different stages of learning/understanding will hopefully make the scoring of CEAAs as objective as possible - though the Geology Department fully realizes that it is impossible to collect fully unbiased objective data. The students’ scores will be tallied and recorded according to student ID#. Using student ID#s is a further step in trying to remove as much bias from the evaluation process as possible.

Finally, a senior-exit concept test will be given on the three concept areas at the end of the required senior seminar. Similar to the introductory test, this test will be graded, tallied and kept on record according to ID#. The test will have a mix of basic fact questions, nomenclature questions, and higher-order concept questions. Questions from the first test will be repeated, and additional more advanced questions will be added. Again, the entire Geology faculty will agree on the final test content.

**Closing the Loop:** At the end of every academic year the department will have data from incoming majors concept tests, that year’s CEAAs, and from senior-seminar concept tests. Where concept deficiencies are identified, we will meet as a faculty on our annual faculty retreat to discuss how best to reinforce the concepts' coverage in the coming year’s curriculum. The curriculum will be adjusted accordingly until the Geology Department’s learning outcomes and goals statement have been adequately met by our graduating seniors.

The objective of this loop is to give the department a way to add a developmental perspective to our assessment of learning goals. That is, as an outcome of Loop#1 the Geology Department will have quantifiable data over the career of a student’s time in the Geology major in order to evaluate how a student has progressed through the instructional material and what has been added through her time in contact with Bryn Mawr Geology faculty.
Student Learning Outcomes and Learning Goals for the Bryn Mawr Geology Major
- Provide a high-quality undergraduate education that combines transdisciplinary problem- and process-oriented, and quantitative approaches to the Earth Sciences.
  - Develop highly competent geoscience students prepared to analyze and comprehend the linkages among Earth system components and their physical and social context
    - Each graduate will demonstrate the ability to apply knowledge, concepts and techniques from complementary disciplines to solve problems
    - Each graduate will employ accepted laboratory and field techniques, protocols, and safety procedures
    - Each graduate will demonstrate the ability to read, construct, and comprehend thematic maps as well as derive conceptual perspectives from existing maps
    - Students will demonstrate the appropriate use of quantitative data through graphs, spreadsheets, and statistical analysis
  - Students will learn the fundamental concepts of geology
    - Each graduate will demonstrate an understanding of plate tectonics and be able to describe how it operates
    - Each graduate will demonstrate an understanding of the geologic time scale and the timing of major events in Earth history
    - Each graduate will demonstrate the ability to identify and characterize important earth materials, and to interpret the physical, chemical and biological processes by which they formed
    - Each graduate will demonstrate an understanding of the geologic time scale and the timing of major events in Earth history
    - Each graduate will demonstrate an understanding of evolution and its evidence in the fossil record
    - Each graduate will demonstrate an understanding of the internal structure of Earth
    - Each graduate will demonstrate an understanding of the hydrologic cycle
  - Educating our students about Earth's natural systems, its resources, and the impact of humans on the planet
    - Applying geoscience knowledge to address problems affecting human society, locally and globally
    - Each graduate will demonstrate the ability to make informed, scientifically based decisions regarding environmental issues, resource exploration and extraction, and anthropogenic effects on the natural world
  - Develop and communicate new knowledge to the broader community through fundamental research that uses current technologies
    - Each graduate will deliver oral presentations, demonstrating the ability to effectively communicate discipline-specific concepts
    - Each graduate will write scholarly papers using acceptable format and organization with citations to appropriate literature
    - Students will deliver presentations making appropriate use of visual or electronic media