**Learning Outcome Assessment Plan**

**for the Department of Geology & Geophysics**

**AY 2020-2021**

**Program Purpose**

The Department of Geology and Geophysics offers Bachelors of Science (B.S.) degree programs that are designed for students who wish to pursue professional careers in the Earth sciences or in other areas of science, engineering, teaching and learning, public service, or business. In addition to providing a broad, rigorous education in the Earth sciences, the curriculum also includes comprehensive preparation in all the physical sciences, so graduates from the program will be competitive when applying for admission to graduate schools and/or quality jobs in the professional arena.

The Geology and Geophysics Department offers three different B.S. degrees in [Geoscience](https://earth.utah.edu/current_students_undergraduate/bs-geoscience.php) (with formal concentration in Geology, Geophysics, or Environmental Geoscience Emphasis), [Earth Science Composite Teaching](https://earth.utah.edu/current_students_undergraduate/bs_Earth_Science_Comp.php), and [Geological Engineering](https://earth.utah.edu/current_students_undergraduate/bs-geo-engineering.php) with a curriculum that is accredited by the Engineering Accreditation Commission of ABET ([www.abet.org](http://www.abet.org/)). A minor in Earth Science also is offered. In addition, the department participates in three cross-disciplinary programs with other science departments – Geology-Biology, Geology-Chemistry and Geology-Physics, and in a Philosophy of Science program with the Department of Philosophy.

This 2020 assessment presents newly updated learning outcomes that align with the undergraduate core curriculum that was revised in 2018 with input from all faculty within the department. This new curriculum was introduced at the start of the Fall 2018 term. Our new curriculum includes four new sequential introductory courses that provide a broader and more process-based overview of the Geosciences. It connects undergraduate students with more, and more diverse, faculty early in the students’ program of study. This new curriculum provides a geoscience foundation from which students extend their focus into one of five degree pathways (Geoscience – Geology emphasis; Geoscience – Environmental Geology emphasis; Geoscience – Geophysics emphasis; Geological Engineering; and Earth Science Teaching). The program lays out coherent plans of study that help students to select logically connected courses among our many electives and are designed in a manner that aims to meet our [program’s learning outcomes](https://catalog.utah.edu/).

The new core includes the following sequence: 1) GEO 1100 Evolving Earth, 2) GEO 2100 Reactive Earth, 3) GEO 2500 Wasatch in the Field, 4) GEO 3100 Dynamic Earth, and 5) GEO 4500 Field Methods cohort. Each of these courses is team-taught by multiple faculty.

**2020 Learning Outcomes**

**Bachelor of Science**

(Geoscience) emphasis areas Geology, Environmental Geoscience, Geophysics, and Earth Science Composite Teaching

[Geological Engineering]

1. An ability to identify, formulate, and solve complex (geoscience) [engineering] problems by applying principles of [engineering], science, and mathematics.

a. Simplify open-ended problems using a systems approach to produce sustainable outcomes.

a. Quantitative approaches

b. Qualitative approaches

2. An ability to apply (geoscience knowledge) [engineering design] to produce (understanding) [solutions] that meet(s) specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences

a. Written and spoken communication

b. Effective visualization and presentation of information

4. Ability to recognize ethical, professional responsibilities in (geoscience consulting) [engineering situations] and make informed judgements, which must consider the impact of (geoscience) [engineering] solutions in global, economic, environmental, and/or societal context.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop hypotheses and conduct appropriate experimentation, analyze and interpret data, reference peer reviewed literature, and use (geoscience) [engineering] judgement to draw conclusions in a timely manner.

a. Think in four dimensions

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

**Masters of Engineering Geological Engineering**

8. Demonstrated level of complexity and independence with respect to 1-7 as appropriate for a non-thesis M.E. recipient.

**Masters of Science Geoscience and Geological Engineering**

9. Demonstrated level of complexity and independence with respect to 1-7 as appropriate for an M.S. recipient.

**Doctor of Philosophy Geoscience and Geological Engineering**

10. Demonstrated full complexity and independence with respect to 1-7 as appropriate for a Ph.D. recipient.

**Program Assessment**

Each of the five degree pathways within the Department of Geology & Geophysics will be rigorously reviewed as a part of an ongoing program-level learning outcomes assessment plan that aims to identify the standard of quality of our undergraduate and graduate programs. Data collection is modeled after the approach that has been taken with the Geological Engineering program with ABET Outcomes Assessment.

The evidence needed to assess each of the listed learning outcomes within each program will be collected from faculty using a template for each of the listed outcomes that prompts them to identify:

1. Brief statement describing the specifics of the assignment, quiz, exam, problem, *etc*. used to assess this outcome.

2. Statement of how the problem addresses the outcome.

3. Student grades on the problem/assignment. Include statistics.

4. What they understand.

5. What they don’t understand.

6. Conclusion (supported by data).

7. Recommendations to improve achievement of this outcome.

These data will be formally collected from each of the faculty who have taught in the new core curriculum in Fall 2020 and Spring 2021. As each of these courses has been team taught, faculty groups who have contributed to these courses will be engaged through a series of small group meetings to determine the potential for retroactive assessment and consensus on best steps for the future. In addition, a matrix identifying each of the departmental electives and how they contribute to the specific learning outcomes will be created. This matrix will use a scale to indicate whether this is a minor or significant outcome for each of the courses taught in the department. We will utilize tools made available in Canvas to help faculty to collect representative examples of student work to inform the assessment. The Curriculum Committee, in partnership with the Undergraduate Affairs Committee, Graduate Affairs Committee, and the Associate Chair for the department will then review all the collected data and suggest changes and modifications to address quality shortfalls in the program. A similar but more expansive assessment plan will also be implemented in subsequent academic years.

APPENDIX: Prior learning outcomes

**Geoscience (Bachelor of Science)**

Emphasis areas: Geology, Environmental Geoscience, Geophysics

* Program graduates will have demonstrated a mastery of the geosciences that allow them to succeed as graduate students in geology, environmental earth science, geophysics, or in related fields, as students in professional schools, or as entry-level employees in industry or government.
* Program graduates will have an understanding of the nature and origin of the materials that make up the Earth.
* Program graduates will understand the dynamic processes that operate within the Earth from its deep interior to the surface.
* Program graduates will have an understanding of geologic time and how it is measured.
* Program graduates will have an understanding of the geologic evolution of the Earth and the development and evolution of life on Earth.
* Program graduates will have the ability to apply basic principles of mathematics, chemistry, biology and physics to geologic issues.
* Program graduates will demonstrate skills in reading comprehension of the scientific literature, and in oral and written communication of scientific results.
* Program graduates will demonstrate proficiency in geologic field skills and in solving integrative, field-based problems in Earth science.
* Students nearing graduation will be able to make informed choices as to post-graduate opportunities for education or employment.
* Program graduates will be prepared and qualified to pass the professional geologist licensure examination.
* Students will understand the place of the Earth sciences in the larger picture of the intellectual landscape of inquiry, including connections between science and, history, philosophy, ethics and the formulation of public policy.
* Ability to engage in lifelong learning and understanding of the need to do so.

**Geological Engineering (Bachelor of Science)**

* Ability to apply knowledge of mathematics, science, and engineering.
* Ability to design and conduct experiments, as well as to analyze and interpret data.
* Ability to design a system, component, or process to meet desired needs.
* Ability to function on multi-disciplinary teams.
* Ability to identify, formulate, and solve engineering problems.
* Understanding of professional and ethical responsibility.
* Ability to communicate effectively.
* Understanding of the impact of engineering solutions in a global and societal context.
* Recognition of the need for and ability to engage in life-long learning.
* Knowledge of contemporary issues.
* Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
* Ability to engage in lifelong learning and understanding of the need to do so.
* Ability to pass the Fundamentals of Engineering examination, thereby allowing them to immediately begin training for Professional Engineering licensure upon graduation.

**Earth Science Composite Teaching (Bachelor of Science)**

* Demonstrate mastery of the geosciences, chemistry, physics, astronomy, biology, ecology, math and atmospheric sciences that allow them to meet State requirements for Secondary Science Endorsements in Earth Science and Integrated Science and Secondary Licensure Program requirements within the College of Education.
* Understand the nature and origin of the materials that make up the Earth.
* Understand the dynamic processes that operate within the Earth from its deep interior to the surface.
* Understand geologic time and how it is measured.
* Understand the geologic evolution of the Earth and the development and evolution of life on Earth.
* Demonstrate proficiency in basic geologic field skills.
* Demonstrate comprehension of the scientific literature, and skill in oral and written communication of scientific results.
* Ability to organize content for student learning and select appropriate evaluation methods to measure student mastery of the content.
* Ability to provide differentiated instructions and curriculum, adaptations, and modifications necessary to promote student learning.
* Ability to adapt instruction to cultural and language differences and to provide effective large group, small group and one to one instruction.
* Ability to assess student learning, including development and administration of assessment instruments and using the results to modify student placement and instruction.
* Demonstrate skills for student learning/classroom management.
* Understand teaching professionalism and ethical responsibility.
* Ability to engage in lifelong learning and understanding of the need to do so.
* Ability to pass the Level I Praxis Exam.