

ERTH Undergraduate Assessment Report

Department or Program: Earth Sciences

Academic Year of Report: 2020-2021

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Section 1: Learning Objectives Assessed for this Report

In the Department of Earth Sciences (ERTH), we have one major with four curricular tracks. For this annual assessment report, we are focusing on learning goals that cut across all four tracks, as outlined below.

Major: Earth Sciences

1. Students will be proficient with the measurement, mapping, analytical and/or modeling tools that are required to quantify and analyze important aspects of Earth materials, Earth processes and Earth history.
2. When confronted with the (real-world) problem of incomplete, inconsistent and noisy geological data sets, students will be able to develop and test hypotheses in a systematic way. Students will become comfortable qualifying their answers to problems by stating assumptions and caveats.
3. Students will use techniques from the traditional disciplines of mineralogy, petrology, geochemistry, structural geology, tectonics, stratigraphy, and field geology to solve complex problems across a diversity of scales through time and space that require consistent geological reasoning.

The following timetable summarizes detailed learning objectives from our tracks and outlines our completed and planned assessment activities moving forward.

In this report we focus on revisiting our assessment and planned responses to learning objectives LO3, 4 and 5 that were described in the AY 18-19 ERTH Undergraduate Assessment Report.

Learning Objective (abbreviated)	AY 17-18	AY 18-19	AY 19-20	AY 20-21	AY 21-22	AY 22-23	AY 23-24
LO1 – Students will learn all aspects of data science at it pertains to ERTH		X				Revisit	
LO2 – Students will learn computational and coding techniques		X				Revisit	
LO3 – Students will be proficient with the measurement, mapping, analytical and/or modeling tools	X			Revisit			
LO4 – Students will be able to develop and test hypotheses in a systematic way	X			Revisit			
LO5 – Students will use techniques from the traditional disciplines of ERTH	X			Revisit			

Section 2: Assessment Activities

For each learning outcome, describe what information was collected, how it was analyzed and discussed, and the conclusions that were drawn from the analysis. In the narrative, reference all relevant means of collecting information about learning goals, including direct measures (e.g. assessment of student assignments), indirect measures (e.g. overall grade patterns in a particular course, student reflections on learning, SERU data), and qualitative information (e.g. faculty observations, student input). While the choice of which assessments are most meaningful is up to the department, a mix of direct and indirect measures is requested.

Following AY 18-19 EARTH Undergraduate Assessment Report, the portion on our Summer Field Camp (3 2-week sessions of GEOL 406 that form our “capstone experience” and usually the last course students in our Department), was passed to the Field Camp Director, Prof Ray Weldon, who shared and discussed the results with other faculty who often teach the course. Most of the issues were no surprise to the faculty and have been discussed in many forums, including the NAGT (National Association of Geology Teachers) that provide guidelines and recommendations for Geology Summer Field Camps, in addition to scholarships and USGS internships for the best students.

Recently we have focused on the goal to increase digital data collection and computational aspects in our Field Camp. We have conducted several experiments in this area, including Prof Ray Weldon teaching several projects with modern surveying equipment, and in the summer of 2019 we had 2 digital/computational projects, 1) a drone project that collected images to make a digital model of Big Obsidian Flow at Newberry Volcano that the students made and used to calculate the volume and others aspect of the flow, and 2) a GRP (Ground Penetrating Radar) project to map out the subsurface thickness of pumice deposits. The students liked these projects but also voiced concerns that came up in earlier efforts and were noted in the AY 18-19 Assessment. These include three main issues. (1) the fact that there were not enough instruments so students spent a lot of time standing around just watching or waiting their limited hands-on time. For example, modern surveying equipment costs 10s of 1000s of dollars and the ground penetrating radar equipment that we rented in 2019 costs 100s of 1000s of dollars. To properly equip (and maintain!) our Field Camp with enough modern digital equipment so that each student or small group of students had their own setup would be prohibitively expensive. For example in 2019, only 2 drones were available and only one person had a license to fly one in a protected environment like Newberry. (2) Personal laptops (that they were required to bring) are difficult to maintain in a field environment and software can be difficult (and expensive) for the students to acquire and learn to use in advance. (3) Few of the students had the needed computer or quantitative skills and for short projects like these there isn't the time to train them; thus some sort of coordinated background skill training would have to be developed for the students to take in advance during the academic year, something that is similar to our Field Methods course (GEOL 318).

In Summer 2020 we had to abandon our planned projects due to Covid and ended up with a mix of virtual material and a short, very traditional field mapping project taught by Prof Weldon in an isolated Wilderness Area that made any digital/computational project impossible. Even with the waning epidemic, we have planned only traditional mapping projects for Summer 2021 because these can be accomplished safely in isolated areas.

Section 3: Actions Taken Based on Assessment Analysis

For each learning goal assessed for each major, describe any actions taken as a result of assessment information, or plans to take action during the next academic year. Describe how the actions or action plans are meant to address the issues arrived at through the assessment activities in Section 2.

To achieve the goal of increasing digital data collection and computational aspects in our Field Camp, we would need to invest a tremendous amount of money and it will take the dedication of several of our more quantitatively-oriented faculty to make it sustainable. To address these challenges we will explore the use of existing equipment within the department (like Amanda's or Valerie's seismic nodes) and have students work on a project that applies to a faculty member's actual research interests. As well as alternate approaches to combine modern data products with field work. For example, this past year, we have bought LiDAR data and also flown drones to make better maps, that the students will use this summer in their mapping assignments. The mapping part is still pretty traditional but at least the students are using modern map products. We will discuss options to pursue here including an academic year course in which students make maps from LiDAR and drone data and then use these maps in field camp the following summer.

Section 4: Other Efforts to Improve the Student Educational Experience

Briefly describe other continuous improvement efforts that are not directly related to the learning goals above. In other words, what activity has the department engaged in to improve the student educational experience? This might include changes such as curriculum revisions, new advising approaches, revised or new co-curricular activities, etc. Describe the rationale for the change(s) and any outcomes resulting from the change(s).

Our degree requirements underwent a comprehensive review and change over the last several academic years, including a major overhaul of the four degree tracks and learning outcomes implemented in fall term 2019. Our advising structure has been significantly revised and expanded in response to the creation of centralized advising at Tykeson Hall. Our head undergraduate advisor collaborates with Tykeson advisors in the Scientific Discovery and Sustainability (SDS) Flight Path to ensure effective communication and coordination of department-level and Tykeson Hall advising activities. We now have two faculty advisors for each of our four discipline tracks, a recent change that has increased both the diversity and subject-area expertise of our advising team. We expect these changes will lead to increased student engagement and learning, while also increasing the number of EARTH majors in future years. Other efforts include working with the UO Career Center to educate students and advisors on what students can do with a degree in EARTH, by tapping into our alumni community and faculty members.

To continue modernizing our program we further developed the skill-focused and computational aspect of our curriculum. This past academic year, the curriculum committee has:

- established an Emphasis on Earth Sciences in the new Data Sciences major
- submitted 9 course proposals to formalize courses developed by our faculty
- embarked on an effort to review course requirements for consistency and logical progression throughout the major.

Section 5: Plans for Next Year

Briefly describe tentative assessment plans for the next academic year. Which goals will be assessed and how? What actions will be taken as a result of this years' analysis of assessment information? What other plans does the department have to improve the student educational experience? What are the budgetary implications of any proposed actions? How will those be addressed?

- In AY21-22, our department plans to embark on an wholesale examination of our undergraduate curriculum with the following goals being front of mind: 1) align our curriculum with societal needs, such as hazards, climate change, and environmental problems, and clearly communicate this alignment to students, 2) align our curriculum with career-ready skills, such as data analysis, computation, mapping, group work, and applied projects, and 3) establish experiential learning and internships as a recurring and supported component of our curriculum.
- This task will be accomplished by revisiting and revising our learning outcomes in the context of a recently released NSF-sponsored report on undergraduate curriculum reform in the Geosciences called "Vision and Change in the Geosciences: The Future of Undergraduate Geoscience Education"
- This work will begin at our September 2021 retreat and continue through the academic year through faculty meetings and an ad hoc committee.
- Within the context of this broader assessment of our undergraduate curriculum, during in academic year 2020-21:
 - We will continue to formalize our courses and finish the review and realignment of course requirements.
 - We also plan to assess learning outcomes centered on the Paleontology Track of the EARTH major. Beyond the courses offered that serve this track, it is clear that our current faculty in paleontology are not sufficient for the teaching needs for this track. Specifically, faculty Greg Retallack is retiring in spring 2021 and the remaining two paleontology faculty have other commitments (Sam Hopkins is associated with the Clark Honors College and Edward Davis is half-time at the Museum) that take away from teaching in EARTH.