Geoscience | 2016-2017 Assessment Report

1. Please give a brief overview of the assessment data you collected this year.

   We assessed two outcomes this year: Outcome #4 -- Students will understand the concept of geologic time and major events in the evolution of Earth and its plant and animal life; and Outcome #2 -- Students will apply the scientific method to investigations of geological processes, Earth systems, and interactions among the various physical and biological realms utilizing standard scientific field and laboratory methods.

   Outcome #4 was assessed in GEOSCI 203—Earth System History. Geoscience 203 is a required course for Geoscience Majors and Minors, as well as those pursuing a Broad Field Science Licensure in Education. This Outcome was assessed during the Final Exam on May 11, 2017 using three separate questions. See attached document from Professor Luczaj, dated May 2017.

   Outcome #2 was assessed in GEOSCI 340—Introduction to Mineralogy and Petrology. Min/Pet lays the foundation for many of the following upper level courses. Assessment of Outcome #2 took place during student presentations of their research project using a rubric described in the attached document from Assistant Professor Currier, dated May 2017.

2. How will you use what you've learned from the data that was collected?

   Both assessments showed that students demonstrated acceptable to above expectation performance with respect to the stated goals of the two Learning Outcomes. Faculty noted that recent tweaks to course materials and assignment instructions likely contributed to favorable student performance on the assessed outcomes. The data suggest that big changes are not needed in either course and that there are no major deficiencies in the Geoscience program with respect to attaining programmatic Learning Outcomes #2 and #4.

GEOSCIENCE ASSESSMENT: OUTCOME #4

John Luczaj - May 2017

I. INTRODUCTION

Outcome #4

Students will understand the concept of geologic time and major events in the evolution of Earth and its plant and animal life.

Course Assessed

GEOSCI 203—Earth System History. Geoscience 203 is a required course for Geoscience Majors and Minors, as well as those pursuing a Broad Field Science Licensure in Education. This learning outcome is addressed throughout the semester in several ways, including lectures, geologic timescale quizzes, and evaluation of primary literature in the field. Learning Outcome #4 was assessed during the Final Exam on May 11, 2017 using three separate questions.

Nature of Assessment

The first question asked students to identify the five largest mass extinctions in Earth's history, including timing and cause. This question summarizes major geologic events during the last 500 million years that had direct impacts on the diversity of life on Earth.

A second question required students to demonstrate their knowledge of the geologic timescale, which provides the framework that geologists use to interpret Earth's History. This question involved a nearly blank timescale with only 7 of 34 geologic Eons, Eras, Periods, Epochs, and numerical ages completed.

A third question (20 part matching) required students to identify the correct Geologic Era in which 18 major taxonomic groups evolved, along with 2 additional major events.

Assessment of Outcome #4 took place on three final exam questions using the rubrics provided below.

II. ASSESSMENT OF QUESTION ON MASS EXTINCTION

Criterion	0 = Unacceptable	1 = Acceptable	2 = Exceeds Expectations
A. Identified the correct timing of the mass extinction events.	Did not discuss or provided less than 3 correct events.	Identified 3 or 4 correct geologic periods in which mass extinction events occurred.	Identified all 5 correctly, OR identified 4 events with details of which portion of the geologic period the event occurred.

B. Description of the causal factor for each extinction.	Weak treatment or incorrect/missing answers.	Adequately described at least 3 or 4 causal factors.	Identified all 5 causal factors; described which species were affected.

ASSESSMENT OF GEOLOGIC TIMESCALE QUESTION

Criterion	0 = Unacceptable	1 = Acceptable	2 = Exceeds Expectations
C. Identified the correct numerical timing of major boundaries between Eras and Precambrian divisions.	Blank or provided incorrect numerical ages.	Identified 3 or 4 correct geologic ages for the timescale boundaries.	Identified all 5 numerical ages correctly (within a few percent).
D. Identified the correct geologic Eons, Eras, Periods, and Epochs.	Incorrect/missing answers.	Completed majority of timescale entries correctly with correct spellings.	Identified more than 20 of 22 entries correctly, including correct spelling.

ASSESSMENT OF BIOLOGICAL EVOLUTION EVENTS (20 questions)

Criterion	0 = Unacceptable	1 = Acceptable	2 = Exceeds Expectations
E. Identified the correct Geologic timing for the evolution of major taxonomic groups through Earth history.	Correctly assigned less than 50% of the taxonomic groups to the correct Geologic age brackets.	Correctly assigned between 50 and 75% of the taxonomic groups to the correct Geologic age brackets.	Correctly assigned more than 75% of the taxonomic groups to the correct Geologic age brackets.

III. RESULTS

Results of Assessment of Mass Extinction Question (S=student)*

Criterion	S1	S2	S3	S4	S5	S6	S7	S8	S9	Average
A	2	2	2	1	1	1	2	2	2	**1.67**
B	1	2	0	1	0	0	2	2	2	**1.11**
Average	**1.5**	**2**	**1**	**1**	**.5**	**.5**	**2**	**2**	**2**	

*One student did not take the final exam (S10).

Results of Assessment of Geologic Timescale (S=student)*

Criterion	S1	S2	S3	S4	S5	S6	S7	S8	S9	Average
C	1	2	1	2	1	2	1	2	2	1.56
D	2	2	2	2	1	1	2	1	2	1.67
Average	1.5	2	1.5	2	1	1.5	1.5	1.5	2	

*One student did not take the final exam (S10).

Results of Assessment of Biological Evolution Timing (S=student)*

Criterion	S1	S2	S3	S4	S5	S6	S7	S8	S9	Average
E	1	2	2	2	1	2	2	2	2	1.78

*One student did not take the final exam (S10).

IV. DISCUSSION

The results of the Spring 2017 evaluation are encouraging. All assessed criteria are at average or above (A=1.67; B=1.11 for Question 1 and A=1.56; B=1.67 for Question 2).

Question 1 (extinctions) challenging because the concepts had been addressed only partially before the final exam. While a few students had trouble explaining all of the causal factors of the extinctions, they did demonstrate some knowledge of events, despite receiving "0" for the assessment. Overall, the average scores demonstrate that students generally demonstrated that they had acceptable or outstanding knowledge of the timing and cause of mass extinctions.

Question 2 (timescale) assessed what is the framework of the course on Earth History – the timing and sequence of events. At the beginning of the semester, students are informed that they are expected to learn the complete timescale. Without it, there is no frame of reference from which to place events into a temporal context. An early quiz, along with partially blank timescales on earlier exams, guarantees that students will be sure to master this material. All students demonstrated an acceptable or outstanding knowledge of the geologic timescale.

Question 3 (age matching exercise) assessed whether students could place the evolutionary timing of major taxonomic groups into the correct temporal context. This question really gets at whether students have learned the course content in the appropriate temporal context, which is so critical to historical geology. It is a rather difficult question that requires knowledge of many details regarding the history of life on Earth. Students demonstrated an acceptable to outstanding knowledge in this area, although two students' performance was just barely acceptable.

A recent improvement to the course involved addition of an online interactive timeline associated with the textbook. Based on anecdotal feedback from students, this likely had a positive impact on students' ability to visualize the correct timing of events in Earth's history.

The results of the assessment do not suggest that any changes to course content or faculty development are necessary at this time.

GEOSCIENCE ASSESSMENT: OUTCOME #2

Ryan Currier

May 2017

I. INTRODUCTION

Outcome #2

Students will apply the scientific method to investigations of geological processes, Earth systems, and interactions among the various physical and biological realms utilizing standard scientific field and laboratory methods.

Course Assessed

GEOSCI 340—Introduction to Mineralogy and Petrology. Min/Pet lays the foundation for many of the following upper level courses. Several laboratory assignments are set up with the scientific method in mind, with the assignment posing a question and the student's task to collect information and weigh in on possible hypotheses. Throughout the semester, several peer-reviewed articles are assigned and we dissect the papers as a class, identifying assumptions, areas that could be clearer, and whether the conclusions are acceptable.

Nature of Assessment

In December of 2016, students presented (~15 minutes) the results of their research projects, aimed at understanding a singular igneous system. Students were tasked with diving into peer-reviewed literature to discover more about their chosen igneous system, and where appropriate, applying concepts learned during class. Special attention was given to identifying hypotheses (even when implicit), understanding data collection techniques, and interpretation of data and model construction. Assessment of Outcome #2 took place during their presentations using the rubric provided below. This is a reassessment, following the same protocol performed in December of 2015. The 2015 results are included for comparison

II. ASSESSMENT

Criterion	0 = Unacceptable	1 = Acceptable	2 = Exceeds Expectations
A. Describing the question being asked and the hypothesis	Did not discuss	Extracted and discussed the question being asked and hypothesis being tested	Placed these questions and hypotheses into a broader context
B. Description of Data, and the Techniques and Methods utilized to collect	Weak treatment	Adequately described data collection methodology	Included additional information, such as: limitations, error, and/or additional data from other sources
C. Conceptual model	Explanation poorly rooted in data or major flaws in logic	Explanation consistent with data	Offered multiple valid conceptual models

III. RESULTS

December 2016

Criterion	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Average
A	1	1	2	1	2	1	1.3
B	1	2	2	0	1	0	1.0
C	1	1	2	1	1	1	1.2
Average	1	1.7	2	0.7	1.7	0.7	1.2

December 2015

Criterion	Student 1	Student 2	Student 3	Student 4	Student 5	Average
A	1	1	1	1	1	1.0
B	0	1	2	0	1	0.8
C	1	1	2	1	1	1.2
Average	0.7	1	1.7	0.7	1	1

IV. DISCUSSION

The results of the December 2016 evaluation are encouraging. All assessed criteria are at average or above (A=1.3, B=1.0, C=1.2). When compared with the previous assessment, evaluations of criteria A and B increased, while C remained constant. This may be due to some small tweaks made in the course content. 1) An additional lab was developed where the full scientific method was implemented. This added opportunity for developing and testing hypotheses, as well as constructing a conceptual model may have provided more familiarity with these concepts for the final project. 2) For article readings, emphasis was placed—at the time of assignment—on identifying the question being asked by the investigators, and the hypotheses that they have developed. With the students seeking these items out during reading, rather than retroactively during discussion, further strengthens their science muscles. 3) A sincere effort was made to discuss multiple times throughout the semester on methodology.

How do we as geoscientists collect the data we rely upon for hypothesis testing? This fit in well during material that centered on basic mineral and rock properties. Moving forward, these tweaks to content will be adopted for future offerings of this course.