Department of Geosciences
Assessment Report 2014-2015

The Department of Geoscience's assessment activities tried to address last year's questions that were the result of our assessment efforts. Therefore, we focused on the same assessment activities; implementing a **long-term assessment of a common knowledge base in 100-level courses**, and **reconfiguring the major requirements** in consideration of new personnel.

Common knowledge across 100-level courses

Last year, the Department developed a series of 100-level exam questions that aimed to assess whether our majors are entering the 200-level courses with a common knowledge set. While compiling the data from the exam questions, we realized that we are not satisfied with using exam questions as the assessment tool. As a recap, we realized that exam questions do not always provide the data useful for our assessment purpose. For example, multiple choice or true/false questions do not necessarily test whether students understand or can apply the concepts. Alternatively, a short answer question with credit for explaining allowed for a fuller understanding of student learning. We learned for some questions that while majority of students could correctly answer a fill in the blank answer, about half of them could not satisfactorily explain *why* the answer was correct. As an additional assessment strategy, one instructor repeated questions from previous exams during the term that served as review and assessed knowledge retention. Those data suggest that students do not retain sufficiently the information from one exam to the next. Indeed, the correct answer totals decreased or remained the same for several of the repeat questions. Such data suggested that we need to rethink how we teach concepts so students can build upon and synthesize information from one topic to the next.

As a department, we were dissatisfied with using exam questions as an assessment tool. We loathe to "teach to the test". In light of the data collected in 2013-2014, we have developed a new assessment tool that we hope will give us a better understanding of student learning. Below, we again show our student learning goals, our direct assessment of the goals, the results, and our discussion of the results.

1) *Student learning goals*

Each introductory class has different student learning goals. However, the courses all have these goals in common:

1. Apply a scientific (geological) approach to appropriate issues
2. Understand the importance of plate tectonics on natural processes
3. Think on geologic time scales

2) *Direct assessment of student learning at the end of the semester*

Each introductory class had a slightly different approach:

<u>Plate Tectonics prompts</u>

GE-101: Blackboard assignment that was assigned during the last week of class as a closed book assessment.

"Please spend some time reflecting on what you have learned about plate tectonics this semester. Take 10 - 15 minutes and provide a well-written and comprehensive analysis of plate tectonics.

Integrate as many features and processes from the course as possible. Some examples might include (but are not limited to): rock types, density, plate boundaries, mechanism, landforms, rates, implications on other geological processes, and implications on society. You may supplement your answer with tables or well labeled diagrams as needed. "

GE-112: Extra credit question on the Final Exam (Note: not all students opt to take the final exam.)

"Provide a well written and comprehensive analysis of plate tectonics.

Integrate as many features and processes from the course as possible. Some example might include (but are not limited to): rock types, density, plate boundaries, mechanism, landforms, rates, implications on other geological processes, and implications on society. You may supplement your answer with tables or well labeled diagrams as needed.

GE-102: Assigned as a mini-essay to be submitted as the final portion of the final exam.

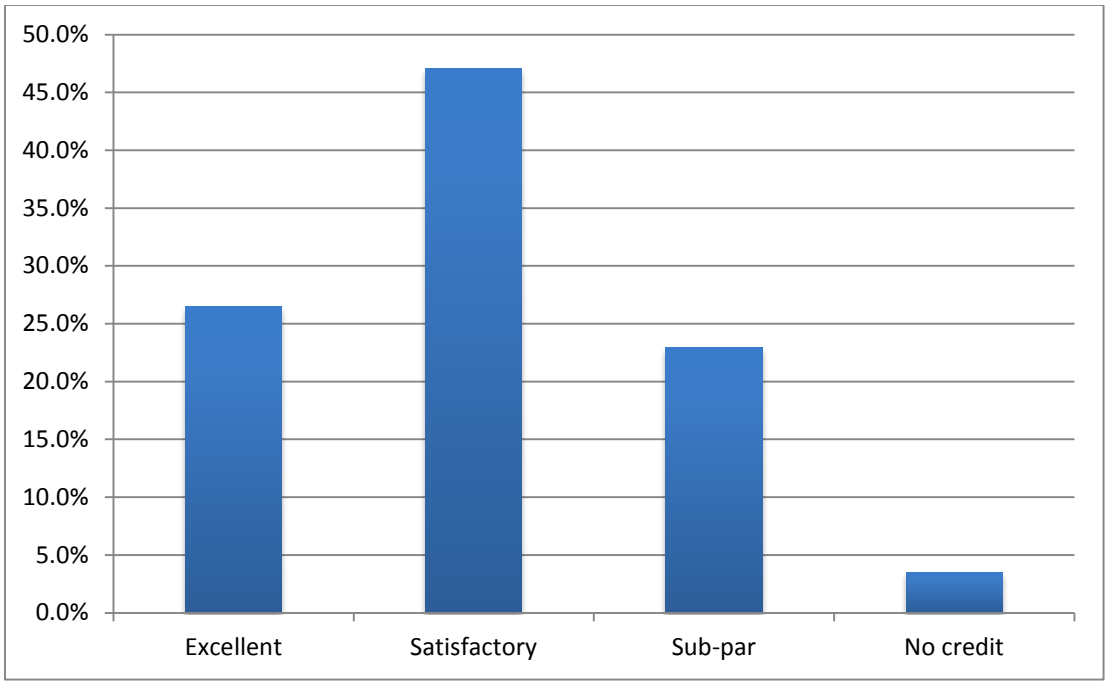
"The plate tectonic history of Phanerozoic (the past 600 million years) consists of two major cycles. The first begins with the late Proterozoic breakup of the super continent Rodinia followed by the assembly of the supercontinent Pangea. The second begins with the breakup of Pangea followed by the ongoing assembly of the current and future supercontinent of Amasia. Both of these first-order cycles have second-order orogenic (mountain building) events/cycles superimposed upon them.

The histories of global biodiversity, climate change, and sea levels are also cyclic. Your task is to describe the long-term Phanerozoic history of these three aspects of global environmental change and relate this history to that of Phanerozoic plate tectonic history. In so doing, you will "discover" the cause/forcing mechanism of long-term global environmental change.

You may use your GE 102 text and lecture notes but must otherwise work alone. Be concise. Restrict your writing to 2-4 typed (word processed) paragraphs. You may use graphs/figures provided they are numbered and cited. This mini-report will be submitted with the remainder of lecture test 3 on Wednesday May 6, 2015."

3) *Results*

n= 170; 73.5% of responses were excellent or satisfactory



4) *Discussion of assessment tool and next steps*

This seems to be a better approach than last year's use of short answer exam questions as it assesses students' understanding of a foundational and unifying theory of the geosciences. It allowed instructors to evaluate student responses in the context of the material covered in each individual course but was a broad enough approach to determine how well our introductory course students are learning some of our most fundamental material.

In order to achieve a "satisfactory" rating, a student response had to demonstrate comprehension of the material. Excellent ratings were given to student responses that showed the ability to apply and synthesize information across a number of topics relating to plate tectonics.

73.5% of all respondents demonstrated a satisfactory or excellent grasp of plate tectonics. For GE-101, 100% of respondents who self-identified as Geosciences or Environmental Studies Science majors demonstrated a satisfactory or better understanding of plate tectonics.

Reconfiguring the major requirements

When the department started to address our assessment goal for this year (develop an explicit assessment plan for our reconfigured major requirements), we realized that our plan for reconfiguring our major was not satisfactory. Thus, we had several meetings revisiting just exactly what we wanted for requirements. Meg Estapa, our newly hired VAP in Oceanography had concerns that the students entering her upper-level courses were not sufficiently exposed to biological processes. Greg Gerbi, our geophysics expert has had ongoing concerns that our students do not have the background in Physics to excel in his courses. Also, as a department, we are not satisfied with the statistics training of our

students (an advisory measure rather than a requirement). These reasons necessitated a greater conversation for changes to our curriculum.

Below, I detail the model that we have developed. I will submit a change to Curriculum Committee by mid-September.

1) Goals of the Geosciences major

The goals of the major are best summarized in part of the Department Mission Statement:

> *The mission of Skidmore's geosciences program is to apply the understanding of Earth processes to contemporary issues such as Earth resources, land-use planning, and global change. The program's curriculum includes ocean and atmospheric sciences, Earth surface processes, and the history of global change. Our courses are designed for students with a general interest in the geosciences as well as for students planning to pursue a graduate degree. We accomplish this mission by providing an environment in which students acquire sound scientific problem-solving, research, and communication skills.*

3) Changes that address the problems

Summary of changes

We have identified that our students lack statistics, physics, biology, and computational training. We will require one semester each of three important cognate sciences: Chemistry, Physics or Biology, and Calculus. This is a change from one year of chemistry and one year of calculus. We also provide the option for our students to take Statistics rather than a second semester of Calculus. For students planning to continue to graduate school, we will encourage them to take additional and relevant cognate science and mathematics courses. While we cannot require students to take additional courses, they will see that by the mere fact that additional courses are listed as options, they will understand that they are important for their education. Finally, we will require two intermediate-level geoscience courses, three advanced geoscience courses, and a senior seminar. We do not plan to change the 100-level course requirements. These changes do not alter the total number of courses for the major. The proposed changes will not only continue to provide flexibility for our students to study abroad and prepare students for postbaccalaureate employment and graduate school, but also provide more structure and hierarchal learning so we can increase the rigor in our advanced courses.

New GE major requirements

Students majoring in geosciences are required to:

Fulfill the general college requirements.

Complete the following:

- GE 101
- GE 102 or GE 112
- GE 377

- Seven additional courses in Geosciences at the 200 or 300 level (with a minimum of 3 credits per course)
- At least two of these courses must be at the 200 level
- At least three of these courses must be at the 300 level
- GE 371 can count for a maximum of one of these additional courses
- GE 399 cannot count as one of these additional courses

- An approved course in GIS
- CH 125
- MA 113 or MA 204
- PY 107 or PY 207 or BI 140 or BI 155 or BI 160 or BI 240 or BI 241

Writing: Successful completion of GE 211 or GE 216 and GE 304 or GE 316

New GE major requirements (version II)

4) Next steps

Over the next year, we will submit a proposal for these modest requirement changes for the Geosciences major and the new courses to the Curriculum Committee. We will submit the course proposals in fall 2015 and implement the courses in the 2016-2017 academic year. As we develop the new course sequence, we will also develop assessment strategies for each component for the major.

Final statement

Since we did not make progress on last year's stated assessment goal, we aim to move forward with that assessment. Thus, our assessment goal for next year is to develop an explicit assessment plan for our reconfigured major requirements. This is a daunting task and will take extensive conversation and meeting. We need to develop assessment plans for the intermediate, advanced, as well as methods components of the major, and the cognate sciences. Finally, we need to develop an assessment plan for what our seniors have learned. Of course, with a new major it will be four years before we acquire the first meaningful data point.

We will also provide the first data from our new 100-level assessment plan.

Respectfully submitted,

Kyle Nichols
Associate Professor and Chair, Geosciences

September 2, 2015

Dear Kyle,

We appreciate your excellent work on this assessment and your planning for next year and beyond. It continues your sequence of wonderfully thoughtful, useful reflections on and inquiries into your students' learning.

As before, we are responding to the department and program reports with particular attention to the ways faculty are framing goals for our students; analyzing student work directly (and also considering indirect information such as surveys and interviews) to see how well they are meeting our goals; discussing the results together; and making use of the results to change courses, requirements, and/or pedagogies. To meet the standards for accreditation, we are also asked to analyze our students' work directly on a regular basis, as you are doing so well.

As always, the key is to do assessment that you find meaningful. Everything lines up behind that.

Student Learning Goals: You have clearly articulated learning outcomes with a strong faculty consensus apparently behind them.

Assessments—Direct: You followed up on last year's assessment, in which you were not satisfied with the use of true/false or multiple-choice questions as a way to evaluate student learning, with short-answer questions for students in GE-101, GE-112, and GE-102 to answer. We were struck by the integrity in your position. Stating, "We loathe teaching to the test," you went on to explore a way to probe your students' learning that relates more integrally to the most fundamentally important concepts you want them not just to know but to integrate into their thinking.

Assessments—Indirect: None this year. (These are entirely optional.)

Results: In the direct assessment, you found that nearly three-quarters (73%) of students' responses to the short-answer questions were either satisfactory or excellent. It's not entirely clear from your report what impact these results had. You found this process more satisfactory than the exam-based assessment, for a number of reasons.

Discussion, implementation: Although reading the essay responses is probably more time-consuming for faculty than grading true/false or multiple-choice questions, it seems that the process allowed your faculty to distinguish students who comprehended the material from those who were able to apply and synthesize the material. Did you talk about ways to address the portion of students whose responses were not satisfactory? Were these outcomes implicated in your discussions of the curriculum?

You also report that as a result of department efforts to develop an assessment plan for your newly configured major requirements, your faculty realized that you needed to reconsider your plan for reconfiguring the major. Your faculty have had important conversations about students' preparedness for courses and you are submitting changes to Curriculum Committee.

Looking ahead: As part of your curriculum revisions you will develop a new assessment plan – an enormous task. Please let us know if we can help in any way.

Overall: Excellent work – it is encouraging to see that have been able to find a process to gauge your students' learning that yields more meaningful results and relates more directly to your most important goals for their learning. It is also good to see that you plan to continue to design ways of analyzing their learning as you reconfigure your major requirements.

Sincerely,

Sarah Goodwin

Lisa Christenson