

Student Learning Outcomes Assessment Summary

Geosciences, BS

College of Natural Science and Mathematics

AY 2016-18

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1. Assessment information collected

- A. Understanding of basic geologic concepts:** Students take a Geoscience Concepts Inventory (GCI) test before beginning Geos 101 and after Geos 112 to assess learning gains or losses during the introductory sequence.
- B. Graduates demonstrate hands-on experience with geologic tools and techniques in the lab and/or in the field:** Final capstone field mapping course (Geos 351) evaluated with a rubric (for geology, geospatial, and paleontology options). Undergraduate research (Geos 488) final report, poster or presentation evaluated with capstone rubric (for geophysics option).
- C. Written and oral communication skills consistent with professional standards:** Final papers in core classes assessed with course-specific rubric. Oral presentations for core classes assessed with "O" rubric.
- D. Students employed or admitted to graduate programs within one year of graduation:** American Geological Institute (AGI) student exit survey. Additional input from annual student feedback seminar.

2. Conclusions drawn from the information summarized above

A. Data on student scores from the Geoscience Concept Inventory test (GCI) show that students scores for Geos 101 students improve on most questions by the end of the semester when compared to average scores at the beginning of the semester (Table 1). More importantly, the average percentage scores at the end of Geos 101 have increased in 2016-18 for most questions relative to the average percentage scores in 2013-15 and 2015-16. This indicates that students are learning material throughout the course that either improves their understanding of significant concepts in Geoscience, or they are learning material for the first time so that their final scores improve over their scores at the beginning of the semester. The improvement of the scores at the end of Geos 101 over the past five years shows that analysis of the scores by Geos 101

instructors has resulted in better methods of instruction to create a clearer understanding of some of these concepts. Students also take the GCI at the beginning and end of Geos 112, which is the second semester course in our entry sequence for Geoscience majors. Scores in Geos 112 also typically show improvement after taking the course, and overall scores have improved from 2013-15. Students do less well on some questions probably owing to a lack of retention of material from one semester to another. This may be somewhat amplified since the content focus of the two courses is different. Results from 2017 show improvement in the post-112 scores indicating a concerted effort to focus instruction on concepts that students appear to have difficulty retaining. It was also concluded that several questions on the test may be confusing for students given that average post-course scores were deemed too low (i.e. average post-course scores below 50%).

B. The field camp rubric summary (Table 2) for the final report in Geos 351W (field camp), the Geosciences capstone course for students in the Geology, Paleontology and Geospatial concentrations, shows the average of all students were able to produce a report that was at least adequate in all respects. As in past years, the five non-UAF students generally scored better, on average, than most UAF students, with several categories receiving scores of excellent. In general, the very best UAF students score as well, or nearly as well, as students from outside. Given that we are able to be highly selective regarding which outside students are admitted to our field camp (i.e. we only take the best students from other schools), it seems that the best UAF students are competitive with good students from other schools across the nation. Student self-evaluations for field camp (Table 3) allowed students to rank their preparation in a number of important professional skills on a scale from 1 to 5 (1=poor; 5=excellent). Students generally felt that their preparation was at least good (3), on average, with the exception of skills in invertebrate paleontology (2 students), and geo-related computer skills (1 student). At the end of the field camp course, students were able to provide feedback which was compiled (Table 4) and discussed by field camp instructors in the fall. Students mainly expressed satisfaction with their field camp experience but their feedback enabled faculty to implement some changes to field camp curriculum, map area, time in the field, time writing reports, and safety.

The Geophysics concentration in the BSGeoscience program uses undergraduate research (Geos 488) as a capstone class rather than field camp (Geos 351W) which is used by the other concentrations. Undergraduate research in the Geophysics concentration is assessed using a two-part rubric that evaluates students on a scale from 1 to 5 (5=excellent; 1=poor). Part 1 of the rubric evaluates the research component of the project and Part 2 evaluates the presentation and writing component of the work. Five students completed Geos 488 research during this review period (Table 5). Scores questions in Part 1 of the rubric were generally in the very good

to excellent range, with a low score of below average in one category for one student., The average scores for Part 2 were also in this range, but with no score lower than average for any category. These results indicate that students in the geophysics concentration typically do very good to excellent work for their undergraduate research projects.

C. Students in several writing-intensive, core courses (Geos 315W, Geos 309W, Geos 351W) write multiple drafts of research papers or map reports. Assessments of their writing are compiled using course-specific rubrics. Comparison of the rubric scores for first and final drafts of Geos 315W term papers for the fall 2016 semester (Table 6) reveals that 10 out of 12 students (83%) improved from their first to final draft. Only 2 of 12 students scored lower on their final draft (20%). Comparison of the rubric scores for first and final drafts of Geos 315W term papers for the fall 2016 semester (above) reveals net learning gains in all categories, particularly Revision (average gain of 0.71), Grammar and Spelling (average gain of 0.96), and References (average gain of 0.83), for an average difference of +5.75% between the first and final drafts. All students improved by a minimum of 1% on the final draft, with the exception of Students 2 and 12, whose score decreased by 3% and 6%, respectively, for failure to revise and incorporate feedback. Comparison of the rubric scores for first and final drafts of Geos 315W term papers for the fall 2017 semester reveals that 8 out of 9 students(89%) improved from their first to final draft, and only one student (11%)scored lower on their final draft. Comparison of the rubric scores for first and final drafts of Geos 315W term papers for the fall 2017 semester (above) again reveals net learning gains in all categories, particularly Organization (average gain of 0.61), References (average gain of 0.89), and Originality (average gain of 0.83), for an average difference of +4.89% between the first and final drafts. All students improved by a minimum of 1% on the final draft, with the exception of Student 7, whose score decreased by 11% for failure to revise and incorporate feedback.

In Geos 309W (Table 7), students write five separate assignments which are then incorporated into a final paper. Students receive feedback on each assignment. Although performance for individual assignments did not always improve, students all produced good quality written work in their final assignment (13 out of 14 students received a grade of A or B).

Oral presentations were assessed in Geos 375, a new course developed and taught for the first time in Fall 2017, using a presentations rubric (Table 8). In the overall rating of their presentations, most students in the class saw an increase in their oral presentation performance between their first presentation and their last presentation. The average grades for the last presentation given in the class are all between 4 (very good) and 5 (excellent).

D. During this period, we reinstated our student exit survey. Unfortunately, we received very low participation rates for the exit surveys (i.e. 9 of 21 undergraduate students) (Table 9). Nevertheless, we can compare the performance of our students to the national survey. In 2016-18, four of twelve undergraduate students (33%) reported that they were going to graduate school, and six students (50%) had obtained employment in a geoscience-related field. 1 student was working as a K-12 teacher, and 1 student was employed outside the geosciences. The AGI survey provides a basis for comparison of our student employment data with national trends. In the 2016 AGI national survey (Table 10), 14% of graduating BS/BA Geology students had accepted a position in a geoscience-related field, while 79% of BS/BA Geology students continued on to graduate school. In the 2017 survey, 11% of undergraduates had accepted a position in a geosciences-related field, and 79% continued on to graduate school (Table 11). Our student employment data compares very favorably to these national trends.

We also compiled the results of our annual student feedback seminar (Table 12). The main feedback focused around regular offerings of classes and a request that courses be offered when the catalog states that they will be offered. There was also a request for some oral intensive classes to be offered every semester on a broader variety of topics. Students also indicated that they want to have more practice doing scientific writing to prepare for their field methods class and field camp. We have tried to introduce more small field writing components into several classes. Offering classes more regularly has been increasingly difficult in this fiscal environment where most faculty who have left have not been replaced.

3. Curricular changes resulting from conclusions drawn above

A. An analysis of the GCI pre- and post-course scores by the Geos 101 and Geos 112 instructors concluded that the GCI has been helpful in redirecting instructional emphasis to better explain concepts that students consistently have trouble with by the end of a course and/or by the end of the introductory sequence. The data show that this has been effective in improving overall scores for most questions year over year. Several questions were re-written following discussion to try to make the questions clearer and more straightforward as instructors felt that this might be at least part of the reason for low average scores on some questions following the introductory sequence. Comparison of 2016-18 data with earlier years suggests that this approach is helping.

B. Data from field camp show that all of our students can write at least an adequate geological report that requires them to integrate many of the skills they have learned during the 4-year program. The main curricular change suggested by all the field camp data is to provide the students with more opportunities to write field reports prior to arriving at field camp. Instructors in some classes (e.g. Geos 112) have already begun asking students to write up brief reports on field trips. We plan to have other faculty provide short report write-ups following field experiences throughout the curriculum to address this need for more experience in writing geological reports. We will also put together an emergency plan that students know about and have access to in the field, and provide for better first aid training for students, if budgets allow that (i.e. wilderness first-aid training). Finally, it has become obvious that students who attempt to take all, or most, of the prerequisites for field camp in the semester before taking field camp, perform less well than those who take a more traditional route. This program exists primarily among students who change majors and/or transfer to UAF. We have decided not to allow students to take all these prerequisites at once in future years.

Data from the geophysics undergraduate research projects (Geos 488) suggests that all of the students who completed undergraduate research were able to conduct research and write it up and present it so that the final product was good to excellent. This is a very good outcome and no curricular changes are required.

C. The data presented from oral and writing intensive classes suggests that these courses have been effective in producing students who have the ability to make written and oral presentations consistent with professional standards. The fact that most students in these courses can make a very good to excellent oral presentation and produce a piece of written work that is of high quality suggests that this curriculum is working as intended. The Department will endeavor to offer a wider variety of oral intensive courses more often so that students have a broader choice of topics to complete this requirement. Our catalog has been changed so that students take writing-intensive and oral-intensive classes as part of their required curriculum.

D. Because of the low response rate to the AGI survey, we have decided to reinstate our own undergraduate exit survey in order to more efficiently collect data on student employment and/or continuing education. We will continue to ask students to complete the AGI survey as well, as this provides a good comparison of our own students' success measured against national standards. The fact that the majority of students who responded to the AGI survey had found employment in a geosciences-related field is encouraging and suggests that our program provides our students with the necessary skills to succeed in geosciences careers following graduation. Most faculty have at least some writing assignments in most classes, and we will ask faculty to try to do more. Additional field trips may be added in some classes at minimal cost but additional multi-day field trips to Alaskan sites more than a few hours drive from Fairbanks are not practical given the current financial climate. We have also decided to put our exit interviews back into a paper form with a mechanism requiring students to fill it out prior to graduation (i.e. at field camp or in a senior required class).

4. Identify the faculty members involved in reaching the conclusions drawn above and agreeing upon the curricular changes resulting

SLOA committee: Rainer Newberry, Sarah Fowell, Elisabeth Nadin, Carl Tape, Paul McCarthy.

5. Has your SLOA plan been updated to include assessment of the program's Communication Plan, as required by Faculty Senate motion? (required for baccalaureate programs only)

Yes. We have included assessment of our oral- and writing-intensive classes, and our students proficiency in writing and presenting scientific information in our SLOA assessments for at least the past 6 years.

Suggested curricular changes will be voted on by all faculty at our first fall faculty meeting in August, 2018.

Tables referred to in this report can be found at:
www.uaf.edu/geology/downloads